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Piet Kommers and Pedro Isaías

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FOREWORD

These proceedings contain the papers and posters of the International Conference e-Society 2013, which was organised by the International Association for Development of the Information Society, in Lisbon, Portugal, March 13 – 16, 2013.

The International Conference e-Society 2013 aims to address the main issues of concern within the Information Society. This conference covers both the technical as well as the non-technical aspects of the Information Society. Broad areas of interest are eSociety and Digital Divide, eBusiness / eCommerce, eLearning, New Media and eSociety, Digital Services in eSociety, eGovernment / eGovernance, eHealth, Information Systems, and Information Management. These broad areas are divided into more detailed areas (see below). However innovative contributes that don't fit into these areas have also been considered since they might be of benefit to conference attendees.

Topics related to e-Society are of interest. These include best practice, case studies, strategies and tendencies in the following areas:

- **eSociety and Digital Divide**: Connectivity may imply social coherence and integration. The opposite may result as well, when systematic measures are taken to exclude certain individuals or certain groups. Papers are welcomed on the next keywords: Social Integration, Social Bookmarking, Social Software, E-Democracy, Social Integration
- **eBusiness / eCommerce**: Business Ontologies and Models, Digital Goods and Services, eBusiness Models, eCommerce Application Fields, eCommerce Economics, eCommerce Services, Electronic Service Delivery, eMarketing, Languages for Describing Goods and Services, Online Auctions and Technologies, Virtual Organisations and Teleworking
- **eLearning**: Collaborative Learning, Curriculum Content Design & Development, Delivery Systems and Environments, Educational Systems Design, E-Citizenship and Inclusion, eLearning Organisational Issues, Evaluation and Assessment, Political and Social Aspects, Virtual Learning Environments and Issues, Web-based Learning Communities
- **New Media and eSociety**: Digitization, heterogeneity and convergence, Interactivity and virtuality, Citizenship, regulation and heterarchy, Innovation, identity and the global village syndrome, Internet Cultures and new interpretations of “Space”, Polity and the Digitally Suppressed
- **Digital Services in eSociety**: Service Broadcasting, Political Reporting, Development of Digital Services, Freedom of Expression, E-Journalism, Open Access
- **eGovernment /eGovernance**: Accessibility, Democracy and the Citizen, Digital Economies, Digital Regions, eAdministration, eGovernment Management, eProcurement, Global Trends, National and International Economies, Social Inclusion
- **eHealth**: Data Security Issues; eHealth Policy and Practice; eHealthcare Strategies and Provision; Legal Issues; Medical Research Ethics; Patient Privacy and Confidentiality

- **Information Systems**: Electronic Data Interchange (EDI), Intelligent Agents, Intelligent Systems, IS Security Issues, Mobile Applications, Multimedia Applications, Payment Systems, Protocols and Standards, Software Requirements and IS Architectures, Storage Issues, Strategies and Tendencies, System Architectures, Telework Technologies, Ubiquitous Computing, Virtual Reality, Wireless Communications.
- **Information Management**: Computer-Mediated Communication, Content Development, Cyber law and Intellectual Property, Data Mining, ePublishing and Digital Libraries, Human Computer Interaction, Information Search and Retrieval, Knowledge Management, Policy Issues, Privacy Issues, Social and Organizational Aspects, Virtual Communities, XML and Other Extensible Languages

The e-Society 2013 Conference had 215 submissions from more than 34 countries. Each submission has been anonymously reviewed by an average of four independent reviewers, to ensure the final high standard of the accepted submissions. Out of the papers submitted, 40 received blind referee ratings that signified acceptability for publication as full papers (acceptance rate of 19%), while some others were published as short papers, reflection papers, posters and doctoral papers. The best papers will be selected for publishing as extended versions in the Interactive Technology and Smart Education (ITSE) journal (ISSN: 1741-5659) and also in the IADIS International Journal on WWW/Internet (ISSN: 1645-7641).

The conference, besides the presentation of full papers, short papers, reflection papers, posters and doctoral papers, also includes a keynote presentation. Special thanks go to Professor Maarten de Laat, LOOK, Open Universiteit Nederland, The Netherlands, for his keynote presentation. Also thanks to Angela Garabagiu, Secretary to the Committee on Culture, Science, Education and Media, Parliamentary Assembly of the Council of Europe, Strasbourg, France, for presenting a special talk.

As we all know, a conference requires the effort of many individuals. We would like to thank all members of the Program Committee (159 top researchers in their fields) for their hard work in reviewing and selecting the papers that appear in this book. We would also like to thank all the authors who have submitted their papers to this conference.

Last but not least, we hope that everybody has a good time in Lisbon and we invite all participants for next year edition of the International Conference e-Society 2014.

Piet Kommers, University of Twente, The Netherlands
Conference Program Chair

Pedro Isaías, Universidade Aberta (Portuguese Open University), Portugal
Conference Chair

Lisbon, Portugal, March 2013

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KEYNOTE LECTURE

TOWARDS INFORMAL-FORMAL PROFESSIONAL DEVELOPMENT NETWORKS

By Professor Maarten de Laat, LOOK, Open Universiteit Nederland, The Netherlands

Abstract

The present e-society has changed the way we are able to participate and act upon the changes around us. Through modern communication tools we are able to share our thoughts and connect with one another. We build networks and engage in open dialogues that have the potential to make a real difference to ourselves and the world. This ability is changing who we are and what we expect from each other. We expect increased participation, self-governance and active involvement to have an impact on the changes around us, whether it has to do with broad issues in our society, life long learning and professional development. At the same time people have always been building networks to increase their participation, but these networks have mostly been invisible to us. It is time to open our eyes and see the networks around us and use them to our advantage. New media and networking tools have made us more aware of the impact these networks can have, but we are still struggling to reach their full potential.

In this keynote I would like to focus on our work in the area of professional development networks. Here we argue that there is a great need to utilize the social networks that professionals develop. Professional networks facilitate not only the way work gets done, it also enables learning, innovation and organizational development. However these networks are mostly personal, invisible and reside outside the formal organization.

I will demonstrate some of our methods and instruments to illustrate that social cognition is an important asset for professional growth. I will show how the tools we use in our research help to visualize and reflect on the presence of informal professional networks and the value they create. These cases show how social media has the potential to raise quality awareness; toget to know your colleagues, their ambitions and build meaningful connections to collaborate on shared challenges and create synergy. These cases also show that we need a better connection between these informal networks and their potential use within the formal organization. From these cases we learn that we need an approach to professional development that not only focuses on the formal aspects of an organization, but we need to be in touch with the learning that happens informally in social networks based on dealing with day-to-day challenges in the workplace. This means that professional development policy and culture needs to embrace an additional set of learning metaphors and incorporate an approach that is termed informal-formal learning. Through informal-formal learning we can create a social professional space within organizations. A space that allow professional networks to have a real impact on changing their (work) environment. The question is what does this space looks like and how can this space facilitate social networking:

-What tools, method, attitude and leadership are needed to utilize this space?
-How can we consolidate and utilize shared expertise and reward value creation?
-How can we manage and increase informal networks without formalizing them?

Our research shows that social networking as such is an important asset to organizations, but these methods and tools also hold its promise for other domains. Raising awareness about how informal social networks have an impact on change is key to stimulate participation and engagement into meaningful action and their ability to raise their profile in formal settings.

SPECIAL TALK

VALUES OF DEMOCRACY AND HUMAN RIGHTS IN AN E-SOCIETY" ERA"

by Angela Garabagiu, Secretary to the Committee on Culture, Science, Education and Media, Parliamentary Assembly of the Council of Europe, Strasbourg, France

Abstract

European citizens have the right to benefit from the information society. The states must be committed to build a people-centered, inclusive and development-oriented information society that fully respects and upholds the values of democracy, human rights and the rule of law, on which European societies are built. Both public and private actors should bear this in mind when designing their operations and activities, including the development of new technologies, services and applications. International organisations, including the UN and the Council of Europe, have taken steps to ensure the protection – on and through Internet -- of all fundamental rights and freedoms and to affirm their universality, indivisibility, interdependence and interrelation in accordance with international human rights law.

The Council of Europe responds to issues that affect now 800 million people Europeans by working with and influencing member states' policies and legal frameworks. These responses are set out in conventions which include the Cybercrime Convention and the Convention on the protection of children against sexual exploitation and sexual abuse. The Council of Europe develops, in addition, other standard-setting documents, such as the Human rights guidelines for Internet service providers developed in co-operation with the European Internet Services Providers Association (EuroISPA). Since 2007, the Council of Europe is an active partner in the organization and running of the UN-led Internet Governance Forum and the annual European Dialogue on Internet Governance (EuroDIG).

The Parliamentary Assembly of the Council of Europe was at the origin of a great number of European conventions. The Assembly addresses key emerging issues in European societies – the development of Internet is high on its agenda. The latest Assembly recommendations in this area refer to "The protection of freedom of expression and information on the Internet and online media", to "The digital divide and education", and to "The promotion of Internet and online media services appropriate for minors".

Internet has brought about a paradigm shift in communication. Internet has also influenced the way "politics" is conducted by all players: citizens, political parties, the public authorities and government bodies. In other words, the Internet is also changing the way people participate in democratic processes and political life. As far as citizen participation in the electoral process is concerned, new relationships between voters and political parties are emerging because of the web and on the web (for instance, the selection of candidates and debates on manifestoes). The Council of Europe developed specific standard setting instruments in the field of e-democracy and e-voting that will be brought to the attention of the participants in the IADIS conference.

Full Papers

DEBRIEFING WITH R-STATISTICS AND SUPPORT FOR SYSTEM DYNAMICS MODELING OF INTER REGIONAL SECURITY

Knut Ekker[1], Viveca Asproth[2] and Stig C. Holmberg[3]
[1]*Nord Trondelag University College, 7729 Steinkjer, Norway*
+47 74 112264
[2]*Mid Sweden University, 83125 Østersund, Sweden*
+46 77 1975000
[3] *Informatik /C8-Labs, 83076 Stugun, Sweden*
+46 69 510455

ABSTRACT

In order to improve interregional security by cooperation across a national border this paper argues for a double loop learning approach. First, data are recorded from a tabletop exercise in which security officers from both involved countries have to react on presented emergency events. Next the R-statistics open source package is applied for analyzing communication patterns in recorded data. With help of those recorded data and a social network analysis model, communication patterns, both within countries and between countries, are next analyzed in order to see who communicated with whom, how often and with what kind of information about the emergency events. The analysis is used for debriefing with the participants in the exercise but also as input into a system dynamics simulation model. Results from simulations can eventually be fed back into construction of new tabletop exercises.

KEYWORDS

Training, emergency, simulation, debriefing, R-statistics

1. INTRODUCTION

True real world data are needed, but often missing, for verification and validation of any System Dynamics (SD) model. Testing is far from a new problem in modeling and simulation and acquisition of real world test data is just part of the problem (Randers, 1980). The purpose of this paper, hence, is to provide a straightforward and swift method for the production of such test data. The paper is the result of the GSS project in the crossroad of two European research and development interests. One of those is security, which has lately become a main issue in the European FP7 research program[1]. The other important European issue is interregional cooperation. Here we have the European Territorial Cooperation Objective[2]. Hence, GSS concerning security in cross-border regions has developed out of merging those two interests. Further, within the scope of GSS there is a great need for new and innovative training and preparation tools (Asproth et al, 2010). On this point SD and simulation with SD models come into play. In this paper we will present a method for proceeding test data for such tools.

[1] Cordis (Community Research and Development Information Service), FP7, EU. URL:http://cordis.europa.eu/fp7/dc/index.cfm (last accessed: 2013-01-02)

[2] EU Territorial Co-operation / Regional Policy - INFOREGIO. URL: http://ec.europa.eu/regional_policy/cooperate/cooperation/index_en.cfm (last accessed: 2013-01-02)

2. THE INTERREGIONAL GSS SETTING

The GSS project (Gaining Security Symbiosis) is funded by Interreg / European Regional Development Fund (ERDF) from 2010 to 2013 and provides emergency management training during computerized / table top exercises. The project is coordinated by the Mid Sweden University and Nord-Trøndelag University College, and includes external supporting partners in the local police, fire and ambulance emergency organizations. An overarching aim of the project is to develop a computer and net based integrated environment for mutual preparation and training for disasters and complex emergency situations, an environment named netAgora. The netAgora environment will include a disaster simulator (used in the 2011 emergency exercises reported here), a scenario editor, and an assessment kit in its core. It will support communication and information exchange, cooperation, coordination, training, preparation, and learning on individual, group, and organisational levels. The netAgora will further include support for an exchange of experiences, tools, and models of response to emergence situations within and between nations with a special emphasis on handling the cultural differences that may impede the emergence response. In the project there are yearly cycles were scenarios are developed and realized in the system, leadership training exercises are implemented and evaluated. The evaluation is accomplished with several data collection methods as logs in the system, surveys before and after, observations and films. It will be possible to assess whether the collaboration patterns change between and within each country in an emergency exercise completed in 2012 and one planned for 2013. Using the post exercise surveys of participants it will also be possible to analyze the extent to which real collaboration patterns change in handling emergencies in 2012 and 2013.

2.1 Data Acquisition from the Tabletop Exercise

In 2011 the emergency training simulation took place at Stiklestad May 18 and 19 during the annual meeting of the Border Rescue Council (Grenseredningsrådet). The scenario for the 2011 emergency training event was that of a severe Winter storm during the New Year holiday in the border region between mid-Sweden and Mid-Norway. The scenario consisted of 13 emergency incidents/events of varied severity that was presented during a 3 hour simulation / role playing session. The participants gathered in two rooms at the Stiklestad hotel – a Swedish and a Norwegian room. The participants gathered around tables with their respective professional unit (police, fire, ambulance, county preparedness agencies, municipality officials and the Swedish 911 agency (SOSalarm).



Display 1. Police and municipality officials (Sweden)

A moderator in each of the two rooms guided the participants through the 4 hour training session, calling on the participants to respond to the various events presented on their computer laptops. A central database distributed the updates of the scenario under the control of a “master” moderator making sure that all participants had completed debate and recording of actions of communication and decisions made following an individual event. The participants recorded which rescue organization they wanted to contact regarding an exchange of information (requesting or providing information).

A given event during the simulation / role playing session would trigger an amount of discussion among the representatives of the various professional organizations participating. In that process, the participants

would use the web-based computer simulation tool to indicate that they needed more information or wanted to share information with another rescue group – either in Norway or Sweden. Figure 1 displays the user interface for recording the exchange of information with other participant groups and decisions made during the discussion of a given event during the simulated emergency.

Each participant group recorded anywhere from zero to 6-8 information exchange actions during each of the 13 events of the simulated emergency. Thus it is an asymmetrical database in which some participants were very active while others recorded no or little exchange of information with other groups.

Figure 1 shows the interface of a participant, in which the text of the warning is presented, and a communications panel is available to share information or ask for information from other groups, as well as recording decisions made in the discussion following the event.



Figure 1. Simulated emergency event: user interface for recording communication with others

In figure 1 the participant (police in Norway) requests information (1) from the police in Sweden. Optionally, the police may have offered information (2) to the county, Swedish 911 (SOSalarm) or other groups on either side of the border. The interface also displayed the last 5 actions taken in this role.

In order to provide summaries of data from the simulation during the debriefing session taking place shortly after the completion of the emergency training session, the project used an open source statistics package (R Project) available on the simulation engine server. The data from the emergency management exercise was aggregated and prepared for graphical analysis using a sequence of programming tools (php programming and R statistics batch scripts).

2.2 Data Analysis

The data analysis first presents a box-and-whiskers plot and an analysis of variance in order to visualize the differences between the various groups participating in the simulation.

Figure 2 shows the box-and-whiskers plot and analysis of variance of the variable communication initiated by role in simulation. The emergency management exercise in May 2011 was not successful in convincing all participants to indicate who they wanted to communicate with – consequently there was little directed communication from AMK (ambulance), Jamtkraft (power company) and kommune (municipality).

The R-project statistics package was used to perform a Social Network Analysis (SNA) of the simulation data from May 2011. John Scott (1987) and Francesco Martino & Andrea Spoto (2006) provide a thorough review of Social Network Analysis, and the use of R-statistics for data analysis in general and for SNA analysis in particular is well documented (Ekker, 2009; Handcock et.al. 2008).

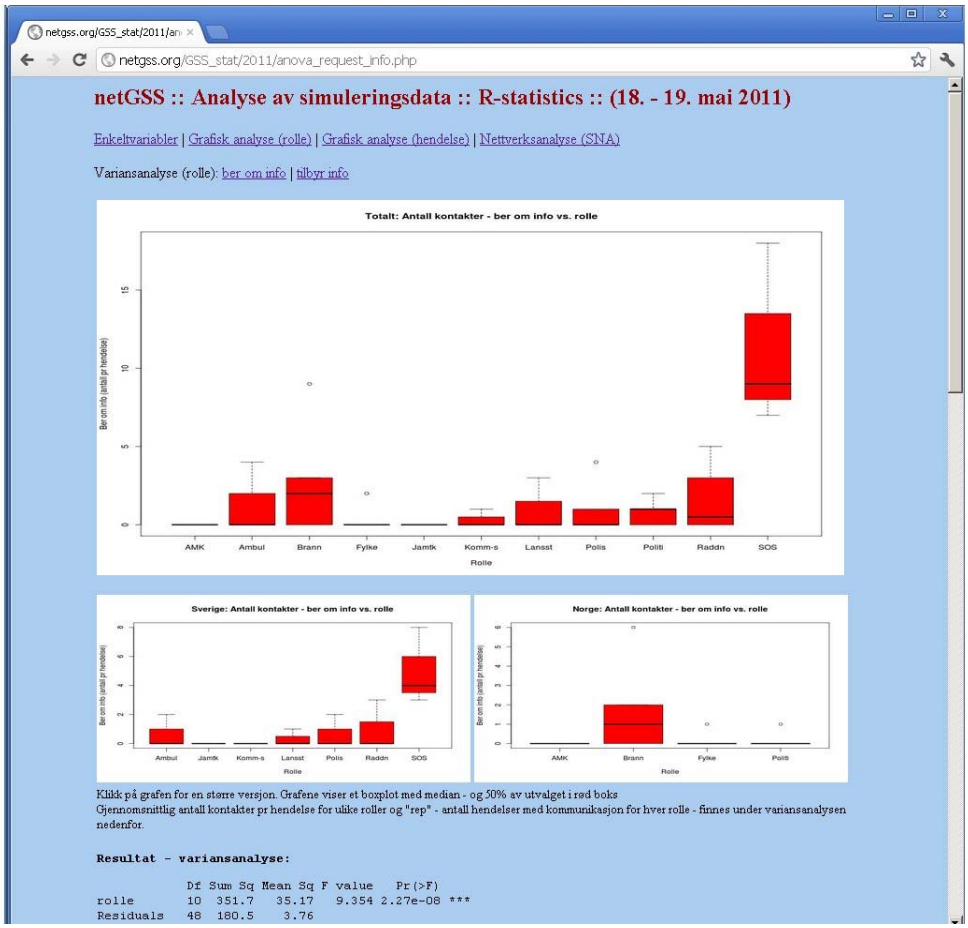

Figure 2. Frequency of communications by role (all participants at top, Swedish and Norwegian participants respectively, bottom graphs)

Here are the graphs from the SNA – figure 3 presenting the communication pattern early in the simulation, figure 4 presents the communication pattern mid-way in the simulation – and figure 5 the pattern towards the end of the simulation.

In figure 3 we see that the S-911 (SOSalarm in Sweden) is a center of the graph as the organization with the largest number of communication messages offering information to other organizations in the early part of the simulation. Arrows point to the organization offering information to others, and an arrow pointing both directions – as in the S-911 and N-county communication in figure 3 indicates two communication messages between these two organizations. Table 1 shows that the proportion of messages crossing the border is 0,35 in the early part of the simulation (figure 3), 7 out of a total of 20 communication messages. The detailed matrix of communication patterns is found here:

http://netgss.org/GSS_stat/2011/eng/SNN_graph_give_segments.php

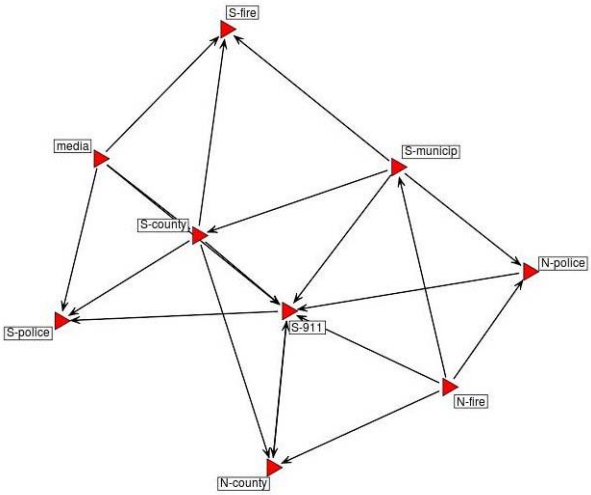

Figure 3. Communications (offering info) by role - early in simulation
(arrows point towards organization offering information)

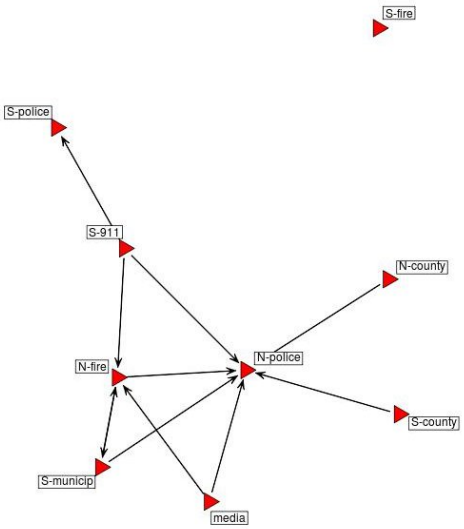

Figure 4. Communications (offering info) by role – mid-way in simulation
(arrows point towards organization offering information)

Figure 4 presents the communications pattern mid-way through the simulation, and at this point in the simulation it is the police in Norway (N-police) that is the center of the social network. Table 5 indicates an increase in the cross-border communications in this period, with a proportion of cross-border communications reaching 0,55, i.e. 6 out of a total of 11 communication messages targeted an organization across the border.

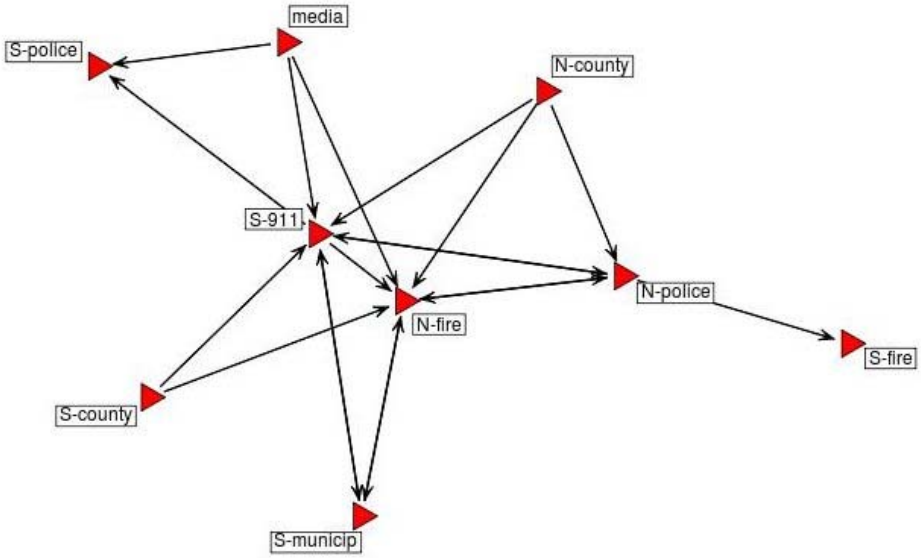

Figure 5. Communications (offering info) by role–towards end of simulation
(arrows point towards organization offering information)

In figure 5 we see that the Swedish SOSalarm (S-911) and the Norwegian fire department (N-fire) are the two centers of the social network graph towards the end of the simulation. The total number of communication messages have increased to 19, and the proportion of messages crossing the border is 0,42 – quite a bit lower than during the middle of the simulation when the proportion was 0,55.

The content of the events during the early part of the simulation was of a more general nature regarding the threat of severe weather during the New Year's weekend. The last event in this early part of the simulation was directed only to the Swedish participants, and informed of the closing of a major road on the Swedish side of the border. This may account for the large number of contacts among the Swedish participants (11 contacts with other Swedish participants) compared to 2 among the Norwegian participants.

During the middle part of the simulation the events became more directed, including a graphic presentation of a car stuck in a snowdrift. Another event was a cell phone message referring to a family seeking refuge in a cabin on the Swedish side of the border, while the phone message was picked up by Norwegian authorities. The last event during the middle part of the simulation included a cell phone emergency message from three individuals being lost in the mountains with injuries to one of the individuals. These messages produced fewer acts of communication among the participants, but more communication across the border (6 out of a total of 11 messages). The fact that a cell phone message from the Swedish side of the border were picked up by the Norwegian side may account for an increased proportion of contacts (0,55) reaching across the border to participants in the neighboring country.

Table 1. Communication contacts established (offering info), total number and proportion across border (Source: R Social Network Analysis output: http://netgss.org/GSS_stat/2011/eng/SNN_graph_give_segments.php)

	Frequency	Total
Early in simulation:		
Norway (internal communication)	2	20 total number of contacts
Sweden (internal communication)	11	
Norway → Sweden	4	7 across border
Sweden → Norway	3	0,35 proportion across border

Mid-way through simulation		
Norway (internal communication)	4	11 total number of contacts
Sweden (internal communication)	1	
Norway → Sweden	5	6 across border
Sweden → Norway	1	0,55 proportion across border
Towards the end of the simulation		
Norway (internal communication)	5	19 total number of contacts
Sweden (internal communication)	6	
Norway → Sweden	4	8 across border
Sweden → Norway	4	0,42 proportion across border

During the last part of the simulation, the events present an increasingly threatening situation in the border region. Temperatures are dropping, wet snow threatens the electric power grid and a bus with 63 passengers is in the ditch just west of the border and a helicopter from the power company has crashed on the Swedish side of the border. The number of communication contacts established between the emergency agencies within each country increases to a total of 19, but the proportion of contacts across the border drops to 0,42. At this point in the emergency simulation the events presented are more clearly delineated as being either on the Swedish or the Norwegian side of the border. As more information becomes available, the need for cross border communications is reduced - the emergency teams coordinate actions among themselves on either side of the border.

2.2 Double Loop Learning with R-data

Besides the table top exercise described in previous sections, a simulation model has been developed in a parallel sub project. Here, by selecting a system dynamics approach it was possible to use open source tools and to make reference to a well known and waste base of user experiences. In any case, the idea being that the two sub projects will benefit from each other in a double loop learning cycle according to figure 6. Hence, by applying the idea of Double Loop Learning (DLL), insights from the simulations will be used in preparing crisis scenarios for forthcoming table top exercises while experiences from the table top exercises will be transformed into improved simulation models. Here some of the more prominent upcoming possibilities for such DLL will be discussed.

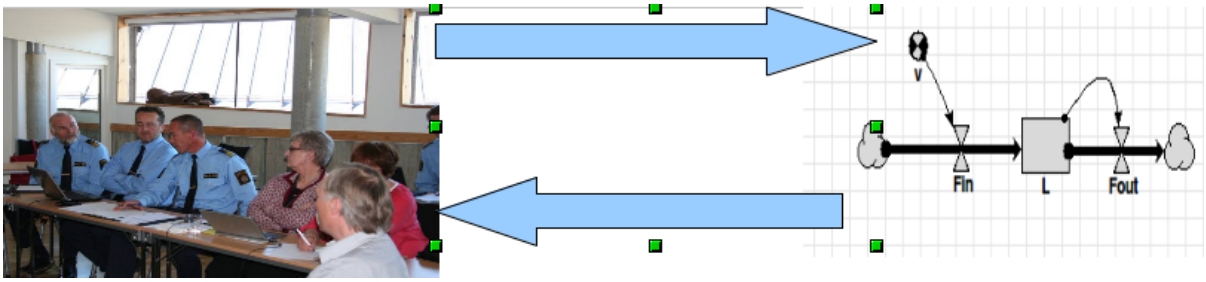

Figure 6. Double loop learning between table top exercise and SD modeling.

In a first version of the simulation model common situation awareness (CSA) was identified as a key concept. On this point the main results in form of the communication patterns (figure 3 - 5) from the table top exercise constitute a most valuable input for developing the simulation model. So, intense communication patterns will support the assumption of a high CSA in the simulation model while scattered communication between security actors will indicate a lower CSA.

A lot of security actors are involved in the real system. However, in order to keep the simulation model reasonable simple it is desirable to limit that number in the simulation model. Even here the communication patterns will be of great help. Actors in the centers of the communication graphs (figure 3 – 5) will be the first to be represented in the simulation model while the others may be left out.

The end users of the simulation model are the same security officers that are participating in the table top exercises and who are handling upcoming real emergency situations. As experiences with Group Information Feedback (Kljajić and Borštnar, 2011) indicate this arrangement will secure for a best possible learning and gain of competence among the security officers.

To a great extent there is the same group of developers working on the simulation model and the table top exercises. So even here we get a form of DLL. What the developers learn in preparing and executing the table top exercises they can use in the SD modeling and simulation and vice versa.

There is a similar computer interface both in the simulation and in the table top exercise. This will to a great extent decrease the learning burden. Even here there will be a cross fertilization between the two training milieus.

At last, the results from the table top exercise shows that communication patterns change during the progress of an emergency situation. That is an important insight, which still has to be taken account of in the SD modeling.

3. CONCLUSION

The main contribution of this paper can be summarized in the following points:

- Preparation and training is a crucial part in any interregional security work. This requirement can be met by regular tabletop exercises for involved security officers.
- By recording communication patterns from such exercises it will be possible both to analyse behaviors in emergency situations and to propose improvements in tranining and current procedures.
- Our social network model has proved itself useful for analysis and visulaisation of communication patterns.
- By combining desktop exercises and computer simulations a double loop learning cycle will emerge.
- It is important to integrate the SD modeling and simulation into a context, as the netAgora preparation and training portal in our case.
- By providing model builders with truthful and realistic data the quality of the SD model and simulation will increase. In this paper this is achieved by help of the table top exercise.
- SD modeling and simulating is an efficient way of generating new questions and disaster situations for new table top exercises.
- SD modeling and simulation can be effectively used without bothering security officers with the technical details of SD modeling.

ACKNOWLEDGEMENT

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LEARNING FROM EVALUATION: THE RELEVANCE OF AN EVALUATION STRATEGY TO THE VOLUNTARY ADOPTION OF E-INITIATIVES

Dr. Mark Liptrott
Edge Hill University,
St. Helens Road,, Ormskirk, L39 4QP

ABSTRACT

This paper argues that the implementation evaluation of the UK policy introducing e-voting was a missed opportunity to gather information to better inform policy revisions. Using a heuristic framework to identify stages in the policy process, the final evaluation stage was recognised as useful to inform policy revisions. However, the evaluation did not ask potential adopters their reasons for non-participation in the pilot program introducing e-voting, so failed to establish policy adoption blocking mechanisms.

The discussion relates the introduction of the new voting methods to the UK drive for greater political participation. It identifies variables influencing e-voting participation in the pilot program of 2003 and tested in the pilots of 2007. The results demonstrate that information is available to provide an insight into reasons for non-participation in such e-initiatives. However, evaluative strategies are sometimes so limited in scope that this source of information is not acknowledged.

The Conclusion draws on the variables to suggest broad spectrum lessons which may furnish revised policy modifications to address innovation adoption blocking mechanisms.

KEYWORDS

Policy, administration, pilot schemes, evaluation

1. INTRODUCTION

This paper uses the participant orientated implementation evaluation of the UK pilot program introducing e-voting to demonstrate weaknesses in the evaluation process (Trochim, 2006). It argues that the evaluation strategy was flawed as it failed to identify reasons that local authorities declined the invitation to join the pilot program. In doing so it failed to view non-participation as a source of information.

E-voting was introduced by the former UK government when in its first administration (1997-2001) it proposed a number of measures which it claimed would bolster democracy and enhance civic engagement (Electoral Commission, 2003). Among these measures was the modernisation of electoral processes including the introduction of pilot schemes of e-voting. The Representation of the People Act (2000) allowed the establishment of trials of the new voting methods to be conducted in conjunction with traditional voting procedures, an incremental approach to policy making.

Local authorities were used by the then Office of the Deputy Prime Minister (ODPM) as conduits to introduce the new voting procedures. The trials were a fact-finding tool to assess the capabilities and any problems of the new systems arising from their use. This accumulation of knowledge was supposed to enable a national rollout of e-voting (Electoral Commission, 2002). Following each pilot, participants were required to report to the Electoral Commission, a participant orientated implementation model of evaluation (Trochim, 2006). There was no strategy to discover reasons for non-participation. This paper uses the results of research into the e-voting pilots of 2003 and 2007 to emphasise the omission in this type of evaluation as it failed to identify reasons for non-participation in the pilots.

Drawing on Anderson's (2002) heuristic policy framework, when the invitation to join the pilot program was issued to local authorities there became a 'choke point' when the decision to trial the new voting

technology passed from central to local government and was placed on the local agenda, as illustrated in figure 1, below. At this point variables most influenced local policy adoption decision-making.

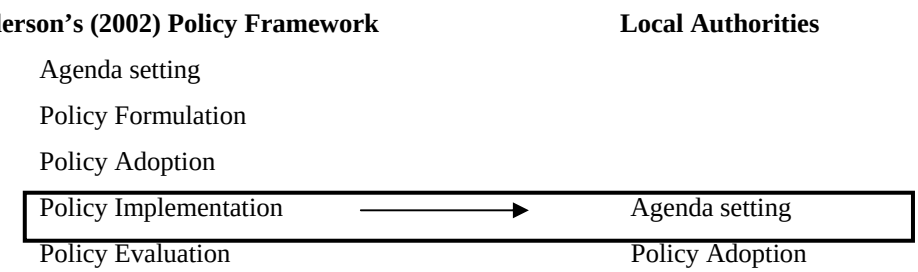

Figure 1. The 'choke-point'

Evaluation supposedly extends to all aspects of the policy including the impact on the target or group, the impact on the wider community, an assessment of future effects, the direct costs of the policy and the indirect costs including the alternative policies (Dye, 2002). People are key to successful innovation and it is only during the reviewing phase that mistakes become obvious. Most projects fail due to the way in which they are communicated and implemented and it is the choice of actions by actors within organisations that dictate success or failure (JSIC, 2011). Nevertheless, often little is learned during a trial and problems still occur when full implementation takes place (Eason, 1988). It cannot be assumed that a successful trial in one location will automatically mean success at another location (Pettigrew et al, 1994).

The paper is structured as follows. The next section discusses the research methodology. The third section discusses the rationale for the introduction of the new voting methods and the fourth section introduces the UK pilot program. The fifth section contrasts variables influencing e-voting adoption decisions in 2003 and 2007. The penultimate section discusses non-participation as a source of information. The final section uses the research results to suggest lessons that can be extrapolated to furnish policy modifications to enhance the voluntary adoption of technology introduced through pilot schemes.

2. RESEARCH APPROACH

The research underpinning this paper was a qualitative enquiry into reasons that local authorities declined the invitations to join the 2003 e-voting pilot schemes. This research adopted a case study approach using a series of semi-structured interviews with a sample of Election Officers who had joined the 2003 pilot scheme and those officers who had declined the invitation to join. Data from those interviews were tested in an interview with a senior executive of the Association of Electoral Administrators (AEA). The findings were in turn tested in a series of interviews with Election Officers who joined the 2007 e-voting pilot program and further interviews with Election Officers who had joined the 2003 e-voting pilots, but declined further participation in 2007. All respondents were guaranteed anonymity.

In both approaches the realist paradigm underpinned the methodology as it can offer an explanation of why a program works better in one context than another (Pawson, 2006). The author believes, like Miles and Huberman (1994:232), that qualitative research offers an understanding of "what happened and how and why it happened" an apt approach to discover reasons influencing voluntary policy adoption.

3. BACKGROUND

The initial rationale behind the introduction of e-voting was the decline in turnouts at elections. Turnouts at elections at every level had been falling from a high of 83.6% in the 1951 General Election to a low of 59.4% in 2001, and had recovered slightly in 2005 with a turnout of 61.3%, and 64% in 2010 (Electoral Commission, 2005; 2010). The decline in turnouts led to fears that future turnouts of less than 50% could mean that the government has no real mandate (ICAVM, 2002). Particular concern followed the General Election of 2001 when the British Election Study (2002:2) anticipated future turnouts being "in freefall."

The expectations of the policy appear to have altered, in April 2003 the former government minister Nick Raynsford stated that the "electoral pilots aim to improve turnout" while in June 2003 a spokesperson for the Office of the Deputy Prime Minister stated that raising turnout was not the main aim "it was more about widening access, extending choice and adapting to a modern lifestyle" (Waugh, 2003; Parker, 2003). This contrasts with the original aim of an evolving process to introduce the new voting methods and to "create electoral processes that are efficient, robust and flexible and which can be adapted more readily to other electoral forms" (Fairweather and Rogerson, 2002:3).

The European Union recognises that the growth of ICT will shape perceptions of government throughout the Union and the implementation of e-government is regarded as essential to modernise public administration to provide new forms of service delivery and to stimulate participation (Nixon and Koutrakou, 2008). On March 31st 2010, as a result of the Lisbon Treaty, the EU adopted the European Citizen Initiative enabling the public to call on the Commission to bring forward legislation with the aim of strengthening democracy and enhancing voter participation in elections to the European Union. Plan D introduced by Wallstrom, former Vice President of the European Commission, has also been expanded to establish Political Foundations to promote debate on European issues. Wallstrom (2010) said, "I firmly believe that communication, dialogue and active involvement of the citizens is crucial for the Union's ability to achieve its objectives……. We need to make it clear to the citizens that their political choice matters."

4. UK E-VOTING PILOTS

Allowing individuals to vote at a time and place of their choosing appeared to be a natural progression in the use of ICT to promote civic participation: yet local authorities did not readily adopt the pilot schemes.

Although the program began in 2000, when 38 local authorities joined the scheme with five undertaking e-counting and three testing e-voting, this paper discusses the pilots of 2003 and 2007. Each scheme included an evaluation strategy reporting on individual authorities and a strategic evaluation looking across the pilot schemes as a basis to suggest revisions to the management of future schemes and any changes to electoral arrangements (Electoral Commission, 2002). They were 'before and after' procedural exercises rather than an exploratory ones investigating adoption decisions in the wider local authority context. Table 1, below, shows the technology and the number of local authorities at each trial discussed in this paper.

Table 1. E-voting Technology and the Number of Pilot Participants

Voting Technology	**2003**	**2007**
All postal	38	
e-counting	8	5
Kiosk	8	
Internet	14	5
Telephone	12	
SMS TEXT	4	
Digital TV	3	
Other (ballot paper innovations, voting hours etc.)	8	9

(Electoral Commission, 2003,2007)

May 2003 saw the largest pilot scheme with 59 English local authorities taking part with almost 6.4 million people eligible to vote in the pilot areas. In that year over half the schemes offered all postal voting and some locations offered extended hours to voters using the conventional ballot box. Seventeen pilot programs offered a combination of e-voting, of those seventeen, fourteen offered Internet voting (Electoral Commission, 2003). However, only 12 authorities volunteered for the 2007 pilots testing mainly administrative functions with only five using the Internet.

5. COMPARISON OF THE INFLUENTIAL VARIABLES IDENTIFIED IN 2003 WITH THOSE IDENTIFIED IN 2007

Evidence suggests that the main variables that impacted on local receptivity to e-voting prior to the 2003 e-voting pilot remained valid in 2007, although in some cases the nature of the impact had altered. The pilot authorities had their reasons for joining the trials and the non-pilot authorities had their reasons for not joining the trials. Issues impacting on local decision making concerned administration, policy design, Election Officers' attitudes and threats to the integrity of the system.

5.1 Administration

In 2007 the increased workload influencing against pilot adoption was preparing for, or embedding new working practices following restructuring, and fulfilling the obligations of the *Electoral Administration Act* 2006. Non-pilot Election Officers concluded that the amount of work to conduct a pilot in addition to the increased administrative burden would be too great. One Officer described the additional strain of checking postal voting identifiers and was convinced that any authority with a large postal vote would not have volunteered to join the pilot program in 2007. Further support for the consequences of the 2006 Act came from another Election Officer who had appointed a dedicated member of staff to administer postal voting. He noted that in the case of a close run election result, and a consequent challenge, he would be "*held to account*" if there was a failure to check 100% of personal identifiers.

In the 2007 study, local authorities that chose not to join the trials had recently experienced or were preparing for, structural changes. In 2008, one authority became a unitary authority with six districts amalgamating. Explaining the additional workload prior to the restructuring, the Election Officer described the aim of the authority to complete CORE (Co-ordinated On-line Register of Electors) by 2009 and how the six districts used three electoral software packages which had to be streamlined.

Authorities had also experienced internal management re-structuring. One officer commented on senior management changes saying, *"with all that has been going on, the new managerial staff will have to get used to their jobs."* Another Officer described the impact of managerial restructuring,

"There was a staff change in 2006 with the introduction of a brand new section. I was the only member of staff left with any experience of elections so I had to set-up the new department, recruit and train a new team and get to grips with the Electoral Administration Act. I could not cope with an electoral pilot in 2007."

A further administrative issue resonating through the years was the preparation time for an e-election. Election Officers in the 2003 and 2007 pilot and non-pilot authorities commented on the short timescale between applying for a pilot, receiving notice of the type of pilot and preparing the necessary Statutory Order. As one Election Officer explained, *"Without extra money and staff, this authority cannot cope with all the changes and e-voting"* and another commented, *"There's just too much to do."*

Election Officers in pilot authorities explained that the formulation of the application and the amending of the Statutory Orders to cover the exact provisions of the pilot took longer than expected. An officer explained, *"We only had weeks instead of months [to complete the preparations]"*.

Election Officers in the 2007 non-pilot authorities had experienced the 2003 pilot scheme and the problems encountered during those pilots influenced their subsequent decision-making. Each officer said that he would not now volunteer for the amount of work involved in conducting the pilot program, especially the numerous meetings with the Ministry of Justice, the Electoral Commission and the contractors coupled with the organisation of a traditional ballot and a pilot scheme. This response offers support for Woodruff's (1993) argument that potential adopters will judge innovation in terms of their personal experience.

5.2 Policy Design

In 2007, the policy design remained incremental, introducing e-voting in addition to traditional voting methods. However, data from the 2007 non-pilot authorities indicated that this type of approach was not minimising resistance to the policy as suggested by Lindblom and Woodhouse (1993), rather it supported Armstrong's (2009) argument regarding resistance to new policies. As the pilot program evolved, testing had

become increasingly targeted at specific types of voting innovations, a strategy identified in the earlier study that had inhibited pilot participation. The government failed to realise that loss of discretion is linked to an increased likelihood of policy failure (Adler and Asquith, in Hill, 1993).

In 2007 there had been no revision of the policy implementation approach and there had been no strategy to establish reasons that local authorities did not join the e-voting pilots. The former government appeared to have maintained the 2003 'top-down' implementation strategy, an approach that was unlikely to enhance policy adoption. Alternative approaches such as the 'bottom-up' approach or the Communications Model, would have improved communication between the two sets of elites: policy makers in central government and policy implementers in local government (Elmore, 1979;Goggin et al, 1990).

In 2007, there did not appear to be a revised central attitude to funding the pilot program. At a local level, there was a difference of opinion regarding finance for the pilot schemes. Officers in non-pilot authorities said that the conduct of a pilot scheme was expensive and taken with the additional obligations of the *Electoral Administration Act* (2006) which they were expected to administer without any increase in funding, they would not join further pilots. They commented that, despite the expense, the 2003 e-voting trials had not resulted in a significant increase (+/-2%) in voter numbers (Electoral Commission, 2003). There was a belief that individuals who had used the new voting methods would have voted anyway. In contrast, Election Officers in the 2007 pilot authorities recognised that pilots were expensive, but were satisfied that they had sufficient funds to meet their legislative and logistical obligations.

5.3 Election Officers' Role

Prior to the 2007 pilots, Election Officers appeared to wield significant influence over the decision to trial the new voting methods, just as they had prior to the 2003 trials. In 2007, all the respondents in pilot authorities had instigated the notion of joining the trials and led the decision-making while the non-pilot authority Election Officers took the decision not to join the pilots using their delegated powers.

The lack of enthusiasm from non pilot officers contrasted with the attitude of the pilot authorities. In 2007, officers in pilot authorities appeared enthusiastic to try the new technology, mirroring claims of pilot officers in 2003. The main motive for pilot participation in 2003 was the increase in organisational and personal status, and similarly in 2007, the officers recognised that their authorities would gain a measure of kudos being regarded as innovative. In 2007, officers recognised joining the pilot program would satisfy government performance targets aimed at increasing public participation or as one officer described it *"tick a box"*.

In one authority the type of pilot, e-counting, had been appealing to the officer who then approached the Chief Executive and together they presented the case to the council members. This officer was willing to *"take the risk"* with *"a product which would do the job."* He was confident in the technology for e-counting, using traditional workstations and scanners rather than specialist equipment which would be *"placed in a cupboard"* for years between elections. He expanded his reasons for joining the pilot describing the position in 2003 when authorities had to remain with one supplier. In 2007, authorities could approach the supplier of their choice and his particular supplier was chosen based on the company's previous pilot experience. The officer insisted, *"if we had not been allowed to use our chosen partner, we would have withdrawn from the pilot."*

Another Officer explained that only 20 staff were needed if e-counting was used, although the candidates and agents did not like e-counting as they could not measure an individual's progress. This latter comment mirrored an observation offered by an Election Officer in the 2003 research that candidates and agents missed the *'theatre of the count'* as they could no longer watch the ballot slips being counted into piles to monitor progress.

5.4 System Integrity

The data suggested that system integrity was influential in both 2003 and 2007. Research from this country and abroad identified that e-voting presents a risk to both the vote and the voter (Mercuri, 2010; ICAVM, 2002; Fairweather and Rogerson, 2002). Reports to the AEA following the 2003 pilots indicated Election Officers' concerns regarding technical failures during elections. The AEA senior executive commented that he would need *"copper bottomed"* guarantees before he would endorse the continuation of e-voting.

In 2003, the technology had, in some cases, proved to be unreliable and the affected local authorities did not wish to risk any threats to the ballot. There had been problems with the postal vote checking system as the officer explained

"The software caused problems as it collated the results. The technology just refused to talk to each other."

One officer explained that he too had experienced problems with the technology especially e-counting, and believed that such incidents resulted in *"question marks against the ballot results."* The same authority had experienced problems with their contractors. This officer remarked, *"The suppliers just didn't realise the tight timescales and it was a nightmare to get through the work. I wouldn't volunteer for that again."*

In contrast, Election Officers in 2007 pilot authorities were not influenced by problems encountered in 2003, even though they had heard and read reports of previous pilots. Election Officers who had applied for a 2007 pilot were aware of the possible risks to the voting process, but were confident that measures were in place to prevent fraud, as only five of the twelve authorities were using electronic means of casting a vote. The remaining authorities were trialling administrative procedures.

6. DISCUSSION

It is understandable that policies will be reviewed to determine what has been achieved, and literature suggests that it is rational to do so. However, that ideal is rarely achieved. The many techniques to accomplish effective evaluation are too numerous to consider in this paper, but the technique used to evaluate e-voting failed to adhere to established theoretical principles advocated by among others Dye (2002), Eason (1988) and Hertting and Vedung (2012) in that evaluation should extend to a wider context. The participant orientated approach of implementation evaluation emphasised users delivering the program, it did not explain the reason that the wider local authority community declined the invitation to join the pilots with the result that their concerns, discussed above, were not addressed. Officers who joined the pilot program in 2003, but declined further participation in 2007 remained convinced that their 2003 pilot evaluation reports had not prompted sufficient action to counter threats to ballot security. The former government failed to realise that there would be greater participation in initiatives if individuals believed their input was valuable (Koussouris at al, 2011).

Evidence existed to suggest that issues surrounding the increased workload to be undertaken without adequate funding, coupled with the lack of local discretion and threats to security, were reasons for non-participation in the pilot program. These motives should have been viewed as a source of information to allow an understanding of whether policy design achieved its objectives. A more dialogical approach to evaluation would have resulted in a greater understanding of individual perceptions (Rowlands, in Rubin 1995).

In preparation for the pilot program the former UK government commissioned a series of reports which included warnings of threats to the integrity of the system resulting from problems with new technology (Fairweather and Rogerson, 2002; Watt, 2002). These reports were issued in 2002, after the commencement of the trials in 2000. Issues identified in those reports could have been addressed prior to the trials in order to build confidence in the technology. Evidence from the Electoral Commission's 2003 and 2007 reports demonstrated similar concerns regarding security and the technological problems experienced during those pilots, yet they had not been addressed in those intervening years. Risks to the integrity of the ballot need to be addressed prior to any continuation of e-voting trials, as there is an argument that fear of failure influences policy adoption (Rist, 2000).

The e-voting trials were a fact finding exercise and in that they had a limited success. In 2007 following recommendations from the Electoral Commission and the Committee on Standards in Public Life, the pilots were halted owing to security issues detected during the trials.

7. CONCLUSION

This section suggests broad lessons that can be extrapolated to revise designs of policies introducing technology including e-initiatives, through pilot schemes, for voluntary adoption.

Research argues that policy designers need to identify the correct policy problem to design a policy that will deliver the desired outcomes (Skocpol, 1993; Birkland, 2005). An incorrect causal theory will result in a policy designed to address issues other than those intended. However, this paper suggests that in 2007, as in 2003, the former government did not realise that it has adopted the wrong causal theory. The problem of falling turnouts at elections is not due to the methods of voting, but to public disillusionment with politics and politicians, and increasing the ways in which to cast a vote will not address that issue (ICAVM, 2002; RFT, 2006). The UK MP's expenses scandal reinforced this distrust of politicians and, although elector turnout in the 2010 General Election rose slightly, many citizens believe that the formal machinery of democracy no longer offers them the opportunity to influence government decisions (Wark, 2010). The issue of public disillusionment with the political sphere was re-ignited by the low turnout during the November election for Police Commissioners averaging 14%, the worst on record (Doyle and Shipmen, 2012)

Policy objectives should be clear. The objective of e-voting veered from widening participation, to widening access, to strengthening voting processes. This lack of clarity coupled with a lack of a firm target date for the national introduction of e-voting may have affected the way in which local authorities viewed the status of electronic voting.

Policy design plays a significant role in its acceptability. Variables within the policy context influence policy adoption and the provision of adequate policy tools is essential to create a sympathetic context to enhance policy adoption. Rose (2005:17) refers to them as "the stuff of public policy".

The beliefs and values of individuals within an organisation influence policy adoption. The target group of the e-voting policy was local authorities. These organisations were conduits through which the public could access the new voting methods. Election Officers acting as Champions or "anti-innovation Champions" held the key to the diffusion of e-voting (Rogers, 2003:144). It was their beliefs and attitudes to the new voting methods that impacted on their actions and communications within local authorities. The provision of incentives including adequate policy tools, as discussed above, may ensure a tipping point in voluntary policy adoption.

The new system must be as trustworthy as the old. Trust in systems takes years to establish but little time to destroy (ICAVM, 2002). Issues of system integrity had been recognised by the Electoral Commission in their reports. The empirical evidence supported their concerns and indicated the significance of ballot security on adoption decision-making. When a new system replaces an established practice, the new system must be perceived as secure as the old system.

The realist philosophy gives rise to the key question of "what works for whom under what circumstances and why" (Sanderson, 2002). This paper has demonstrated the importance of an effective evaluation strategy to answer those questions by identifying motives behind policy adoption decisions. The e-voting policy was used to demonstrate that inadequate evaluation leaves gaps in knowledge thereby supporting Pawson's (2006) argument that often evaluation is limited in scope and as such fails to recognise all aspects of the policy. These gaps need to be identified and addressed to give greater insight into reasons that policies are not adopted in order to enable policy revisions to enhance adoption. This research demonstrated that although the problems were not insurmountable, they required government will and action to address them.

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INFORMATION SOCIETY IN CROATIA: LANDSCAPES OF KNOWLEDGE FOR DIGITAL INCLUSION: E-ISLAND PROJECT

Jorge Ricardo da Costa Ferreira
e-Geo Center for Geography and Regional Planning / Faculty of Social Sciences and Humanities
NOVA University of Lisbon
Avenida de Berna 26C 1069-061 Lisboa

ABSTRACT

Croatia remains a country with an historical problem concerning development asymmetries. That is also true when it comes to knowledge dissemination. Information and communication technologies sector (ICT) is crucial to leverage economic growth assuming an important role in some aspects of the so called information society (IS). The ICT sector is also important for the decrease of territorial asymmetries, assuming of course that a basic set of social and economical variables has already been taken into account. But the difference between numbers is bigger when it comes to large cities or metropolitan areas compared with its peripheries or rural regions. A country's education system is one of the main indicators of competitiveness in human resources. Highly competitive human resources are a consequence from high quality educational system that is available to a large percentage of the population. There is a major correlation between an increase on the level of education and economic growth (Hall, 2002; OECD, 2001a, 2001b, 2001c; Bassani and Scarpetta, 2001). An additional year of education counts as an increase in output per capita by four to seven percent (Bassani and Scarpetta, 2001). In developed and in transition countries the quality of education is even more important than the quantity of education in determining economic growth (Hanushek and Kimko, 2000).
Croatia has also undergone a program of information and knowledge dissemination. Although we cannot refer to as a specific program, we could see that ICT is growing and that is considered a priority sector within economy. Some reports and strategic documents clearly state the importance of information and their infrastructures (RERASD: 2012).
The dissemination of information is now determinant in terms of territorial competitiveness and both public and private sector take large benefits when the data-information-knowledge value chain repeats itself trough space and time.
Competitiveness is played at world scale and telecommunications play a major role. The need for information corridors has become crucial. Information diffusion catalyses regional development and lead to informational clusters. The polarization of places contrasts with the dispersion of spaces. And all this geographical hierarchies are important to achieve higher stages of territorial development. Knowledge networks are determinant to create critical mass and are crucial to globalization processes. To be out of the networks means only one thing: you do not exist.
CARNet, the Croatian network for research and education has done a major job to disseminate information and knowledge throughout the territory. Supporting the educational structure and overcome gaps between regions (when it comes to digital literacy) are some of the priorities. Projects of digital inclusion represent an obvious advantage in countries in transition to a more global economy. This research shows some of the aspects considering the information society, as well as a particular digital inclusion project: e-Island.

KEYWORDS

Information Society, Knowledge, digital inclusion, e-Island, CARNET, Croatia

1. INFORMATION SOCIETY AND INFRASTRUCTURES

1.1 Croatia in the European Context

The European Union promotes the active inclusion of persons with disabilities in society, in line with the EU human rights approach to disability issues. Inclusion is one of the main pillars of the i2010 initiative on the Information Society (IS).

In 2008 the European Commission adopted the "Communication Towards an accessible information society". The background document to the Communication explains: "We are living in a society where many aspects of our daily life are increasingly dependent on technology-based products, ranging from emails and the internet to digital television, automatic teller machines and ever more sophisticated inventions." In January 2009 the Croatian government adopted a Strategy for the Development of e-Government for the period of 2009-2012. It aims to lay down the foundations for the building of a modern, transparent, efficient and streamlined public service for citizens. The new strategy is in line with the provisions of the Croatian Public Administration Reform Strategy, in particular those relating to the use of ICTs as a key tool. The purpose of the Strategy for the Development of e-Government is to put public services online in order to make them more accessible to end-users. This idea is crucial for regional development and also to reduce territorial asymmetries. But the evolution of ICT sector is quite heterogeneous among different countries. It varies according to different evolution rhythms and political options. Public policies, liberalization of markets and sectors, technology convergence, mobile telephony, xDSL technologies, wireless and triple-play are just a few examples of the many technologies involved in such evolutionary scenery.

Croatia has to redirect some national government strategies and investments to leverage the dissemination of information. Only by doing that, they can achieve a knowledge society. And Croatia has very strong tradition on education. That context arises from earlier decades of a rigid communist educational system. Optic fiber alone does not raise education levels nor can broadband teach how to read and write. Similarly, broadband cannot bring children nearer to a school which is 50 kilometers away from their home. Technology helps but it does not solve structural problems. Hence, other variables such as, for example, the expenditure on education or university graduates and researchers employment rates should be considered as well when assessing the development level of a country when it comes to knowledge society.

1.2 Is Croatia Going Global?

Living in Information Society only makes sense if all the citizens have access to it. But this global sense is not so global has we would like. Physical networks (coaxial cables, fiber optics, etc.) are far from global and sometimes this definition loses its meaning.

Looking at a country profile, it seems obvious the differences between rural and urban areas when it comes to "going global". The strategy behind the connectivity rankings is always the same: just above a certain level of population density, companies are willing to invest on better connection infrastructures. In less populated regions, connectivity levels depend on public and governmental supports.

Broadband must be recognized as an imperative for economic Development and employment but also a key factor for improving healthcare system, science and culture. Rural areas must be a priority and Croatia needs to implement a strategy for these areas. The increase of intellectual potential must be developed or otherwise, the migration of young people to urban areas will progressively turn the rural areas into depopulated regions with even bigger asymmetries.

A research paper presented in a conference from HAKOM (2011), the Croatian communications incumbent clearly identifies the main reasons for lower broadband penetration in rural areas:

a) Potential user density in rural areas is lower and distances greater thus resulting in more expensive implementation. Lower density leads to lower demand, that is, less income per use for operators;

b) Age structure of population in rural areas is less favorable. The elderly are less likely to use the Internet. They are unfamiliar with computers and often afraid of technology;

c) Rural population is often less educated which results in lower IT literacy which creates a barrier for internet use;

d) Rural population on average has lower income and cannot afford to buy computers and broadband access;

e) Exclusive focus on broadband access with modest offer of real applications and services cannot convince rural population of the usefulness of Internet use.

It's also important to refer some more general reasons to that gap between urban and rural regions. Issues like late privatization schedule, unsuitable concession agreements, insufficient investments and general economic crisis context.

2. RESEARCH AND EDUCATION NETWORK: CARNET

2.1 The Evolution of CARNet

Croatia had a late start and it was only on October of 1991 that the first meeting of the Committee for the establishment of Croatian Academic and Research Network - CARNet took place. The Committee (appointed by the Minister of Science, Technology and Informatics) had the challenge of organizing a network capable of supporting communications to students, scholars and research community in all the Republic of Croatia and connect them to the world. It was formerly founded by the Croatian government in 1995 operating under the Ministry of Science, Education and Sports. The headquarters located in Zagreb have five distributed regional centers in Rijeka, Osijek, Split, Pula and Dubrovnik.

The whole project of planning, construction and financing of CARNet throughout all 20 years was actively followed and supported by the Ministry, as well as a number of institutions, partners and organizations. A special contribution to the development of the Croatian Academic and Research Network was also provided by the University Computing Centre in Zagreb - Srce. A special partnership CARNet was also developed with the Faculty of Electrical Engineering, University of Zagreb, and that partnership is ongoing ever since, while the Faculty remains actively involved in the development of services that CARNet builds and maintains.

In the early years, besides establishment of the advanced communication network to all academic institutions in the Republic of Croatia, CARNet achieved two major breakthroughs**:** the establishment of the first Croatian Internet connection to the world, on November 17th of 1992, which started the age of Internet in the Republic of Croatia and three months later, on March 27th of 1993, when CARNet registered and started to administer the national top-level Internet domain .hr. On March 1st, 1995, Croatian Government adopted the Decree on the establishment of the Croatian Academic and Research Network - CARNet as an institution for information and IT infrastructure activities in education and science.

In June of 2005 CARNet started the activities to connect the primary and elementary schools to the network which would be the base of the future academic network. Among the many pioneering initiatives, a few of them deserve to be mentioned:

- 1995 - The first implementation of a national network based on ATM technology;
- 1996 - The first transmission of video over the network;
- 1997 - The first remote lectures Internet based;
- 1999 - Coordination of the Croatian Internet Exchange (CIX);
- 2000 - The launch of the first regional Cisco Networking Academy;
- 2003 - The first traffic exchange between users over IPv6 protocol.
- 2003-2004 -The modernization of the network on the gigabit technologies;
- 2005 - Implementation of hosting for online services for secondary and elementary schools (HUSO);
- 2006 - Provision of individual access to CARNet network;
- 2007 - Launch of the Portal for schools and implementation of the project e-Islands;
- 2008 - Establishment of content filtering;
- 2009 - Construction of a based fiber optic infrastructure.

In 2010 CARNet initiated and gave its support to the National Information System for Applications to Universities (NISpVU) and developed a web application for managing the schools' *e*-Diary. It has 100 employees and 40 associates.

2.2 Infrastructure, Worldwide Integration and Users

Network infrastructure is owned by the CARNet institution, but the phisical structure (cables) is rented from telecommunication service providers (ISPs). In Croatia, the CARNet network connects the major Croatian towns and cities on the continent and a number of points of presence (PoPs) on the islands. The larger university centers like Dubrovnik, Osijek, Pula, Rijeka, Split, Zadar and Zagreb) have high speed connections (from 155 Mbit/s to 1 Gbit/s) while smaller centers are connected at speeds ranging from 2 Mbit/s to 100 Mbit/s. Zagreb has a particularly advanced infrastructure connecting larger faculties and scientific institutions at speeds of up to 10 Gbit/s. The currently supported version of the TCP/IP protocol is

IPv4. CARNet has 241 member institutions from the academic community connected to the CARNet network at 437 locations. There are 1386 members from the primary and secondary school systems, connected at 1919 locations. Individual users are higher education students, professors, researchers, primary and secondary school students, teachers and employees at primary and secondary schools and student homes.

Data retrieved from the last Terena Compendium (2010) shows that 106 Universities are now connected, 41 Institutes of higher Education, 36 Research Institutes, 422 Secondary Schools, 905 primary Schools, 10 Libraries, museums or national archives, 15 Non-University hospitals and 11 Government departments.

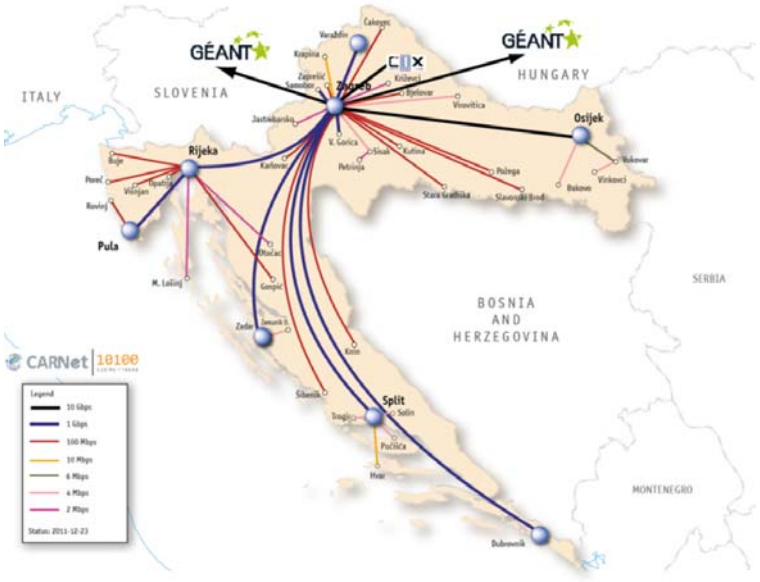

Figure 1. CARNET Network, Croatia, 2012.

Carnet is involved in several projects that include for example, the Nikola Tesla National Portal for Distance Learning with lots of interactive digital material for secondary schools (available on http://lms.carnet.hr), online courses in Moodle (available on: http://moodle.carnet.hr). This moodle application was used by an average of 7500 people per month (2010).

The CARNet network establishes its international connection through the GÉANT pan-European research network, with the current connection speed of 10 Gbit/s. The connection to other Internet service providers in Croatia has been implemented through the Croatian Internet Exchange Point – CIX.

Croatia has done some progress to overcome lower levels of connectivity concerning some of the islands that are part of its territory. When it comes to digital gaps, the sea is also a problem. One of the most interesting projects of e-inclusion developed by CARNet is the *e-Island* project that connects the most remote 21 primary schools in different islands and locations via Wireless/radio to the backbone infrastructure. This project covers a complete system for remote teaching enabling e-learning on low inhabited and depopulated Croatian islands.

2.3 CARNET E-Island Project: Digital Inclusion for Knowledge

Installing the newest available technology for e-learning (H.323 videoconference system, wireless infrastructure, smart boards, etc) the e-Island project allows teachers from a main school on the land to lecture pupils on the islands as well as broadcast seminars to the teachers. This project also equipped schools with projectors, cameras, speakers and microphones. The connection is established between the Elementary Schools in the "continent" and the Branch Schools in the Islands. The e-Island project comprises the following elementary schools and branch schools on islands) divided by four main connection Hubs (Zadar, Sibenik, Trogir/Split and Dubrovnik).

a) Link to CARNet PoP Zadar:

- *Zadarski otoci Elementary School, Zadar*

•Ist Branch School, Ist
•Olib Branch School, Olib
•Veli Iž Branch School, Veli Iž
- *Petar Lorini Elementary School, Sali*
- *Maria Martinolića Elementary School, Mali Lošinj*
•Ilovik Branch School, Ilovik
•Susak Branch School, Susak
•Unije Branch School, Unije

b) Link to CARNet PoP Šibenik:
- *Fausta Vrančića Elementary School, Šibenik*
•Prvić Branch School, Prvić Šepurine
•Zlarin Branch School, Zlarin
- *Juraja Šižgorića Elementary School, 22000 Šibenik*
•Krapanj Branch School, Krapanj

c) Link to CARNet PoP Trogir/Split:
- *Majstor Radovan Elementary School, Trogir*
•Drvenik Branch School, Drvenik Veli

d) Link to CARNet PoP Dubrovnik:
- *Ivan Gundulić Elementary School, Dubrovnik*
•Koločep Branch School, Koločep
- *Antuna Masle Elementary School, Orašac*
•Lopud Branch School, Lopud
- *Slano Elementary School, Slano*
•Sudurađ Branch School, Sudurađ
•Šipanska luka Branch School, Šipanska luka

The next four maps show the location of the nine Elementary Schools (two in Sibenik) – represented by a bigger school - and the fourteen Branch schools, divided by the 4 main Hubs – represented by smaller schools. The option to use GIS software (ArcGis 10®) to perform the digital cartography became an option as for future studies and spatial analysis could be addressed. All the information about settlements, roads and administrative borders was uploaded. Other variables could also be uploaded to the system as long as they are available for general public, like for example demographic or economical data.

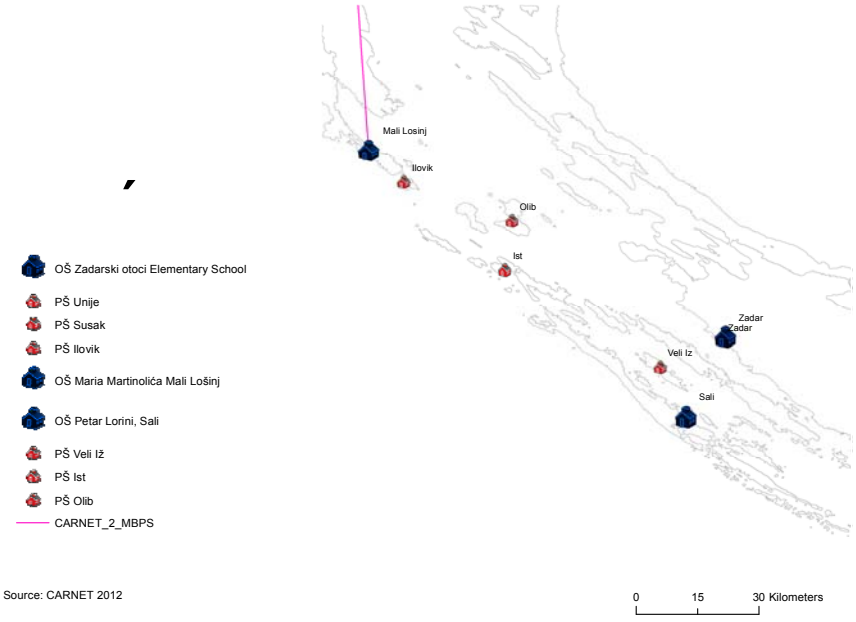

Figure 2. E-Island Zadar Hub

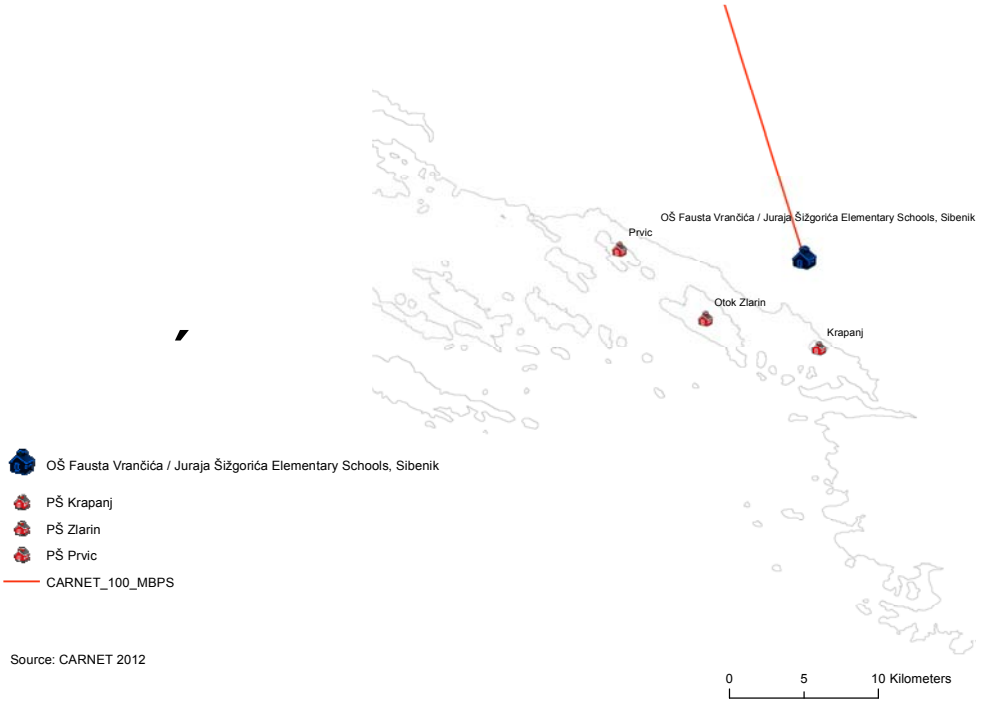

Figure 3. E-Island Sibenik Hub

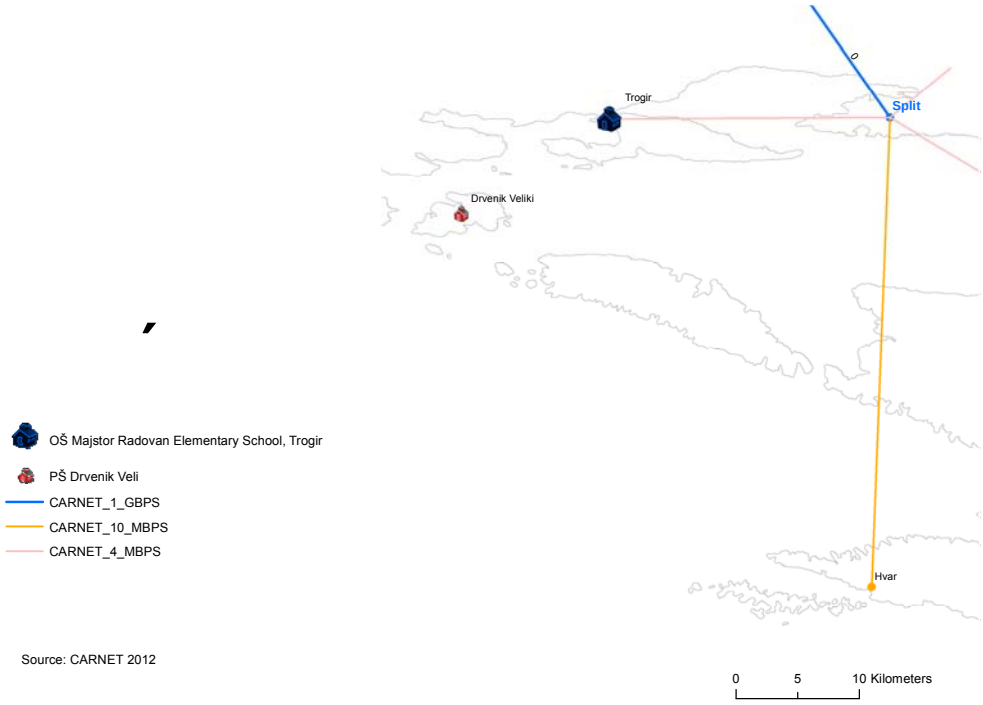

Figure 4. E-Island Split Hub

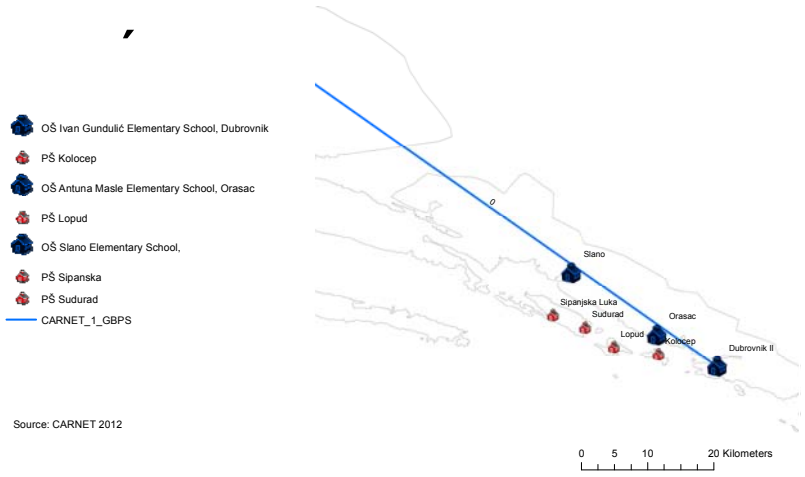

Figure 5. E-Island Dubrovnik Hub

About this e-Island project, a more profound analysis is being carried out with the collaboration and support of the Faculty of Economics from the University of Split. From all the primary schools in the islands, four have been chosen and visited (Lopud, Zlarin, Sepurine and Drvenik Veli). To evaluate the importance of the Carnet project, on the island community, on students, on teachers and methods and practices of teaching, a survey has been made.

Although a few schools were inquired, the process of collecting data has been slow. All the documents had to be translated as teachers don't speak English or because the primary schools didn't have the authorization from the Elementary schools/main schools to answer the survey. The small size of the sample remains as the major constrain to a reliable evaluation. So the results and final considerations supported by the surveys have to be addressed on future research works.

3. CONCLUSION

Croatia has done major efforts to compensate a late start on the Information Society issues. The lack of regional statistics to assure the complete quantification of gaps and asymmetries across the territory arises as the main concern. This is a problem affecting information society variables but also socio-economical and innovation indicators. Without reliable numbers, research can only be based on qualitative data, important for social sciences but insufficient for economical data.

Doing research about digital gaps and the relation between information society and development is challenging but it gets even more difficult when it lacks regional statistical data. And for Croatia the only information available was about demography.

When it comes to information society, the strategies adopted seem appropriate. Looking at the governmental and public policies adopted over the last few years, it's possible to see a considerable evolution. Internet infrastructures, research and education networks linking schools, universities and research labs. Likewise, a strategic alliance has been undergone with private companies because public domain doesn't own all physical infrastructures (from an economical point of view it would be unsustainable to own all of them). So the option is to use private networks as a part of CARNet infrastructure.

CARNet has done a considerable amount of investments and the e-Island project is definitely a good example of e-inclusion. Although the surveys have not been received and analyzed, the educational and social aspects of its implementation seem obvious. Talking with the young students, teachers and people from the islands, the feedback is positive, although some problems persist after the project.

A primary school is always good for an island. Children are very young and traveling every day to another island or to the mainland to attend school would be impossible because boats connecting the islands are scarce in winter season.

For some of the islands, the fact that they could have a primary school is very important. But for the majority of the islands, economy is too weak to support young workers. The seasonality of its most important sector, tourism, remains a problem. Apart from the 3 months of summer, there is not too much to do.

It seems obvious that Internet and information infrastructures reflect a regional dynamic. Internet is an element that reinforces economic and social dynamics, especially when related to the new information and knowledge sector. Different countries across the world present some interesting case studies where Internet seems to induce a new information potential, giving people the necessary tools to leap across the digital divide: India is one of them.

Strategies based on geo-marketing should also be addressed. Although tourism have long been considered as governmental priority along the Adriatic coast, rural regions still lack a more strong effort on territorial marketing.

Information society is not "the solution" but it also helps people to develop some skills. To disseminate information across a territory creates knowledge and knowledge leads to growth and presumably to development. But this piece of research also showed weaknesses. Croatia needs to strengthen economical tissue on more rural or peripheral regions. Public research labs, tourism schools, private research facilities, new University Campus resulting from aggregation of different Faculties or Universities could be considered as anchor projects. These investments on research and education could leverage regional development delivering a continuous path after sustainable projects of digital inclusion like the CARNET e-Island.

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EVALUATING STUDENTS' EXPERIENCES WITH WIKI-BASED COLLABORATIVE WRITING IN TEACHER EDUCATION

Said Hadjerrouit
University of Agder
Serviceboks 422, 4604 Kristiansand, Norway

ABSTRACT

Wikis as emerging Web 2.0 technologies offer new possibilities for teacher educators to collaborate around joint writing tasks. Three basic elements are of crucial importance for wiki-based collaborative writing in teacher education: the content of the writing task, the wiki functionality for designing the content, and group work to perform collaborative writing. Based on these considerations, the main purpose of this paper is to assess students' experiences of wiki-based collaborative writing in teacher education. The work also critically discusses factors that prevent students from collaborating. Finally, the article concludes with some recommendations for successful wiki-based collaborative writing in teacher education.

KEYWORDS

Collaboration, collaborative writing, teacher education, Web 2.0 technology, wiki.

1. INTRODUCTION

Wikis are been promoted as tools that support collaborative writing, group discussion and reflections in a wide range of educational settings. In teacher education, wikis have been used to perform collaborative writing associated with various educational purposes, such as wikis for online coursework, teacher evaluation, class project, joint article or writing task (Austin et al, 2010; Deters, Cuthrell, & Stapleton, 2010; Chao & Lo, 2011; Every, Garcia, & Young, 2010; Grant & Mims, 2009; Hadjerrouit, 2012; Mindel & Verma, 2006; Parker & Chao, 2011; Witney & Smallbone, 2009). More specifically, wikis are used to perform collaborative writing activities and design student-oriented content on the basis of usability criteria. Wiki content is normally aligned with a given school curriculum and includes information that is relevant to the target users. Collaborative writing, wiki content, and wiki functionality are closely related to each other. Their integration into teacher education requires a thoughtful understanding of their relationships. Based on these considerations, the main purpose of this work is to examine students' experiences of wiki-based collaborative writing by means of survey questionnaires with open-ended questions, and issues addressed in the discussion page of the wiki. The results are critically discussed, and recommendations to foster wiki-based collaborative writing in teacher education are suggested.

2. WIKI-BASED COLLABORATIVE WRITING

The underlying assumption of wikis is that they are potentially powerful to support collaboration writing, and as such they enable participants to collaborate around joint writing tasks, and offer new possibilities for group discussions. The benefits of collaborative writing are underpinned by the collaborative learning theory and associated learning paradigms such as the socio-cultural learning perspective (Vytgosky, 1978). As a result, collaborative writing is considered as superior to individual writing (Yarrow & Topping, 2001; Witney & Smallbone, 2011). Wikis may be used collaboratively by a team of students for a joint project, essay or article. Wikis may stimulate students to work together to create a collective document. Basically,

collaborative writing includes joint writing activities, group discussions, and feedback from peers. Wikis have a history function that tracks all versions of the writing task and enables the assessment of students' individual contributions to the groups. Wikis have also a discussion page that allows group interactions and critical reflections.

The use of wiki as collaborative writing tools in teacher education requires the close integration of the content of the writing task and the wiki functionality needed to design the content (Fig. 1). The wiki functionality is used to structure and organize the content using a simplified HTML language and an intuitive user interface (Lamb, 2004; Tetard et al., 2009). Wikis have also a discussion page that provides a platform for reflections and group discussion. In addition, wikis have a history function that tracks all versions of articles, enabling a statistical analysis of students' contributions to collaborative writing. Among a plethora of wiki tools, MediaWiki was chosen as a platform for this work. MediaWiki incorporates all features mentioned above. In addition, MediaWiki is restricted to university members, making it appropriate for education (Kasemvilas & Olfman, 2009). Wiki functionality is evaluated in terms of ease-of-use, technical design, formatting, linking, inserting of tables and images, and added value in comparison to other writing tools such as Google Docs.

Wikis allow educators to edit a writing task associated with a specific content that is aligned with a given curriculum. Editing content means several activities: adding and deleting content; adding, fixing, and deleting links; formatting, grammar, spelling, and rewriting each other's contributions. Genuine collaboration is a matter of reworking each other's contributions (Hadjerrouit, 2012). Wikis can include content from textbooks, but also online study material. Wikis can be created to support various topics of a subject, and study material at all levels in teacher education. The content dimension of wiki is important for many reasons. It stimulates students to be engaged in the design of the writing task. It motivates students to collaborate and discuss the wiki functionality in relation to the writing task. Finally, it challenges the students to take into account the characteristics of the target users.

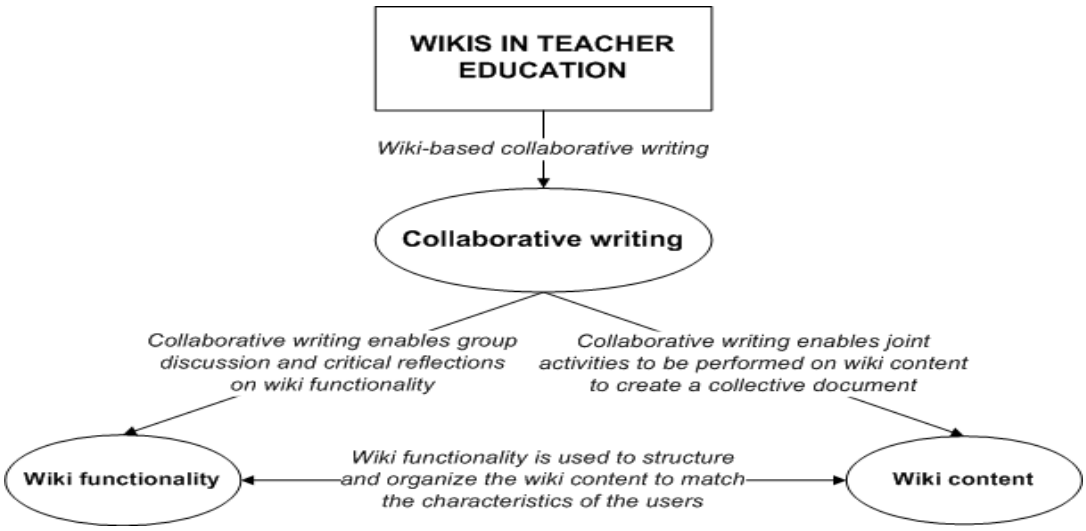

Figure 1. Basic Elements of Wiki-Based Collaborative Writing and Their Relationships

3. METHODS

This work used a case study to evaluate students' experiences of wiki-based collaborative writing. Data from came from 16 students enrolled in a course on Web 2.0 technologies in teacher education (n=16). The students were divided into 6 groups of 2 to 4 to perform collaborative writing activities over a span of 8 weeks. None of the students had experience or background in wiki-based collaborative writing. The students were required to follow general usability criteria for designing the wiki writing task, such as technical layout, formatting, and style. Content should draw on recent curricular development, and include study material of

good quality with references. The content must be adapted to the characteristics of the target users. The students were also required to use the discussion page to argue and reflect on the way they used the wiki functionality to design the content, edit each other's contributions, adapt the language to the needs of the users, etc. The students were not assessed individually, but as a group working collaboratively.

To report on students' perceptions of wiki-based collaborative writing, two complementary methods were used: a survey questionnaire with open-ended questions, and discussion logs. The students were asked to judge and reflect on the quality of their wiki and the wiki tool being used to carry out to collaborative writing activities. The discussion logs were analyzed quantitatively in terms of number of comments, and qualitatively in terms of quality of the comments provided. The items of the survey questionnaire and discussion logs were categorized by wiki technology, wiki content, and wiki collaboration. The survey was performed using a questionnaire with 13 items. The results were analysed quantitatively and interpreted qualitatively. To assess their responses, the survey used a five-point Likert scale to measure the extent to which they strongly agree, agree, neither agree or disagree, disagree, or strongly disagree. Finally, the students were asked to respond to two open-ended questions and comment what they liked and disliked about the wikis, and what they think should be improved.

4. RESULTS

4.1 Survey Questionnaire

The survey questionnaire was designed to include 13 items, which themselves were categorized by wiki functionality (item 1, 2, 3, and 4), wiki content (item 5 and13), and wiki collaboration (item 6, 7, 8, 9, 10, 11, and12). Table 1 shows the students' responses to the questionnaire and associated results for each item.

Table 1. Students' Responses to the Survey Questionnaire

	Items addressed	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
1.	MediaWiki is easy to use and user friendly	3 (18.75%)	10 (62.50%)	1 (6.25%)	2 (12.50%)	0
2.	MediaWiki is easier to use than other Web 2.0 tools such as Google Docs	0	0	12 (75.00%)	4 (25.00%)	0
3.	The wiki is technically well designed	3 (18.75%)	9 (56.25%)	4 (25.00%)	0	0
4.	It is easy to navigate through the wiki	6 (37.50%)	10 (62.50%)	0	0	0
5.	The content of the wiki is easy to understand	6 (37.5%)	8 (50.00%)	2 (12.50%)	0	0
6.	MediaWiki supports collaboration and discussion	4 (25.00%)	10 (62.50%)	3 (18.75%)	0	0
7.	I like editing peers' contributions	1 (6.25%)	6 (37.50%)	9 (56.25%)	0	0
8.	I like that peers edit my own contributions	5 (31.25%)	7 (43.75%)	4 (25.00%)	0	0
9.	The wiki topic stimulates collaboration	4 (25.00%)	10 (62.50%)	2 (12.50%)	0	0
10.	The wiki topic stimulates discussion	0	10 (62.50%)	5 (31.25%)	0	1 (6.25%)
11.	The level of collaboration is high	4 (25.00%)	8 (50.00%)	3 (18.75%)	1 (6.25%)	0
12.	The level of discussion is high	2 (12.50%)	6 (37.50%)	6 (37.50%)	2 (12.50%)	0
13.	The wiki is adapted to the characteristics of the target users	2 (12.50%)	7 (43.75%)	7 (43.75%)	0	0

4.1.1 Wiki Functionality

Table 1 shows that the vast majority (81.25 %) of the students strongly agreed or agreed that the wikis were easy to use, technically well designed (75.00 %), and the navigation through the wikis was straightforward (100 %). Furthermore, 87.50 % of the students believed that MediaWiki supports collaboration and discussion. In stark contrast, 75.00 % of the students neither agreed nor disagreed when asked if they found MediaWiki easier than other Web 2.0 tools, while 25.00% disagreed. Students' responses to open-ended questions also revealed the lack of a good WYSIWYG interface. Some representative students' comments were:

I don't think that the MediaWiki editor was very user friendly. If you have a lot of text, it can be confusing for some users to find their way through the editor.

MediaWiki should be developed in the direction of being able to offer a WYSIWYG interface.

Some other students pointed out that the lack of advanced functionality would students from developing more usable and user friendly wikis. They preferred to have more alternative options for creating wikis:

What I did not like was that it gave few opportunities to show what they had changed - or see what others had actually changed.

I think that they should develop a page for viewing (so everyone can see it) and a developer side (as they are editing the page you see) - so you can select the new text in a different color on the developer page for example.

It could have been a kind of toolbar where one could see the characters one should use (bold, size of images...)

A little bit difficult to insert tables (…) and post pictures.

4.1.2 Wiki Content

Table 1 indicates that 87.50 % of the students strongly agreed or agreed that the wiki content is easy to understand. In some contrast, only 56.25 % strongly agreed or agreed that the wiki content is adapted to the characteristics of the target users. There were a few responses to open-ended questions. One of them was:

Parts of the wiki are easy to understand, but somehow written for adult people in relation to the target users. The theme we have chosen has not much with the students' interests to do, but is still a subject they are teaching (…)

4.1.3 Wiki Collaboration And Discussion

Table 1 reveals that 43.75 % of the students strongly agreed or agreed that they like to edit other's wikis. In contrast, 75.00 % strongly agreed or agreed that they liked that peers edit their own contributions. In addition, 87.50 % strongly agreed or agreed that MediaWiki supports collaboration and discussion. Furthermore, 62.50 % believed that the wiki topic stimulates discussion, and 87.50 % fosters collaboration. Finally, 75.00 % think that the overall level of collaboration is high, while 50.00 % strongly agreed or agreed that the discussion raised critical reflections on the wiki. However, responses to open-ended questions revealed the difficulty of collaborating and discussing using MediaWiki. Some students emphasized their preference for verbal and face-to-face communication:

I think it was a bit artificial to use the discussion page, especially when we are not away from each other. However, we have tested it out, and it is probably a great tool if you work with people you do not meet very often.

We took some decisions about how to design the page. Yet I must admit that several of the decisions were taken face to face.

It is necessary for peers to comment on contributions, but I think it may be more useful to do this verbally than in the discussion page. Then you can make yourself more easily understood.

We have commented each other's work more critical and reflective than on the discussion page.

Students were also critical regarding collaboration as the following comments clearly reveal:

We could have worked more on the content, and discussed more together. I could even have contributed more on the written content, with images and tables.

The wiki quickly becomes more like an encyclopedia, in which facts are a top priority. I feel that to the extent we have been working with the wiki, there has been little interest in discussing the substance (…)

The starting point was that we would rather have been 3 in a group, but since one chose to give up, the level of collaboration was not particularly good.

Collaboration has been the main focus of the wiki. I felt I should have done more.

4.2 Comments Posted on the Discussion Page

The students' comments posted on the discussion page of the wikis were analyzed and categorized by wiki functionality, wiki content, and wiki collaboration. In addition, unrelated comments were also considered (Table 2):

Table 2. Comments Posted on the Wikis Derived from a Content Analysis.

Category	Comments addressed	Frequency of comments
Wiki functionality	Technical layout, structure, formatting, images, tables, lists, paragraphs, headings, pages, subpages, categories.	105 (53.57 %)
Wiki content	Addition and deletion of content and links, spelling, grammar and language corrections, references, wiki length.	75 (38.27 %)
Wiki collaboration	Critical reflections on usefulness of content, critical review of literature, adaptation of language to target audience, reworking content, editing each other's contribution.	10 (5.10 %)
Unrelated	Comments that were not related to wiki functionality, wiki content and wiki collaboration.	6 (3.06 %)
Total no. of comments		**196 (100 %)**

As Table 2 shows, 53.57 % of the comments were related to wiki functionality such as technical layout, insertion of tables and figures, and formatting of headings and subheadings. Regarding wiki content (38.27 %), most comments related to addition or deletion of content and links, language corrections, wiki length, etc. Finally, students posted few comments on issues related collaboration (5.10 %), such as reflections on usefulness of information sources, critical review of literature and adaption of language to the target audience. Some representative comments on wiki functionality were:

Can we make this as a table with two columns? The first one showing the name (often linked to more detailed material) and the other column showing for example (…). Do we agree on the visual layout?

The images have been added are from Flickr. See that the resolution is very low and have therefore extended it. The image can then be a bit grainy when viewed at a large scale, but I do not think it is detrimental.

Should not proper names be written in bold? We must agree on how to have it, for I have spent a lot of time to write all proper names in bold, so it's not good if I do it and we should not have it like that.

The following were typical comments on wiki content:

I think we need to put more info in the background, as an introduction. We also need to have more references, literature and further reading.

I guess today we will deliver the wiki. Who takes care of creating tables? I thought I was writing the page about (…), and proofread the entire wiki. We also need to arrange the reference list.

We have to write about 5300 words. So far we have written about 3800 words. I recognize that the wiki satisfies the requirement as soon as we have put in more content.

Regarding the third category of comments, none of the students discussed the issue of adapting the language to the target audience. Only one student emphasized the need to work collaboratively:

Someone has to write a bit more and change what I have written about (…), and I can write more about (…)

4.3 Summary of Results

The survey questionnaires show that students were globally satisfied with the wikis and their potentialities to foster collaboration. However, responses to open-ended questions revealed a number of unresolved problems:

- MediaWiki lacks a WISIWIG editor that may facilitate collaborative writing
- MediaWiki lacks advanced functionality that would make the tool more usable and user friendly
- The issue of adapting the wikis to the characteristics of the target users was not specifically addressed
- Individual work was more evident than collaboration
- The level of collaboration among students was rather low
- Students still value verbal and face-to-face communication

The problems revealed by open-ended questions were globally confirmed by the issues addressed in the discussion page. Considering that comments on editing each other's contributions and critical reflections on content were the ones that require collaboration, it can be asserted that the level of collaboration was rather low. This is in accord with the results achieved for the categories of actions carried out on the wikis. An analysis of the history function reveals that the most frequent activities were formatting, addition of content and links. In contrast, genuine collaboration by editing each other's contribution was not a frequent activity.

5. DISCUSSION

Even though most students did not encounter major technical difficulties to design their wikis, it is obvious that MediaWiki needs to be improved to include extended functionality that facilitates editing. There is also a general agreement that is a need for a WISIWYG editor that ensures a trouble-free interaction with the tool to free more resources for collaborative writing (Thomas, King, & Minocha, 2009). Although students were globally satisfied with MediaWiki and its potentialities to support collaborative writing, an analysis of the issues addressed in the discussion page shows that only a few students did reflect on the writing tasks in terms of usefulness of content, critical literature review, adaptation of the wiki to the needs of the users, and reworking each other's contributions. Students did not firmly grasp their knowledge in order to make the wiki more relevant and attractive for the target users. Rather, the students focused more on selecting content from Wikipedia and other Web sites than critically discussing their ideas. Clearly, this limits the creation of shared knowledge. As a result, the content produced seems to be limited to each individual student, rather than developed in collaboration, since relatively few students reworked each other's contributions. This behaviour is in accord with the results of previous research work (Cole, 2009; Forte and Bruckman, 2007; Grant, 2009; Lund and Smørdal, 2006; Meishar-Tal, & Gorsky, 2010). One explanation is that students

appeared to use practices of individualised work they were accustomed, rather than collaborating to realize shared knowledge (Grant, 2009). Another explication may be the assessment form used, which does not require mandatory participation. Furthermore, in contrast to the view that wiki technology supports collaboration, being aware of technical affordances is a pre-requisite for using wikis, but not sufficient to engage students in collaborative writing, if students do not know the advantages of group work, or are not able to develop effective collaborative and discussion strategies. Responses to open-ended questions also revealed the difficulty of collaborating and editing each other's contributions. Furthermore, some students reported that they still value face-to-face meetings and oral communication with their peers by means of other channels, e.g. mobile phone and email (Ferris, and Wilder, 2006). One possible reason to prefer face-to-face discussion is that current wiki platforms do not have sufficient functionality to enable students to discuss without writing down the date of contribution and name of contributor. Clearly, this disturbs the flow of a discussion thread. As a result, it appears that while wikis might support group work, collaborative writing is not exclusively determined by the technology.

Based on the results, some suggestions are recommended to engage students in genuine collaborative writing. First, students need to familiarize themselves with the wiki topic and the characteristics of the target users. Second, some language proficiency is expected to make the writing process easier (Li & Zhu, 2011). Third, assessment of students' individual contributions to collaborative writing should be considered (Harsell, 2010; Li & Zhu, 2011). Then, relying too much on wiki technology does not make collaboration automatically happen (Pifarre & Fisher, 2011; Grant & Mims, 2009). Rather, collaborative writing cannot be successful without seeing the relationships between the wiki topic, wiki functionality, and the way to collaborate on writing tasks for designing user-oriented wikis. Furthermore, according to (Huang & Nakazawa, 2010) and (Ferris & Wilder. 2006), the process of creating wikis needs to be carefully planned by teachers to sustain students' activities, such as writing collaboratively, critically revising and reviewing each other's wiki throughout the wiki development process. Finally, according to Cole (2009), wiki-based collaborative writing cannot be successful without a sound pedagogy based on collaborative learning.

6. CONCLUSION

Summarizing, wiki technology alone is simply not sufficient to foster collaborative writing. Rather, wiki-based collaborative writing requires a thoughtful understanding of the complex relationships between wiki functionality, wiki content, and collaborative writing (Mishra & Koeler, 2006). Based on the results, some recommendations are suggested to successfully foster wiki-based collaborative writing in teacher education. Several case studies will be undertaken in the future to explore wiki-based collaborative writing in more details and depth. Finally, since this study used a small convenient sample with only one class (n=16), case studies with a larger population of students will be considered in future research to strengthen the reliability and validity of the results.

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THE FUTURE OF ELEARNING

Simone Deslarzes and Emily Grandjean
Wellesley College
106 Central Street, Wellesley, MA 02482

ABSTRACT

This paper examines the current state of education with regard to technology. The explosion of eLearning tools and resources has revolutionized the way society approaches teaching and learning. eLearning has ignited a newly invigorated passion for learning across many generations. Because of the Web's accessible nature and the vast amount of free content, eLearning has become a democratizing force in education. With its permeating presence, eLearning has evidently reached its way into the classrooms of educational institutions. Teachers are using these new resources and tools to more effectively and efficiently teach their students. Students who have access to eLearning resources are able to cater to their specific learning styles and needs in order to personalize their education. Although there are advantages to traditional classroom learning, this paper presents ideas for ways in which these advantages can be incorporated into eLearning using future technology.

KEYWORDS

eLearning, education, online interface, Classroom Learning, educational resources

1. INTRODUCTION

Before the invention of the World Wide Web, people had to rely on printed information, audio and video records, and person-to-person communication in order to learn from or teach others. Education, especially at the higher levels, was simply unavailable or unaffordable to many who desired to learn. To persuade states to begin to build public schools, the famous education reformer Horace Mann declared that the schools would "equalize the conditions of men" [6]. He could not have predicted at that time how far technology would eventually advance to work toward his goal. The turn of the 21st century has seen the birth of the Web and the beginnings of a new paradigm of education. Anyone with Internet access now has the possibility to take online courses provided by some of the world's finest educational institutions, search through the text of thousands of books, and publish and view comments in global online forums intended for discussion and reflection.

This new way of learning, in which a person's source of instruction comes primarily from the World Wide Web and/or through interaction with a digital device either in or outside of the classroom, rather than a physical interaction with an instructor in a classroom, is what we will call "eLearning". While other papers may examine eLearning as a more structured and limited process, we define eLearning as a process that may or may not be highly structured depending on one's preference, may or may not take place within an educational institution, and includes technological educational sources of all kinds, such as online university courses, blogs, videos, images, and discussion forums. On the other hand, the more traditional person-to-person and technology-free learning method is what we will call "Classroom Learning". In addition, we will refer to a person who processes information through eLearning as a "learner," regardless of age and whether or not they are necessarily a student attending an educational institution.

In this paper by reviewing a select number of eLearning sources, we will first discuss how this dramatic change and increase in the number of ways information can be exchanged for the purpose of eLearning has affected society and the traditional classroom experience in the United States. Secondly, we will assess the benefits and disadvantages of eLearning compared to Classroom Learning. Finally, we will offer ideas about ways in which we can improve eLearning by incorporating the advantages of Classroom Learning using current and future technology.

2. EFFECTS OF ELEARNING

It is unlikely that there is a person in the United States who has not been informed in some way by the Web. Indeed, many classrooms across the country have been integrating the use of technology in their curriculum to varying degrees. In this section, we seek to understand the changes that have been made to the student experience, however subtle. Some of the questions we will cover include the following: With the widespread use of current eLearning resources, how has our society been affected? How has eLearning changed the environment of the classroom and the education system? How has it brought people from across the world together for the purpose of learning? How has it benefited from our inherent human social characteristics?

2.1 Crowdsourcing an Education

The Web has acted as a universal classroom in which anyone may contribute either as a learner or teacher. People all over the world have uploaded and shared tens of millions of videos to video-sharing websites like YouTube.com, as well as billions of photos to photo-sharing sites such as Flickr.com. Not only that, by late 2011, Twitter users were collectively publishing 250 million tweets each day while users of Tumblr and WordPress had created a combined total of over 100 million blogs [10]. Sharing a single video, photo, or blog may not seem so significant until one considers the vast collection of content to which it contributes. This collection of human thought, emotion, and experience is diverse; it may include such things as a video clip of a man speaking in French with his children, a woman's photograph of the attack on the World Trade Center, or a young girl's blog post about being bullied in school. Because the Web contains such a large assortment of information, learners can find information about virtually anything. It is here where the true value of eLearning lies. It has ignited a passion for learning about not only traditional academic subjects but all areas of interest. eLearning has transformed traditional education and in doing so it encourages the idea that education does not end at graduation but rather is an eternal endeavor for this new wave of learners. Furthermore, the "shareability" of the Web's content, meaning the facility with which it is able to be shared amongst users, plays well into our inherent social human characteristics; it allows us to relay information we find important with the people to whom the information is relevant. People naturally enjoy communicating by sharing things like funny videos, interesting articles, delicious recipes, et cetera, and the Web makes that type of sharing extremely simple and fast. In addition, because online advertisements are profitable, websites are able to provide content to its visitors free of charge. This has allowed people to have access to online information and resources without necessarily having to pay for them.

Because people are able to search for any topic that interests them and publish their own content about those interests, the Web has facilitated the creation of groups in which members may exchange information about a particular topic. For example, the website Parkour.com invites learners interested in parkour, or "free running", to connect with other group members on their official Facebook page, watch informational videos to learn parkour techniques, and sign up for email updates with helpful tips and event invitations. Colleges and universities have mimicked this demonstrated technique of catering to a particular interest and providing an interface through which users can share and discuss in creating their online education eLearning tools. The University of Northern Iowa, for example, designed UNI eLearning, their centrally supported web-based Learning Management System, in this same fashion by developing tools such as discussion boards and chat rooms for students and professors [6].

Like members of the Parkour community, language enthusiasts have joined together on LiveMocha.com to strengthen and develop their foreign-language skills. The website allows learners to both acquire new language skills and teach others their native languages. Since anyone can be both a learner and a teacher with the facilitation of these types of websites, education is now a widely shared endeavor.

The Web has significantly increased the world's capacity for sharing, and thus has increased social interaction, which in turn has served to fortify the bonds in our community. One outstanding reason for this trend is Facebook.com, which has connected people in ways never before possible. It is not uncommon to hear stories about people finding their biological parent or an organ donor through Facebook. New mothers and fathers who are in the same geographical area are able to create support groups on Facebook to share tips and organize child day care. Students attending college can ask and respond to questions about events, classes, and transportation. In general, Facebook users who are members of Generation Y and the following generations will, if they so choose, be able to maintain regular contact with childhood friends for the rest of

their lives, adding new friends to their network as they advance through life. Furthermore, Facebook provides a platform for businesses to interact with their customers, governments to notify their citizens of important information, and even citizens and consumers to unite in massive demonstrations (e.g. the Arab Spring).

While not a direct tool of eLearning in the classroom, the significance of Facebook is that it encourages Web users to share and learn from their "friends", a social activity that likely leads to greater sharing in other Web activities and in other aspects of life. This increased utilization of social interaction via the Web has forever changed the way members of society interact with one another. This behavior is relevant to the involvement of eLearning in the classroom because it has normalized the social interaction between students themselves and with the professor on an online interface. Whereas beforehand this type interaction would have seemed foreign to students, now it is normal to chat online with a professor or other students or to gain assistance using email or an online discussion board. No longer is it necessary to schedule group study sessions in the library because a shared Google Document or a Facebook group can serve the same function from the comfort of a learner's dorm room. Because of social media and its immediate accessibility, not only are people better able to learn from each other, they are more likely to ask a question in the first place. This is the beauty of the Web: it feeds people's curiosity and makes them more passionate about learning, since it is self-directed and can be easily done with the help of one's friends and larger network using a technological interface.

2.2 A Personalized Education

One of the biggest challenges facing the current public education system is that the student-to-teacher ratio in many schools is terribly unequal. Because classroom sizes are so large, teachers must spend less time with each student individually. Students, in turn, are usually made to follow a predetermined curriculum regardless of their particular skill set, background, or preferred method of learning. As a result, Classroom Learning is traditionally a "one-size-fits-all" approach to teaching.

eLearning breaks that mold. Using eLearning tools, students have the power to personalize their education. According to Daphne Koller, professor at Stanford University and co-founder of Coursera.com (a website that provides free access to online university classes), courses may be broken down into modules which students can traverse on an online platform based on his or her own interests and background [9]. Online viewing of lectures caters to students because it allows them to replay certain parts of a lecture that were confusing without having to suffer the embarrassment of being slow to understand a concept in the classroom. Furthermore, the teacher who gives the lectures can see where students are having the most trouble based on the frequency that students view particular parts of a lecture online. With this previously unavailable information, teachers can make precise adjustments to their curriculum and lectures to make them more effective.

Surprisingly, incorporating technology into curricula can actually allow for greater face-to-face interaction between students and teachers. For example, KhanAcademy.com, which was founded by former hedge fund analyst Sal Khan, has a library of over 3,500 courses that cover everything from art history to finance. In a TED talk he gave [8], Khan explained how his video lectures have inspired teachers to "flip" the classroom, which is to say that the teachers would assign his lectures for homework and then use class time to work one-on-one with the students to help them better understand the material. Not only that, the students would be able to interact with each other in class much more, when previously they were expected to be silent as the teacher lectured. This is one way in which eLearning has allowed for greater "face time" in the classroom, a counterintuitive result of a greater use of technology.

The availability of free online courses promotes lifelong learning and allows people to gain new skills in order to re-route their career paths. The website Skillshare.com provides professionally-taught courses at low cost that cater to a wide array of interests. Currently, course offerings include User Experience Design for Non-Designers ($40), Intro to Electronic Circuits ($105), Food Photography ($15), and Eyes on the Sky: Find the Autumn Stars and Constellations ($10). Clearly, some courses are meant to teach skills that could lead to a lucrative career while others are meant simply for personal enjoyment and satisfaction of curiosity.

2.3 Anyone (With Internet Connection) Can Go To Harvard

Universities that are working to provide greater access to their classrooms include a group made up by Harvard University, and MIT and later joined by Berkeley, Wellesley College, Georgetown University, and The University of Texas System. In the semester of Fall 2012, they launched their new online courses website edX.org which describes itself as "The Future of Online Education: for anyone, anywhere, anytime." A short video that introduces the website on its home page features Susan Hockfield, the President of MIT, acknowledging that "edX is, in the very best sense, a work in progress, but it is also an act of progress" [8]. Also featured in the video is edX President Anant Agarwal, who declares the goal of edX to be to "educate a billion people around the world." The Web is limitless, and the goals of those who seek to use it to democratize education are equally boundless in ambition.

The next necessary step is to make Internet access universal. The limitless possibilities of eLearning, that are meant in part to improve underprivileged schools and assist students who do not have access to educational resources such as tutors, are useless if their interfaces are financially or circumstantially unavailable to these target audiences. One group that has gone to great lengths to provide technology to disadvantaged children is One Laptop per Child (OLPC), a non-profit organization founded by faculty members of MIT's Media Lab in 2005. They work to "design, manufacture, and distribute laptops that are sufficiently inexpensive to provide every child in the world access to knowledge and modern forms of education" [8].

In a TED talk given by OLPC Foundation Chairman Nicholas Negroponte, he describes a then-recent initiative in Maine that provided every student in the state a laptop. Three and a half years later, teachers reported a significant drop in student truancy and discipline problems, and increased participation and engagement of students and parents. Meanwhile, the teachers found their work more enjoyable and received such an overwhelming number of emails from students in the evenings that sometimes the servers were turned off at night [10]. From this information, OLPC recognized that personal laptops were essential in engaging students and their families. OLPC reports on the FAQ section of their website that they have distributed over 2 million laptops as of 2011 to students in countries all over the world [5].

Needless to say, there is still much work to be done before people in every country have consistent access to the Internet and at least a basic understanding of Web navigation.

3. THE PROS AND CONS OF eLEARNING

The addition of eLearning to the educational spectrum has evidently had major effects on the manner in which learners receive and process new knowledge. It has reinvigorated and greatly influenced the teaching and learning styles of not only typical teachers and students, but also of the entire active population on the Web. Information has never been easier to access for the general public. The days of devoting numerous hours to studying printed sources in order to gain specific knowledge on a certain subject are quickly diminishing. Today, through the utilization of personal devices such as laptops and smartphones, a person can gain basic and in depth knowledge by simply typing in a question to a search engine and receive an answer within milliseconds. The eLearning phenomenon has swept across the world, and in doing so, has forever changed present teaching and learning methods, for better or for worse. In addition, it is has opened the door for numerous educational possibilities. In this section we will explore the positive effects of eLearning on traditional students and how it has ignited other generations of learners. In opposition to that, we will also examine the detrimental effects eLearning has had on the textbook industry, the social aspects of the classroom, and the availability of online content. We will also investigate how the economy is adapting to accommodate consumers who are beginning to expect to have unconditional access to free educational resources and how these seemingly free resources have very limited access to some.

3.1 The Pros of eLearning

The progressive rate at which eLearning has penetrated society is a direct result of the public's positive reception of it. With the international accessibility to the Web, learning has become more inclusive than ever before. Learners are no longer excluded from educational institutions for economic or social reasons. The exclusivity that previously surrounded prestigious institutions is also diminishing as institutions such as

Harvard, Berkeley, and MIT begin to offer their lectures and course materials online for the benefit of the entire world. This democratization of education is quickly leveling the academic playing field which has been riddled with social problems for far too long. By bringing high-quality educational tools right before the faces of all learners, society is on the path toward decreasing disparities in social and commercial skills, as well as closing educational gaps.

With the rising cost of higher education, which has increased at twice the rate of health care since 1985 [10], academic opportunities are often unaffordable and therefore unavailable to many people. Two professors at Stanford University, one of whom is Daphne Koller who was mentioned earlier, have created the website Coursera.com in hopes of providing the best quality education to the largest amount of people in the world. Projects like Coursera.com have taken eLearning above and beyond the expected outcome in providing not only learners with innovative educational tools, but also teachers with useful and insightful ways to better instruct their students.

The personalized approach of Coursera.com involves a retrieval question-and-answer format during lecture breaks throughout the student's personal video-viewing experience [9]. This gives the student a chance to finish taking their notes for the moment, reread the question, perhaps review parts of the lecture, think of a response, and thoughtfully answer the question. Whereas in a similar Classroom Learning situation when a teacher would ask a question, students have but mere seconds to finish digesting the previously stated material, try to recall the pertinent information from the teacher's lecture, think of a response, and then volunteer their answer. In that situation, only one student will actually be called on to respond to the question. It is evident that in the previous situation, the student has much more time to process the new information and better respond, thereby increasing learning, building confidence, and encouraging participation. Furthermore, this eLearning method requires every single student's participation, whereas the previous in-classroom methodology relied upon the participation of only one student out of the entire class [9].

In addition to benefiting the students, eLearning greatly benefits the teacher and their ability to instruct their students. With the virtue of large numbers of students and the online collection of data, teachers are now able to have large overviews of student participation and gradual progression. This collective representation of an entire class' individualized progression is extremely valuable to a teacher. When plotting the varied answers to a certain homework question, if the resulting data shows that a majority of the class answered it incorrectly, a teacher could quickly determine if there was a common misconception on that problem, and would then be able to provide immediate advice to her students on how to avoid making that mistake in the future. The amount of detailed vision and governance over their class to which teachers now have access was never so large previously. In addition, in the setting of Classroom Learning, teachers can exhaust their zeal for teaching if overworked, and schools typically do not have the financial resources to provide students with personal tutors [9]. But with eLearning tools, students can review and complete material as many times as necessary, something that teachers cannot do, as they grow weary when made to repeat lessons and hand-grade countless assignments. eLearning eliminates the problems that can inhibit teachers from being the best instructors for their students and greatly assists them in providing better, more inclusive instruction.

3.2 The Cons of eLearning

The price of e-textbooks is still higher than buying used, physical books, and until this price difference evens out, consumers have few incentives to make a complete transition to the digital eLearning movement. Due to this hesitant transition, it is not surprising that the projected percentage of e-textbook sales only accounted for 11% of all higher education and career-oriented textbook sales [9] in 2012. While the use of e-textbooks has not become predominant, it is no secret that digital technology has become an essential tool in students' current educational experiences. A recent survey from Wakefield Research reports that 73% of students say that they would not be able to study without some sort of technological device and 38% of these students admit to not being able to go for more than ten minutes without checking their device [9].

This presents evidence of a reliance on technology to a degree that has never been seen before in the educational sphere. From this reliance stems a desire and expectation that online content will be limitless and consistently offered at no charge. This comes into conflict with the desires of the textbook publishers who are feverishly combating the fearful anticipation of the end of their lucrative industry. The drawbacks from this technological reliance manifest themselves in several ways. From the economic perspective, textbook

publishers are scrambling to maintain their revenue by assigning high prices to online educational content and offering only temporary access to most books, making it more as though the student is renting the book for a brief period rather than owning it. As a result, this has pushed learners, who expect to be provided with limitless free content, to find ways around paying these extravagant fees. The problem of online piracy of copyrighted content is rampant on the Web and it only continues to grow as textbook and e-textbook prices alike continue to augment. With the rapid progression of this technological reliance, a plethora of personal devices have emerged onto the market. The problem of platform support discrepancies amongst this diversity of devices reveals yet another hindrance of eLearning. If the goal of eLearning is to provide all people with access to quality educational tools, these tools must all be able to utilize the same content.

From the social perspective, this technological reliance has depreciated the occurrence and the value of human interaction that normally occurs during Classroom Learning. Apart from the family unit, schools serve as the primary form of socialization of future generations. If the basis of society's social formation is changing due to the reliance on technology, it is inevitable that society and the way its members process information, learn, and interact will also change. Journalist and publisher Chris Anderson insisted during one of his TED talks on the importance of face-to-face communication [10]. During in-class communication, or what we will refer to as "physical communication," more is being transferred than simply words between the student and the teacher. The physical gestures, vocal cadence, eye contact, and body language are all aspects that cannot be transferred or understood via technological media such as email or PowerPoint [10]. Having the ability to sense how the class is reacting and how well the students are understanding the material while the lecture is in session is a valuable attribute of physical communication in the classroom. Reading and writing are relatively recent inventions, while physical communication has evolved and has been fine-tuned over centuries. Therefore the resonance of physical communication in human brains is typically much more profound than that of reading a printed source, writing, or in this case typing, a response [10].

From the economic perspective, while eLearning promoters' objective of making a world-class education accessible to all is honorable, the financial carry-through is somewhat more complex. The existence of these new educational tools is considered as major progress but they will not be able to serve their intended target if these populations do not have the financial means to obtain access to these online interfaces. For the moment, only schools or individuals who can afford expensive tools such as laptops, smartphones, Smartboards, or projectors can have privileged access to eLearning. Once these tools are obtained, there are also financial means needed in order to sustain this access through wireless Internet fees and device maintenance. While progress has been made through widely offered wireless Internet in public places and state governments allotting money for more technological devices in classrooms, eLearning currently remains as an educational luxury for those privileged enough to have access to it.

Perhaps in the future, engineers will invent ways to incorporate some aspects of physical communication into eLearning and promoters will find ways to make eLearning more universally accessible. This paper examines the technological possibilities in the following section.

3.3 Reconciling the Benefits of Both

The differences between eLearning, which we will discuss as being a two-dimensional learning experience, and Classroom Learning, a three-dimensional learning experience, both have their educational benefits and deficiencies. Two-dimensional learning and communication is not yet something that all people use every day and it is therefore at times an awkward interface to use for those who are not habituated to it. Basic technological glitches also serve as a large deficiency for two-dimensional learning. For example, Skype is an extremely useful technology for more socially involved communication, yet it is riddled with issues that need to be improved upon. The quality of the calls on Skype is inconsistent and often poor. Fortunately, this issue may be remedied in the future with upgrades to the quality of the video and audio that Skype provides. However, at present, the same technical difficulties that face Skype users also face learners, who watch and use online education resources. If videos do not load or links do not work, learners are unable to follow the lectures or complete their assigned work. Having learners who cannot complete their work delays the in-class experience and can serve as a major hindrance to teachers' curricula. Technical difficulties such as interface incompatibility or simply a lack of wireless Internet connection are major downfalls in the eLearning process that are avoided in three-dimensional learning.

The previously discussed benefits that come from the fine-tuned physical communication of three-dimensional learning can be applied to future improvements of eLearning. As noted, when communicating in person, more data is transferred than simply just the words and that is why the basic format of Classroom teachers' lectures has not changed over several decades. One improvement that can be made to the eLearning process is to include this social aspect.

We hypothesize that with the progression already show in technology, innovations such as holograms of professors could be utilized by programs like Coursera.com to provide its students with a technological, three-dimensional, educational experience. If a learner were to take an online dance course, a hologram of the instructor would be extremely useful to the student because it would allow him or her to view complex body movements from many different angles.

Another possible innovation could include the use of robotics. For example, if a learner in China were to take an online course in Impressionistic Painting provided online by UCLA, the student could apply the techniques he or she had learned by using a device similar to a game controller in conjunction with an online course. With this device, the learner could manipulate the brush strokes made by a robotic arm in an art studio in California, where the teacher would be located. In the art studio, the teacher would be able to examine the student's work in progress as the robot performs it.

For a third example, imagine the SmartBoard version of a conference call. This multi-way board would allow a group of people working remotely to collaborate on a project in a whole new way. Not only would the board show everyone's writings and drawings in progress simultaneously, it would also play audio so people could hear each other speak and it would display everyone's faces as if they were looking through a window directly to the other side of the window pane at each other. As members of the group drew, they would be able to explain their thinking not only by using their voice, but also with facial expressions and body language. This would allow the valuable attributes of three-dimensional physical communication to be integrated with the advantages of two-dimensional communication. This "super-smart" board could possibly be used, for example, by computer programmers to write up code together and architects to collaborate on blueprints. And these are but a few ideas; with the progressive rate of technological innovation, the possibilities for combining the technical with the social are infinite.

4. CONCLUSION

In this paper we first presented a select number of current eLearning resources and projects being offered globally and how they have been received and used. We demonstrated how eLearning has served as a catalyst in creating a new wave of life-long learners. We then examined the effects of eLearning on society and the classroom for the purpose of seeing how eLearning has brought people together across the world. Then we proceeded to present the benefits and deficiencies of both eLearning and Classroom Learning and illustrate how these two methods can be combined to form the best educational tools for students.

We aim to highlight the fact that eLearning has only begun to make its impact on the widening domain and age-range of education. Over its early existence in the educational sphere, definite benefits have been recognizable as is evidenced by society's progressive utilization of eLearning. As the world makes new technological advancements and uses them within educational environments, certain deficiencies have become apparent. The argument has been made that the lack of physical interaction, and therefore direct socialization, is a huge detriment to the eLearning process. After one recognizes the primary benefits and deficiencies of eLearning, one can begin to imagine how these deficiencies can be improved upon in the future by integrating eLearning with Classroom Learning.

eLearning has already made a colossal impact on the way society receives and processes information, and the time is now to improve upon its deficiencies. The sooner these improvements are made, the sooner we can establish education as a fundamental human right so that anyone with the ability and the motivation can effectively use the tools he needs to make a better life for himself and his community. The Web has enabled a wave of innovation, and it is of the utmost importance that this wave be fostered and encouraged so that we may continue on our way toward providing a world-class education to all people.

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ESTIMATION OF LEARNERS' COMPREHENSION LEVEL IN QUESTION-POSING LEARNING

Yuta Ito[1],Yuki Hirai[1], Keiichi Kaneko[1], Ayami Nomura[2] and Atsuo Hazeyama[2]
[1]*Graduate School of Engineering, Tokyo University of Agriculture and Technology*
Nakacho 2-24-16, Koganei, Tokyo 184-8588, Japan
[2]*Faculty of Education, Tokyo Gakugei University*
Nukuikitamachi 4-1-1, Koganei, Tokyo 184-8501, Japan

ABSTRACT

A learner who has acquired a solution method cannot always employ it adequately. Typically, practice in employing a given method is indispensable to mastering it. Problem-solving practice is the most popular means of aiding a learner in mastering solution methods, and designing problems which can be solved by a given solution method is a promising means of facilitating such mastery. Setting such problems is sometimes called 'question-posing'. In question-posing, students design problems consisting of a question-stem, the correct answer, and an explanation. Question-posing involves higher cognitive activity than question-answering, and has a positive effect on learners' problem-solving skills. However, question-posing activity, together with related support systems, is not necessarily effective for all students. Nonetheless, research has provided quantitative results suggesting that students who actively participate in such systems perform better in final examinations than students who do not. In this study, we defined the score on an examination or test as the 'comprehension level', hypothesized that there are appropriate question-posing activities for various comprehension levels, and developed a method for estimating learners' comprehension level in question-posing learning. Here, we outline this method, using the learning history stored in a question-posing learning support system (QLSS).

KEYWORDS

Question-posing, Learning support system, Comprehension estimation, Collaborative learning

1. INTRODUCTION

A learner who has acquired a solution method cannot always employ it adequately. Therefore, practice in employing the given method is indispensable to mastering it. Problem-solving practice is the most popular means of aiding a learner in mastering solution methods, and designing problems which can be solved by a given solution method is a promising means of facilitating such mastery (Nakano et al., 1999). Setting such problems is called "problem-posing" (English, 1998; Nakano et al., 2000) or "question-posing" (Yu et al., 2005; Hirai et al., 2009). In question-posing, students design problems consisting of a question-stem, the correct answer, and an explanation. Question-posing involves higher cognitive activity than question-answering, and has a positive effect on learners' problem-solving skills (Polya, 1945). Numerous systems have been developed to support the activity (Nakano et al., 2000; Yu et al., 2005; Takagi et al., 2007; Yokoyama et al., 2007; Denny et al., 2008; Hayashi et al., 2008; Hirashima et al., 2008; Hirai et al., 2009). However, question-posing activity, together with such related support systems, is not effective for all students. Yokoyama et al. (2007), for example, found that (1) their developed system primarily improved the problem-solving ability of low-performance students, (2) second-grade students of the target elementary school posed problems continuously with the system, and (3) both students and teachers confirmed, in questionnaires, that problem-posing activity using this system was useful for learning. Denny et al. (2009) reported quantitative results suggesting that students who actively used their developed system performed better in final examinations than students who did not. In short, question-posing activity may be effective for specific student groups.

We defined the score on an examination or test as the 'comprehension level' (CL) in this study. We hypothesized that there are appropriate question-posing activities for various CLs, and developed a method for estimating students' CL in question-posing learning. Our goal is to recommend the learning activity best

suited to a given CL in the question-posing learning support system (QLSS). In this paper, we propose a method for estimating students' CL using the learning history stored in the QLSS.

2. RELATED WORKS

Suganuma et al. (2005) have developed the AEGIS system, which dynamically evaluates the CLs of learners, and question difficulty (QD), based on the status of learners' system utilization, and automatically generates exercise questions according to the students' CL. In this section, we describe the AEGIS estimation method.

(1) Estimation method for determining learners' CL in AEGIS

In AEGIS, the learners' CL is evaluated each time they answer a question proposed by the system. The system calculates the CL $s_{i,t}$ of a student i at time t, based on the expression shown in Figure 1. The CL is expressed by a real number value ranging from 0 to 10. Q is the set of questions answered by the learner (30 most recent answers), and $q_{j,t}$ is the difficulty of question j at time t. $\delta_{i,j}$ is a constant, equal to 1 if learner i answered correctly a problem of higher difficulty than his/her CL $s_{i,t-1}$, or answered incorrectly a problem of lower difficulty than his/her CL $s_{i,t-1}$, and otherwise equal to 0.

As it is natural for a learner to answer correctly (or incorrectly) a question with lower (or higher) difficulty than his/her CL, the default setting of the constant $\delta_{i,j}$ is 0, to ensure that it typically has no influence in the evaluation of the comprehensive level of the learner in AEGIS. If, on the other hand, a learner answers incorrectly (or correctly) a question with lower (or higher) difficulty than his/her CL, AEGIS judges that the CL of the learner is overestimated (or underestimated), and $(q_{j,t}-s_{i,t-1})$ becomes negative (or positive) so as to decrease (or increase) $s_{i,t}$. The CL of a learner is calculated based on the respective QDs of the 30 questions (which make up Q) at the time they were answered by the learner, not at the time of the summative CL calculation; therefore, CLs change with the results of answers by other learners.

(2) Estimation method for determining QD in AEGIS

Based on the comprehension levels of learners, difficulty of questions is dynamically evaluated. Then, the difficulty of $q_{j,t}$ of the question j at time t is calculated by the expression shown in Figure 2. Evaluation of difficulty of questions is carried out not every time a learner answers a question but at regular intervals. Difficulty is real number values from 0 to 10. S is a set of learners who answered the question j between an interval from time $(t-1)$ to time t, and $s_{i,\tau}$ is the comprehension level of the learner i at time τ $(t-1 \le \tau \le t)$. $\varepsilon_{i,j}$ is a constant such that it is equal to 1 if the question j is answered correctly (or incorrectly) by the learner i with the lower (or higher) comprehension level than the difficulty $q_{j,t-1}$ of the question j while it is equal to 0 otherwise.

Similar to the evaluation of learners' CL, as it is natural for a learner to answer correctly (or incorrectly) a question with a lower (or higher) difficulty than his/her CL, the default value for the constant $\varepsilon_{i,j}$ is set at 0, to ensure that it typically has no influence in the evaluation of QD in AEGIS. If a learner answers incorrectly (or correctly) a question with a lower (or higher) difficulty than his/her CL, AEGIS judges that the difficulty of the question is overestimated (or underestimated), and $(s_{j,\tau}-q_{j,t-1})$ becomes negative (or positive) so as to decrease (or increase) $q_{j,t-1}$.

$$s_{i,t} = \begin{cases} s_{i,t-1} + \dfrac{\sum_{j \in Q} \left(q_{j,t} - s_{i,t-1}\right)\delta_{i,j}}{\sum_{j \in Q} \delta_{i,j}} & \left[if \sum_{j \in Q} \delta_{i,j} \neq 0 \right] \\ s_{i,t-1} & [otherwise] \end{cases}$$

Figure 1. The estimation equation for learners' CL in AEGIS

$$q_{j,t} = \begin{cases} q_{j,t-1} + \dfrac{\sum_{i \in S} \left(s_{i,\tau} - q_{j,t-1}\right)\varepsilon_{i,j}}{\sum_{i \in S} \varepsilon_{i,j}} & \left[if \sum_{i \in S} \varepsilon_{i,j} \neq 0 \right] \\ q_{j,t-1} & [otherwise] \end{cases}$$

Figure 2. The estimation equation for QD in AEGIS

(3) Estimation method in this study

In this study, we estimate learners' CL in question-posing learning, based on question-posing, question-answering and question-evaluation, with learners reviewing each other's questions. The expressions shown in Figures 1 and 2 are used with regard to question-answering. In the present study, we propose a new

expression, regarding question-posing and question-evaluation. Then, we conduct a simulation using the expressions in Figures 1 and 2, as well as the expression proposed in this study, to verify whether CLs are correctly estimated based on the utilization of the question-posing learning system.

3. ESTIMATION METHOD

Here, we will outline the nature of the question-posing learning discussed in this study, based on several studies focusing on question-posing learning involving learners reviewing each other's questions (Yu et al., 2005; Takagi et al., 2007; Hirai et al., 2009). Table 1 shows the process of question-posing learning that we are concerned with.

In the question-posing activities, the format of the posed questions (multiple-choice, free-description, etc.) is not significant; however, the learner plays an active role in shaping the question-stem, the correct answer, commentary on the question, and assessment of QD. With respect to QD, a scale such as Table 2 is provided by the teacher, and learners assess the QD according to a 5-level scale, with 1 the easiest and 5 the hardest. Learners can use such measurements to contribute to effective question selection; and among the question-posing activities, a learner is able to modify question-stems (etc.) based on his/her own evaluations. In the question-answering activities, questions are not provided by the system automatically, but rather the learner him/herself selects the questions to answer. In the question-evaluation activities, learners can evaluate the reliability of the questions they answer, based on a 5-level scale provided by the teacher, such as is shown in Table 3, with question reliability ranging from 1 for the least reliable, to 5 for the most reliable. Learners can use such reliability measurements to select the most effective questions. If the reliability of a question is low, the learner who has posed the question can modify the stem (etc.) to enable re-evaluation and consequent improvement in question reliability. The modified question, information about the question, and information on answers to the question, are all registered in the system database.

Table 1. The Learning Process in This Study

Process #	Activities
1	(S)he logs in to the QLSS.
2	If (s)he does question-posing activities then jump to Process 3. If (s)he does question-answering activities then jump to Process 4.
3	(S)he poses a question-stem, its answer and its explanation to the QLSS. Jump to Process 7.
4	(S)he selects a question stored in the QLSS.
5	(S)he answers the selected question.
6	(S)he evaluates the selected question. Jump to Process 7.
7	Jump to Process 2 or 8.
8	(S)he logs out of the QLSS.

Table 2. An Sample Scale of Degree of QD

Difficulty	Equal to the difficulty level of …
1	Guided Practice
2	Independent Practice
3	Problem Solving
4	Mixed Problem Solving
5	Test

(McKay Creek Elementary School, 2012)

Table 3. A Sample Scale of Degree of Question Reliability

Reliability	Conditions
1	(S)he cannot answer the question because there is a problem with it.
2	There is no problem with the question. The answer is incorrect.
3	There is no problem with the question. The answer is correct. There are some mistakes in the explanation.
4	There is no problem with the question. The answer is correct. The explanation is correct, but is not sufficient for a clear understanding.
5	The question is ideal.

$$s_{i,t} = \begin{cases} s_{i,t-1} + \dfrac{\left(\overline{u_{i,t}} - s_{i,t-1}\right)}{\sum_{j_i \in P, k \in S} \gamma_{j_i,k}} \\ \left[\text{if } \overline{c_i} \geq C \quad \text{and} \quad \overline{u_{i,t}} > s_{i,t-1} \quad \text{and} \sum_{j_i \in P, k \in S} \gamma_{j_i,k} \neq 0 \right] \\ s_{i,t-1} \qquad\qquad [\text{otherwise}] \end{cases}$$

Figure 3. The estimation equation for students' CL based on question-posing and question-evaluation activities

```
Procedure CADE{
/* Initial Settings */
  Set S,s^(TRUE), s^(CADE), Q, and q^(CADE)
/* Calculation of Comprehension and Difficulty */
  Select a student from S
  Select the student's activity, question-posing or -answering
  if question-posing{
  Set q^(CADE) of the posed question
      Add the question to Q
  }else{
  Select a question from Q
  Determine whether the student can answer the question
      Calculate s^(CADE) using the equation shown in Figure 1.
      Calculate s^(CADE) using the equation shown in Figure 3.
  }
  Calculate q^(CADE) using the equation shown in Figure 2.
}
```

Figure 4. The pseudocode of the CADE program used in the simulation

CL represents a measure of the possibility that a learner with a certain CL can easily answer a question with difficulty of the same value as the QD. For example, if the CL of a learner is 3.0, he/she can easily answer a question of difficulty level 3.0. Based on this relationship, we assume that if 'the value of CL – the value of difficulty' increases (or decreases), the learner can more (or less) easily answer the corresponding question correctly.

Numerous studies have confirmed a correlation between question-posing activities and improvement in academic performance. However, as learners do not pose questions in the AEGIS system described in Section 2, only question-answering activities are considered when the CL of learners is calculated. In this study, we propose an expression to calculate the CL when learners pose questions, where the calculation of learners' CL is divided into two elements, question-answering and question-posing, with both elements factored into changes in the learners' CL. Several studies have shown that the CL of learners who posed questions does not always increase. In addition, one study suggested a correlation between question reliability and improvement in academic performance (Hirai et al., 2009). In light of these results, we conjectured that the evaluation of posed questions may provide an accurate index for measuring whether learners have comprehended the content of questions before posing them. Hence, we took question-evaluation activities into account in estimating CLs.

Given the foregoing, we introduce an expression to estimate CL based on question-posing activities. Each time a learner answers a question and makes his/her evaluation, the CL of the learner who posed the question is calculated. The expression (Figure 3) calculates the CL $s_{i,t}$ of a learner i at time t. P is the set of questions the learner has answered and evaluated. j_i is one of the questions posed by learner i. S is the set of learners who have answered question j_i from time (t–1) to t. c_i is the average reliability ascribed to j_i. $u_{i,t}$ is the average CL at time t of learners who have correctly answered j_i. $\gamma_{ji,k}$ is a constant, equal to 1 if learner k correctly answers j_i, and equal to 0 if not.

In question-evaluation, if the reliability average is not less than a constant C, we judge that the learner who posed the question has comprehended its content, given the confirmed correlation between the level of question reliability and improvement in academic performance (Hirai et al., 2009). In addition, when the average CL of the learners who have answered the question correctly is higher than the CL of the learner who posed the question, we judge that the CL of the latter is equal to that of the former, adjusting the latter value in accordance with the dynamic structure of comprehension evaluation outlined above. The proposed calculation expression augments learners' CL if the above two conditions are satisfied.

4. COMPUTER EXPERIMENT

We conducted a computer simulation to verify the correctness of the estimation of CL described in Section 3, in terms of the question-posing learning process described in Section 3. Figure 4 shows a pseudocode of the CADE program used in the simulation. The program proceeds according to the question-posing learning process shown in Table 1, and includes the procedures for the estimation of CL $s^{(CADE)}$ and QD $q^{(CADE)}$. The parts underlined in Figure 4 include randomization settings.

4.1 Situation

In this study, we assume a case where the system is used in a school classroom, and the number of learners is set at 30. According to the scale of difficulty in Table 2, the CL $s^{(CADE)}$ and QD $q^{(CADE)}$ take real number values from 1.0 to 5.0. The original CLs of the 30 learners are set from 1.0 to 5.0, following a normal distribution (CL 1.0: 1, 1.5: 2, 2.0: 4, 2.5: 5, 3.0: 6, 3.5: 5, 4.0: 4, 4.5: 2, 5.0: 1). Following the simulation by Suganuma et al. (2005), the initial estimated value of $s^{(CADE)}$ is set at 1.0. The number of questions initially stored in the system (Q) is set at 100, with 20 questions at each difficulty level, from 1.0 to 5.0. The initialization stage of the CADE program executes these settings.

Next, we will describe learners' behavior, and the calculation of CLs, as well as the difficulty associated with them. We define the number of activities as the sum of the number of question-posing activities and the number of question-answering activities. Since the number of activities of each of the 30 learners is not unique, the learner who is going to conduct activities first is selected randomly from 30 learners in the program, and it is then decided whether the learner performs question-posing or question-answering. According to the literature (Yu et al., 2005; Takagi et al., 2007), it is rare that only question-posing activities are performed; and (Hirai et al., 2009) the average number of question-posing activities per learner is 3.01 during the system-use time. Hence, we assumed that a learner can, at the most, perform the question-posing activities five times, and that he/she also performs question-answering activities. In the question-posing activities, the learner sets the question-stems, the correct answers, and the comments, as well as the QD. The initial value of this difficulty $q^{(CADE)}$ is set (as an integer) close to the CL of the learner posing the question.

Though there is a possibility that a question with low reliability may be posed, we expect that the question-stem will always be modified to be reliable. Hence, in this simulation, each question is added into Q immediately after its difficulty is set. In the question-answering activities, one question to be answered by the learner is randomly selected from Q, and whether the learner answers the question correctly or incorrectly is randomly decided, based on $s^{(TRUE)}$ and $q^{(CADE)}$. $s^{(TRUE)}$ is the original CL of the learner. Suganuma et al. (2005) did not describe the relevant conditions in detail. Thus, in this study, we assume that if the CL and QD are commensurate, the learner can answer the question easily. Therefore, we set the percentage of correct answers to be 80 if $s^{(TRUE)}$ and $q^{(CADE)}$ are equal. Otherwise, the percentage (minimum 0% and maximum 100%) is given by $\{(s^{(TRUE)}-q^{(CADE)})\times 10+80\}$ if 'CL ≥ difficulty' and by $\{(s^{(TRUE)}-q^{(CADE)})\times 70+80\}$ if 'CL ≤ difficulty'. Though the question-posing learning process includes question-evaluation activities aimed at measuring reliability after the question-answering activities, only highly reliable questions are posed in the simulation. Hence, we do not consider question reliability in this simulation.

The simulation is conducted according to the scenario described above. Given the expressions in Figures 1 to 3, the CL of a learner answering only one question will be unstable. Hence, the CL in the question-answering activities is calculated only for learners who have answered questions at least five times; and similarly, the CL in the question-posing activities is calculated only for questions that at least five learners have answered. QD values are calculated whenever the total number of activities of all learners reaches a multiple of 500, and the simulation ends when the total number of activities of all learners reaches 1,500.

4.2 Results

(1) All learners performing question-answering activities only

To verify whether the CADE program designed in this study operates correctly, we conducted simulations where all learners perform only question-answering activities. In these simulations, only the expressions in Figures 1 and 2, proposed by Suganuma et al. (2005), were used for estimating CLs. Therefore, we can replicate the previous research results.

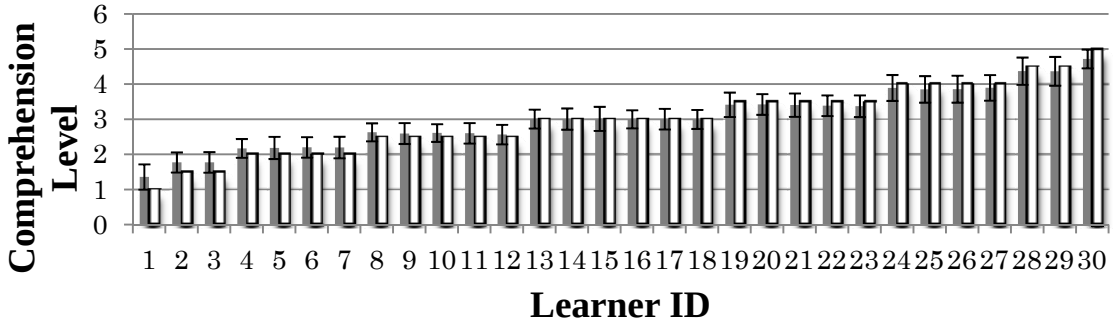

Figure 5. Simulation results when all students perform question-answering activities only. White and gray bars represent the $s^{(TRUE)}$ and $s^{(CADE)}$ of each learner, respectively, with gray bars showing the average of the 100 estimated CLs for each learner ID. Gray bar whiskers represent the average of 100 values + (top)/– (bottom) sampled standard deviation of 100 simulations

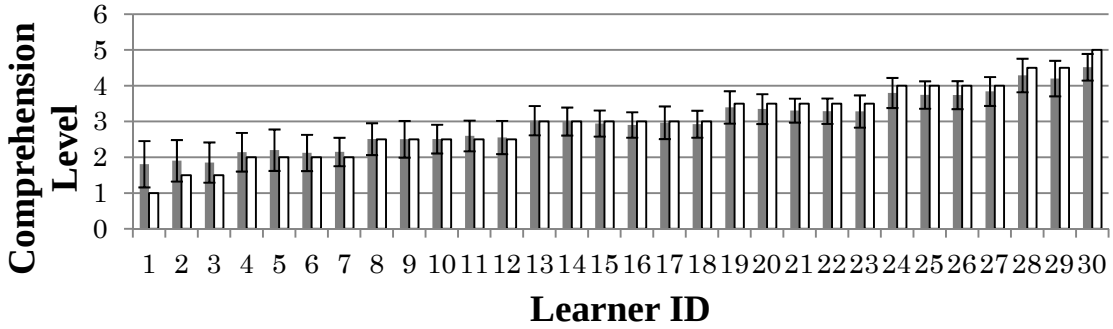

Figure 6. Simulation results when all students perform question-posing, question-answering and/or question-evaluation activities (Structures show in Figure 5.)

Figure 5 shows a graph of the simulation results, with the horizontal axis representing 30 learners' IDs and the vertical axis representing the respective CLs. The white and gray bars represent the $s^{(TRUE)}$ and $s^{(CADE)}$ of each learner, respectively. For each ID, we conducted 100 simulations, and each gray bar shows the average of the resulting 100 estimated CLs. The top and bottom of a gray bar whisker represent 'the average of 100 values + sampled standard deviation of 100 simulations' and 'the average of 100 values −sampled standard deviation of 100 simulations', respectively. Figure 6 has an identical structure and shows the simulation results when all students perform question-posing, question-answering and/or question-evaluation activities.

If $s^{(TRUE)}$ is inside the whisker, we conclude that the CL is correctly estimated using the expressions shown in Figures 1 and 2. From the simulation results regarding learners with IDs 1 to 29, the values for $s^{(TRUE)}$ are within the above-mentioned interval. Hence, we conclude that the values are correctly estimated. For the learner with ID 30, however, $s^{(TRUE)}$ is not within the interval. Therefore, we conclude that here the value is not correctly estimated. Now, if we define the ratio of correct answers as the percentage of learners whose CL is correctly estimated, then, in the case where all learners performed the question-answering activities only, a high ratio of correct answers (97% or 29/30) was attained. From this, we conclude that the estimation of CLs using the expressions in Figures 1 and 2 is accurate and confirms the research results of Suganuma et al. Furthermore, we have verified the correctness of the CADE program behavior.

(2) All learners performing question-answering and question-posing activities

Next, to verify whether the estimation of CLs using the expression proposed by this study (Figure 3) is equally accurate, we conducted simulations where all learners perform both question-posing and question-evaluation activities. The simulation results (Figure 6) suggest that, for the learners with ID's 1 and 30, the CL was not estimated correctly, because their $s^{()}$ values do not fall within the interval specified by the gray bar whiskers. However, the CL of the remaining ^{TRUE} learners was correctly estimated. The ratio of correct

answers in the case where all learners performed both question-posing and question-evaluation activities was 93% (or 28/30).

5. DISCUSSION

The present study discovered a 93% ratio of correct answers in estimating CLs where all learners performed activities according to the question-posing learning process described here; somewhat less than the 97% ratio discovered in the case of question-answering only. However, we conclude that in both cases the CLs were correctly estimated since ratios of more than 90% were obtained.

A comparison of Figures 5 and 6, with respect to learners with lower estimated CLs, reveals that the whisker lengths in Figure 6 are notably longer, probably owing to the expression in Figure 3. Learners with low CLs tend to pose questions with lower difficulty. Hence, if learners with higher CLs answer such questions correctly, the CL of the low CL learners is increased. CLs vary widely as the average CL of learners who have answered questions correctly is increased. As a result of this, in the case of the CL 1.0 of learner ID 1, for example, a CL of more than 3.0 was estimated in two of the 100 simulations; therefore, the sampled standard deviations became large. Learners with higher CLs tend to pose difficult questions, and thus this type of phenomenon does not occur. To avoid this phenomenon, we may consider formulating an expression in which question-posing activities lessen CLs. However, there are few previous studies in which question-posing activities lessened exam performance. Therefore, we do not believe that question-posing causes lessening of CLs in this study. Another means to avoid the phenomenon might involve assuming that learners automatically select questions whose difficulty is similar to their CL. However, in the extreme case where there is little alteration in QD, the same questions may be automatically selected by the system. Therefore, in this study, the system does not select the questions automatically, but instead the learners select the questions to answer.

The CADE program includes multiple randomization procedures, which may dramatically affect the simulation results. Given this, we conducted simulations where the total number of activities of all the learners varied from 1,500 to 2,000 to 3,000. Moreover, by assuming various situations, we adopted expressions such as $\{(s^{(\mathrm{TRUE})-}q^{(\mathrm{CADE})})\times 25+50\}$ for the ratio of correct answers, instead of $\{(s^{(\mathrm{TRUE})-}q^{(\mathrm{CADE})})\times 10+80\}$, in order to confirm whether CLs could be estimated correctly. The simulation results in this study reflect only correct estimation cases, but there are numerous known situations which similarly validate the estimation method. As an example of a situation with incorrect estimation, we might consider the case where the total number of activities of all learners is small.

6. CONCLUSION

From the simulation results in this study, we conclude that CLs may be estimated based on learners' system utilization status in a question-posing learning system, by employing the method proposed in this study. However, in cases where the system is applied in an actual educational context, there is a possibility that some learners may utilize the system without following the full question-posing process; that is, they may only pose questions, without performing question-answering and question-evaluation activities. In such exceptional cases, a flexible response, such as a system instruction for them to answer questions, is required.

In addition, even if a learner is following the question-posing learning process, he/she may not be able to easily pose a question if, for example, he/she is a novice learner. In this case, the system could encourage them to practice answering questions intensively, so that they may learn how to better pose a question. Furthermore, since question-posing is an intelligent activity, it may be difficult for learners with lower CLs to pose questions. Therefore, using the method proposed in this study, we might limit the posing of questions to learners with a CL of at least 3.0, for example. This would mean that only learners with higher CLs could pose questions, so that relatively reliable questions would be posed. By involving all learners in answering and evaluating questions, autonomous learning becomes more feasible.

In this study, we have considered whether and how a question-posing learning support system can form a useful part of effective learning activities for all learners. Our goal was to recommend learning activities in accordance with the comprehension status of learners, so that all learners can utilize the question-posing

learning support system. To estimate the comprehension status of learners in the question-posing learning system where learners review each other's questions, we have proposed an expression to estimate CLs based on learners' system utilization status. By constructing the calculation engine and conducting simulations using the engine, we assessed the effectiveness of the calculation expression proposed in this study. As a result of the simulations, including question-posing, question-answering and question-evaluation activities using a question-posing learning support system, we have verified that the original CLs of learners can be estimated using the calculation expression.

In future, we will introduce the algorithm proposed in this study into a question-posing learning support system, and conduct an experiment with actual learners in order to recommend appropriate learning activities. This will enable us to verify whether or not all learners are able to utilize the question-posing learning support system effectively.

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DESIGN COLLABORATION MECHANISMS FOR MEDIAWIKI

Sumonta Kasemvilas[1] and Lorne Olfman[2]
[1]*Department of Computer Science, Faculty of Science, Khon Kaen University, Khon Kaen, Thailand*
[2]*School of Information Systems and Technology, Claremont Graduate University, Claremont, USA*

ABSTRACT

This research study utilized six design science research methodology (DSRM) steps. The first round of the Build-and-Evaluate loop was completed and applied a problem-centered approach to the problem, which was the lack of control and accountability support for students working in highly collaborative settings, such as group writing with MediaWiki. The need for more efficient automated mechanisms for MediaWiki triggered the design and development of specific extensions to enhance support for collaborative writing. The purpose of the study was to design collaboration mechanisms for groups, particularly those who are performing mandatory collaborative writing of Wiki pages. The findings illustrate some potential impacts of MediaWiki when used in the classroom. The results of this study potentially offer new mechanisms that can be used to teach graduate students involved in collaborative writing.

KEYWORDS

Design science; MediaWiki; collaborative writing; group writing; collaboration mechanisms

1. INTRODUCTION

The purpose of the study was to design collaboration mechanisms for groups, particularly those who are performing mandatory collaborative writing of Wiki pages. We term mandatory collaborative writing in classroom settings in which a group must achieve its goal within a limited timeline. An example of this type of collaborative writing is class projects. A Wiki is a social technology tool for collaborative writing in Web 2.0 era, but when it is used in a mandatory setting, some new mechanisms and further refinements are needed (Kasemvilas et al., 2011).

This research study utilized six design science research methodology (DSRM) steps: 1) problem identification and motivation; 2) definition of solution objectives; 3) design and development; 4) demonstration; 5) evaluation; and 6) communication (Peffers et al, 2007). The first round of the Build-and-Evaluate loop was completed (see Figure 1) and applied a problem-centered approach to the problem, which was the lack of control and accountability support for students working in highly collaborative settings, such as group writing with MediaWiki (Kasemvilas & Olfman, 2009). The need for more efficient automated mechanisms for MediaWiki triggered the design and development of specific extensions to enhance support for collaborative writing (see Figure 2). The design science methodology will help answer a research question: Do these mechanisms work? Therefore, it is important to measure whether these tools would be easier to use than existing MediaWiki tools.

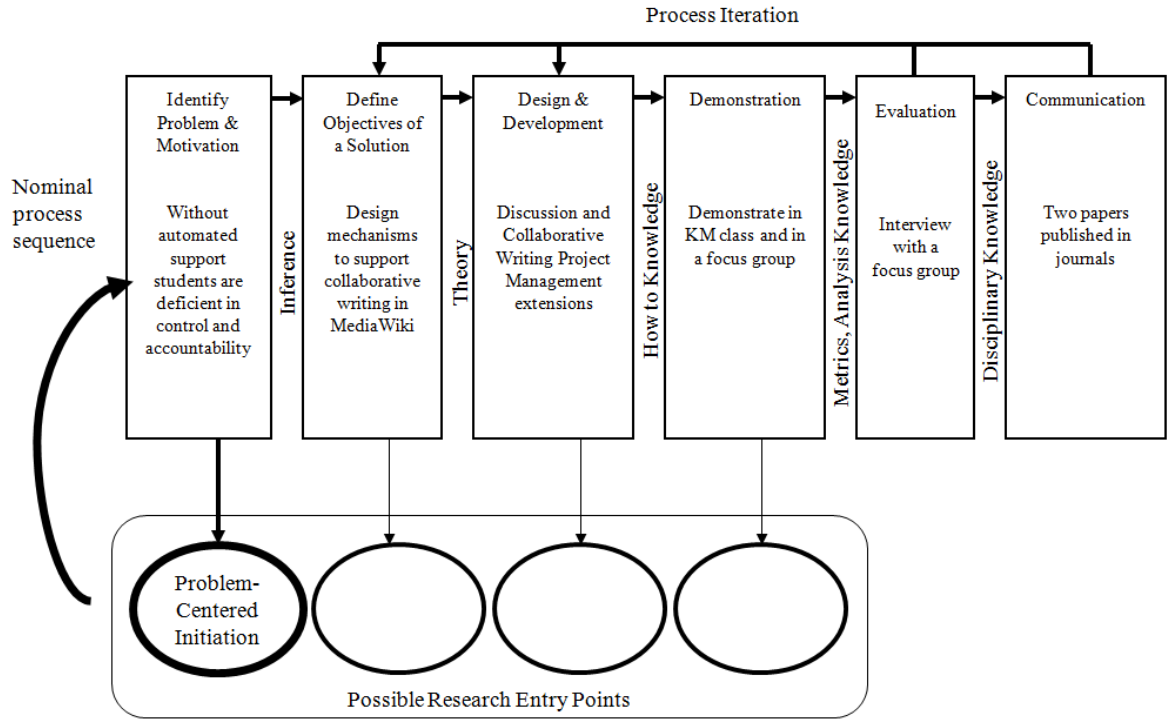

Figure 1. DSRM process model of the first Build-and-Evaluate loop

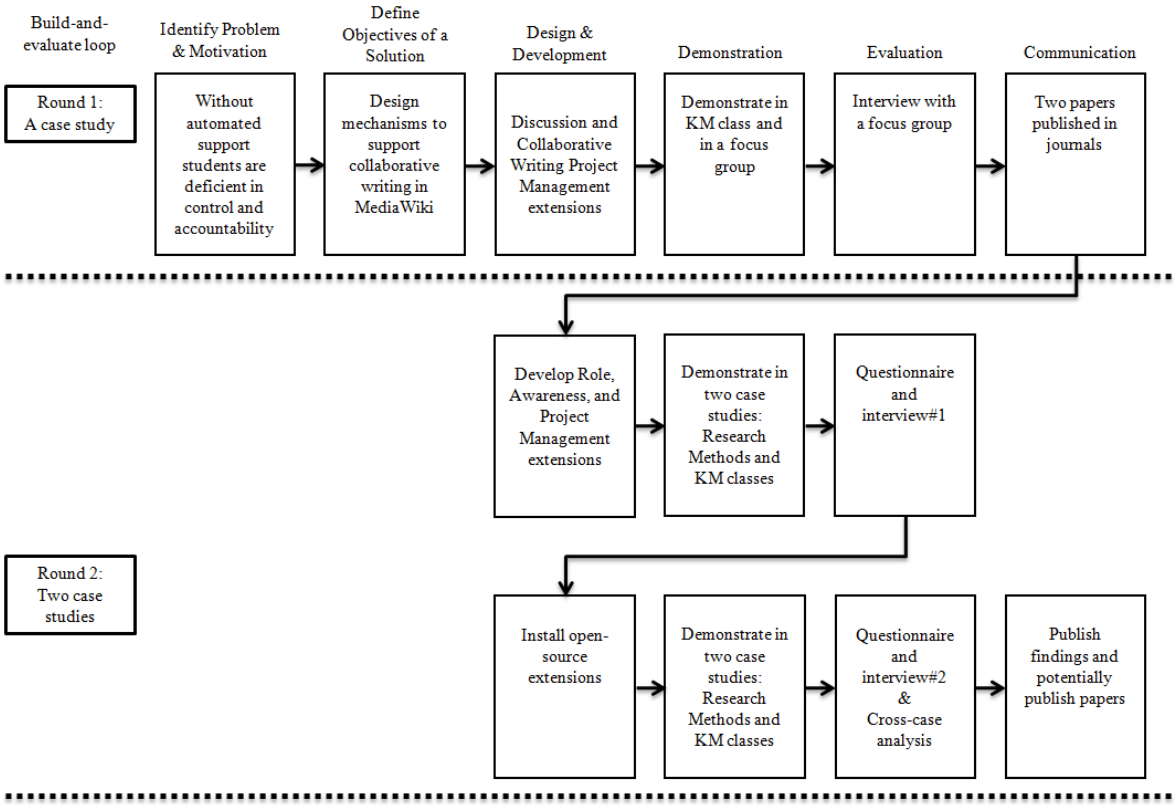

Figure 2. DSRM process model of rounds 1 and 2 of the Build-and-Evaluate loop

2. DESIGN SCIENCE RESEARCH

Kasemvilas and Olfman (2009) thoroughly demonstrated the first Build-and-Evaluate loop. Thus, this paper will focus on the second Build-and-Evaluate loop.

2.1 Problem Identification and Motivation

The flexible characteristics of MediaWiki complicate concepts of practical design when applying MediaWiki in a mandatory writing context. Kasemvilas and Olfman (2009) stated that MediaWiki is not appropriate for use in the classroom setting because it is decentralized, arbitrary, and shared. The need to identify solutions that facilitate collaborative writing led to an inquiry into design mechanisms that enable such collaboration.

2.2 Define Objectives of a Solution

Based on the requirements of the mandatory collaborative writing process, this study proposes extensions and features that contribute to collaborative writing in classroom settings while providing students and the instructor with a collaborative effort structure. The researcher developed features to support the demands of collaborative writing in a classroom setting.

2.3 Design and Development

The second Build-and-Evaluate loop (see Figure 2) that was created was used to measure the effectiveness of an extended version of MediaWiki. The extended version included a number of MediaWiki extensions that the researcher wrote to implement the following mechanisms to support the collaborative writing process: 1) a role mechanism that assigns roles to each member in the group; 2) an awareness mechanism that allows users to view and edit the page status of each Wiki page; and 3) a project management mechanism that increases awareness of the status of each component of the writing project and provides an overall summary of the project. The creation of the newly developed extensions is the original and innovative component of this study. These extensions are designed to increase project control and accountability.

The researcher also installed and customized a number of open source MediaWiki extensions: 1) a discussion mechanism for supporting an effective asynchronous discussion; 2) a chat mechanism for supporting synchronous and asynchronous communication; 3) a text editor mechanism for simplifying Wiki page editing; and 4) an online notification mechanism for aiding awareness among group members. Tables 1 and 2 show the newly developed extensions and the customized open source extensions, respectively.

Table 1. Newly developed extensions

Feature requirement	Wiki extension	Design
1. Role: The instructor is able to assign roles to each user to establish each user's responsibility.	1.1 Create Role 1.2 Assign Role	- Add roles, such as author, reviewer, and editor - Assign roles to users, e.g., "James has author and editor roles"
2. Awareness: Users are able to see and edit the page status of each Wiki page.	2.1 Page Status	- Edit and show the status of a page, such as "not started," "being edited," "requires more review," "requires more writing," "ready for review," "ready to publish," and "complete" - Sort by page title and username - Filter by the status of a page
	2.2 Graph Summary	- A bar graph shows the number of pages viewed more than or equal to 100 times - A bar graph shows the number of pages viewed fewer than 100 times - A bar graph shows comparisons of the numbers of user edits (times) - A donut graph shows comparisons of the numbers of user edits (in bytes)

Feature requirement	Wiki extension	Design
3. Project Management: Users are able to see a summary table for an overall view of the entire project.	3.1 Summary Table	- Show a summary table, number of pages viewed, whether it is a new page, length (in bytes), and when each page was last updated and by whom - Sort by page title or username
	3.2 Summary Role	- Show a summary role table that includes information on Wiki pages edited, when each page was last updated and by whom, status of the page, and who the page authors, reviewers and editors are

Table 2. Open source extensions

Feature requirement	Wiki extension	Design
1. Discussion and comments: Users are able to add comments to the Wiki page, reply to a comment or start a new comment, and input criteria to search recent comments made during a specific time period.	1.1 Discussion	- Add contents of comments - Show the author of a comment, how long ago the comment was posted, and the content of the comment - Show or hide comments - Show recent comments on a special page by using a filter to identify a specific time period and the number of comments that a user wants to see
2. Online Notification: Users are able to see who is currently online.	2.1 WhosOnline	- Show the usernames of those who are online at the same time - Choose to view how many users are online
3. Chat: Users are able to chat both asynchronously and synchronously.	3.1 Chat	- Chat online - Leave a message for offline users - Send private messages to specific users
4. Text editor: Users have more options for editing.	4.1 FCKeditor (Rich Eeditor)	- Provide rich-style (WYSIWYG) text editor functions and functions such as “create table” and “insert a picture”

Most extensions were installed and listed on the menu on the left side of the MediaWiki interface under the “group writing” Group Box (see Figure 3). Thus, users can access the extensions whenever they want. Other extensions had to be specified (e.g., the Discussion extension requires the user to embed a <discussion/> tag on a Wiki page, and the FCKeditor extension requires the user to click on the “edit” tab and then click on the “Rich Editor” link to invoke it).

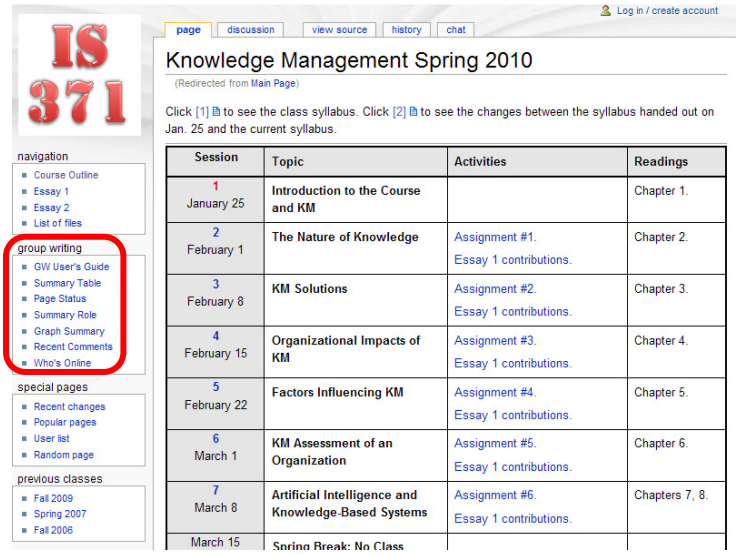

Figure 3. Main page for the Knowledge Management class wiki

2.4 Demonstration

MediaWiki version 1.15.1 was used in this study (The installation guide can be found at http://www.mediawiki.org/wiki/Installation. The latest stable release of MediaWiki is 1.19.1 as of August 30, 2012). The case study research method is used to address a contemporary phenomenon, such as an event or activity in a real-life situation (Benbasat el al., 2002; Yin, 2002). Two case studies in classroom settings were conducted. The case studies differed with respect to the details of the assignments, roles, and time period (see Table 3) which was reported in a previous study (Kasemvilas et al, 2011). The two case studies provided detailed information about two small groups of participants and were used to explore and describe the complexity of the processes that occurred as a result of using the form of MediaWiki that was designed to enhance the collaborative writing process.

At the beginning of the semester, students used standard MediaWiki. After that students were asked to complete questionnaires regarding their perceptions of Perceived Usefulness (PU) and Perceived Ease Of Use (PEOU) of standard MediaWiki. Then, the researcher modified and installed MediaWiki extensions and preparing tutorials.

In the second half of the semester students used the extended version. Students were given training on how to use it and were provided with a tutorial that also provided documentation for using the extensions. Finally, at the end of the semester students were again asked to complete the questionnaire.

Table 3. Overview of both case studies (Kasemvilas et al, 2011)

Items	Case Study 1	Case Study 2
Course	Seminar in Research Methods	Knowledge Management
Class size	N = 8	N = 12
Age	20-30 = 50%; 31-40 = 25%; 41-50 = 25%	20-30 = 41.7%; 31-40 = 25%; 41-50 = 25%; 50+ = 8.3%
Gender	M = 50%; F = 50%	M = 66.7%; F = 33.3%
Degree	Master = 25%; PhD = 75%	Master = 66.7%; PhD = 33.3%
Have used Wikis in classrooms	Yes = 37.5%; No = 62.5%	Yes = 25%; No = 75%
Know how to configure MediaWiki	Yes = 37.5%; No= 62.5%	Yes = 16.7%; No = 75%; Missing = 8.3%
Group size	4 (2 groups)	4 (3 groups)
# of group writing assignments	4 review papers	2 essays
Time	3 weeks /1 paper	6 weeks /1 essay
Roles	Author and reviewer	Author, reviewer, and editor
Role assignments	Each student wrote their own review, including an evaluation, recommendations, and comments to the editor and the author(s) of the paper (summary, assessment of claims and reasons, warrants, evidence, and methods). Then, each student reviewed the reviews of other students in the group.	Two students were assigned to collaboratively write a section of the essay. Then, each student was assigned to be a reviewer and/or editor of other sections that other students wrote.

2.5 Evaluation

Each user was asked to evaluate each distinctive MediaWiki extension and feature by completing a questionnaire that included two key concepts from the TAM (Davis, 1989), namely, PEOU and PU. In effect, the user indirectly assessed a combination of features that should be perceived as favorable if the features were considered useful and easy to use during collaborative writing activities.

2.5.1 Technology Acceptance Model (TAM)

The TAM is one of the most prominent and widely used theoretical models to predict IT acceptance and adoption (Davis, 1989; Venkatesh & Davis, 1996). According to Davis (1989), two of the most important variables in the TAM model are Perceived Ease of Use (PEOU) and Perceived Usefulness (PU). PEOU is

defined as "the degree to which a person believes that using a particular system would be free of effort" (p. 320). In contrast, PU is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (p. 320). The controversy regarding the relative importance of PU and PEOU can be explained in the context of the nature of these variables. PEOU is judged from its intrinsic aspects, such as ease of learning, understanding, and use, while PU is assessed from its extrinsic contribution to tasks, such as efficiency and effectiveness.

Davis (1989) claims that "ease of use operates through usefulness" (p. 332). Many researchers posit that PU plays a more important role in user's technology acceptance than PEOU (Adams et al, 1992; Gefen & Straub, 2000; Venkatesh & Davis, 1996). Many studies explain the relative importance of PEOU in the use of information systems (Aziz & Macredie, 2005; Gefen & Straub, 2000; Venkatesh, 2000). However, one study showed that PU does not have an important influence on the adoption of technology in some developing countries and that PEOU is the main predictor of both usage and PU (Brown, 2002). Thus, PEOU plays a significant role in certain situations. Morris and Dillon (1997) show that the easier the system is to use, the more useful the system will be.

2.5.2 Evaluation Measures

Questionnaires were used to collect answers to questions about PEOU and PU. The questionnaire employed a seven-point Likert scale to measure the perceptions of users, from "strongly disagree" (1) to "strongly agree" (7). The scales used to measure PU and PEOU were adapted from the extant literature.

The first step involved pre-testing these measures in a small pilot study with three doctoral students to ensure that the study and the manipulation seemed sensible and to identify obvious errors in the procedures and materials. As a result, measurements were refined so that the wording in the questions was unambiguous.

2.5.3 Data Analysis

PEOU and PU were measured for reliability by applying Cronbach's alpha to the individual scales. A paired comparisons t-test was used to compare the PEOU and PU values before and after the extensions were installed. Pearson's correlation coefficient was used to compare the PEOU and PU for each extension and feature.

2.5.4 Validity and Reliability

To ensure internal consistency, the constructs were measured for reliability by calculating Cronbach's alpha for each construct. According to Teo el al (1999), the alpha values must be greater than the minimum standard guideline of 0.7 required for constructs to be considered reliable. The six-item measure of PEOU is highly reliable (α at pretest = 0.928 and α at posttest = 0.949). The six-item measure of PU is also highly reliable (α at pretest = 0.968 and α at posttest = 0.971).

2.5.5 Questionnaire Evaluation

The participants consisted of twenty graduate students in two classes ranging in age from twenty to over fifty years. Two students were enrolled in both classes. Twelve of the students were male, and the remaining eight students were female. Ten of the students were Master's students, and the other ten were Ph.D. students. Six participants had used Wikis before, and five of the six knew how to configure MediaWiki. The researcher counted the students who were in both classes as separate cases because they answered questionnaires differently in both classes and were asked to answer a questionnaire regarding their perceptions associated with a specific class.

All comparisons were subjected to a paired-samples t-test at a significance level of .05 (α = .05, 1-tailed). Table 4 shows how knowledgeable the participants were in general about MediaWiki at the middle and end of the semester. A paired-samples t-test was conducted to compare participants' knowledgeability at the middle of the semester with their knowledgeability at the end of the semester. The results indicated that, overall, students' knowledgeability of MediaWiki increased during the study period. The students reported significantly higher knowledge of the Watchlist, Wiki Markup, Special Pages, and Wiki Extensions at the end of the semester than they had at the middle of the semester. However, students' knowledgeability about the talk page at the middle and end of the semester was not significantly different. One reason for this lack of a difference is the fact that students were required to use the talk page (the discussion page) in most of their

Wiki assignments. As a result, they may already have been knowledgeable about the talk page at the start of the second half of the class.

Table 4. Knowledgeability of Wiki scores at the middle and end of the semester

Knowledgeability	MIDDLE		END				
(n = 20)	M	SD	M	SD	T	df	p
Talk page	3.65	0.93	3.95	0.61	1.45	19	.082
Watchlist	2.44	1.29	3.61	1.15	2.93	17	.005*
Wiki markup	2.72	1.07	3.39	0.85	3.69	17	.001*
Special Pages	2.28	1.32	2.94	1.00	2.49	17	.012*
Wiki Extensions	2.21	1.44	2.89	1.20	1.79	18	.046*

** Significance at the 5% level of confidence.*

The students' perceived usefulness of MediaWiki with additional extensions and features for their writing process was significantly higher than the perceived usefulness of MediaWiki without these extensions and features (M_{before} = 4.73, SD = 1.55; M_{after} = 5.26, SD = 1.32; t_{19}=1.848, p = 0.040). This result suggests that the presence of extensions significantly increased the perceived usefulness of MediaWiki for group writing.

The students' perceived ease of use of the MediaWiki with additional extensions and features for their writing process was significantly higher than that for the MediaWiki without these extensions and features (M_{before} = 4.83, SD = 1.35; M_{after} = 5.39, SD = 0.99; t_{19}=1.732, p = 0.049). This result suggests that the presence of extensions significantly increased the perceived ease of use of MediaWiki for group writing.

The Pearson correlation coefficient revealed that PEOU and PU were highly correlated (before installation of the extensions, r = 0.676, n = 20, p = 0.001; after installation, r = 0.749, n = 20, p < 0.001), indicating that these measures have face validity. Pearson correlations were computed to assess the relationship between PEOU and PU after the use of the extensions. The participants did not answer every question in the questionnaire; therefore, the n values were different for each extension. The results indicated that there was a statistically significant correlation between PEOU and PU with respect to the Summary Table (r = 0.699, n = 17, p = 0.002), Summary Role (r = 0.779, n = 18, p < 0.001), Page Status (r = 0.755, n = 17, p < 0.001), Watchlist (r = 0.647, n = 15, p = 0.009), and Rich Editor (r = 0.940, n = 15, p < 0.001) extensions. Users felt that these tools were both easy to use and useful. Overall, there was a strong, positive correlation between PEOU and PU.

However, although users proposed to have Chat and WhosOnline features in MediaWiki, there were no significant correlations between PEOU and PU for the Discussion (r = 0.430, n = 19, p = 0.066), Chat (r = 0.249, n = 12, p = 0.435), WhosOnline (r = 0.328, n = 18, p = 0.184), and Graph Summary (r = 0.239, n = 17, p = 0.356) extensions.

2.6 Communication

One conference proceeding recently was accepted for publication in the international conference. Other findings from the second Build-and-Evaluate loop of this research study will be continually published in conferences and journals.

3. CONCLUSION

This study originated from theory-driven technology and problem-centered approaches. The study draws from design science research, to create a MediaWiki-supported environment for collaboration on mandatory group writing assignments. Two case studies were conducted to understand how a MediaWiki with additional extensions potentially facilitates collaborative writing and mutual learning in a time-and-space-transcendent classroom atmosphere. These tools were translated into a set of MediaWiki mechanisms that were introduced and examined in this study. The findings from these studies led to the design of a set of pragmatic tools to enhance group collaboration and learning in the graduate classroom environment. The researcher anticipated that these mechanisms would increase the students' sense of awareness, clarify management, increase discussion, and clarify students' roles. The implications of this study can be useful for researchers and

developers. They can make use of what the study articulates the benefits and the needs of MediaWiki extensions.

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REAL WORLD EDUTAINMENT SYSTEM AND ITS APPLICATION TO EVACUATION DRILL

Keiji Miki[1], Hiroyuki Mitsuhara[2], Takahide Sumikawa[1], Jun Miyashita[1], Kazuhisa Iwaka[1], Masashi Konishi[3] and Yasunori Kozuki[2]
[1]*Graduate School of Advanced Technology and Science, The University of Tokushima, JAPAN*
[2]*Institute of Technology and Science, The University of Tokushima, JAPAN*
[3]*Tsuda Junior High School, Tokushima City, JAPAN*

ABSTRACT

Real World Edutainment (RWE), which provides location-based learning on a tablet PC, combines experiential learning in the real world and digital learning materials. In RWE, learners can learn through interacting with the real world (real objects) based on a branched game story. As a learning topic suitable for RWE, we chose "earthquake disaster prevention" (EDP) and conducted an evacuation drill as EDP education for junior high school students. This paper describes the outline of a network-based RWE system, how to apply the system to the drill, and the questionnaire results obtained through the drill.

KEYWORDS

Edutainment, real world, competition, evacuation drill, earthquake disaster prevention education, tablet PC

1. INTRODUCTION

Recently, the integration of learning and computer game has attracted attention (Kafai 2006)(Squire 2007). This integration is called edutainment, which is educational software that increases learning motivation and effect by using interactive, multimedia, and game technologies. Many of the conventional edutainment systems provide pre-programed virtual worlds for learning and are isolated from the real world. In other words, it is difficult to learn with five senses in such systems.

In this study, we proposed Real World Edutainment (RWE) and developed an RWE system (Noda et al. 2010)(Miki et al. 2012). In RWE, learners can learn from real objects (e.g., creatures, artifacts, and human) and virtual objects (digital learning materials). The RWE system works on a Windows tablet PC and fuses the real world and the virtual world with RFID, GPS, and Web camera. In addition, RWE attaches importance to a game story and human actors to increase learning motivation and effect. Digital learning materials (e.g., audio, image, and video, and single-choice quiz/question) are presented according to the game story and sensor data (e.g., location represented by latitude and longitude), and the human actors support learners face-to-face. Thus, learning in the real world is controlled and supported.

Learning in the real world has been extensively studied (e.g., (Chen et al. 2012)(Dede et al. 2009) (Lu et al. 2011)(Sandberg et al. 2011)). Nilsson (2012) developed an augmented reality game for contextual learning that has a game story revolved in the real world. In addition to these, the integration of disaster prevention learning and computer has been extensively studied in recent years (e.g., (Shana et al. 2009)(Thushari et al. 2012)(Tobita et al. 2009)). Earth Girl is an edutainment system that helps learners to gain a better understanding natural hazards (e.g., earthquakes, tsunamis and flooding) through digital game (Isaac et al. 2012)).

As a learning topic suitable for RWE, we chose "earthquake disaster prevention" (EDP) and created a game story that provided university students (at the University of Tokushima) with knowledge about earthquake, tsunami, first aid, evacuation route, etc. One of the reasons for our choice was that Tokushima prefecture in the western part of Japan is expected serious damage by Nankai earthquake (magnitude of around 8.0), which is anticipated more than 60% of the time within 30 years. Then, we conducted a preliminary experiment to survey whether RWE was useful for EDP. The experimental results indicated that

RWE increased learning motivation (awareness of EDP) in comparison with traditional classroom education (Noda et al. 2012).

After the preliminary experiment, we focused on "evacuation drill" in EDP because it can be regarded as experiential learning where participants follow the evacuation route in the real world. Simply, it has a high affinity for RWE in the common denominator of "the real world". Then, we created a game story set in the Tsuda district (Tokushima prefecture) and conducted an RWE-based evacuation drill for 30 second-year students at Tsuda junior high school.

The remainder of the paper is organized as follows. Section 2 outlines the RWE system. Section 3 describes an application of RWE to an evacuation drill, showing the game story focusing on earthquake and tsunami. Section 4 summarizes the paper and shows the future works.

2. REAL WORLD EDUTAINMENT SYSTEM

RWE provides story-based learning in the real world; that is, learning through RPG (role-playing game) and AVG (adventure game) in real world. A game story helps absorbing learners into the game world (the fictional world in the real world). In addition, we adopted human actors as active characters in the game story, who can provide flexible instruction to learners' characteristics (e.g., understanding) and situations (e.g., time and place).

The RWE system recognizes learning scenes from a game story and sensor data, and then presents digital learning materials corresponding to the recognized scenes. In addition, it can store learners' logs in a database server on the Internet through a wireless communication unit. The system is schematically illustrated in Figure 1.

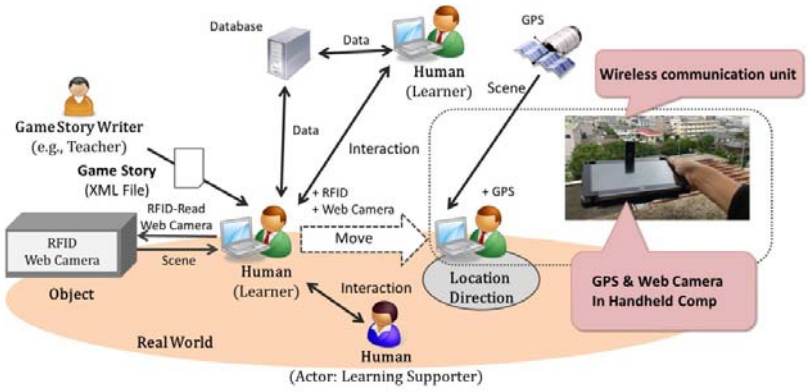

Figure 1. System overview of Real World Edutainment

2.1 Game Story

A game story consisting of ordered learning scenes can be branched. The branched story can provide multi-ending and flexible instruction, and therefore learning motivation and effect will be increased. There are two kinds of branching. Irreversible branching does not have backtrackings and loops in the story. For example, if a learner's answer to a quiz is wrong, he/she is moved to a series of scenes about a basic topic. Reversible branching has backtrackings and loops in the story and allows a learner to alternate learning scenes. For example, if his/her answer is wrong, he/she can retry the same scene or return to the previous scene.

2.2 Learning Scene Recognition and Learning Material Presentation

In many cases, RWE will be conducted outside. This is because GPS is in widespread use than RFID and covers a wider area for a game story. For the outside scene recognition, location data (latitude, longitude, and direction gathered by GPS) are mainly used. When the gathered data matches a location ID described in the game story, the corresponding learning material is presented from the corresponding scene ID.

2.3 Collaboration and Competition in Learning

The RWE system, which can access the Internet, can involve collaboration and competition in learning. The database server receives the learners' logs from the RWE systems (clients) at a regular interval or every scene. The logs are shared by being transmitted to the RWE systems when needed for the story progression.

(1) Collaboration

When gathering at the same scene, learners can increase their learning motivation by solving the same task together and increase learning effect (knowledge) by teaching each other what they have learned.

(2) Competition

There are two kinds of competition in RWE. One is competition against time. When a limited time is set in the game story, learners will attempt to complete learning within the limited time (Figure 2-left). Another is competition against other learners. When it is declared that the learner who visits the last scene first is the winner, learners will concentrate on learning (Figure 2-right).

2.4 Reflection Support System

After learning in the real world, learners are allowed to access to a Web-based system for reflecting on what they learned. The system retrieves their logs (e.g., locational trajectory, selected answer to quiz/question, and comment) from the database server and visualizes the logs on a Google map (Figure 2). The learners can view not only their learning processes but also the learning materials again.

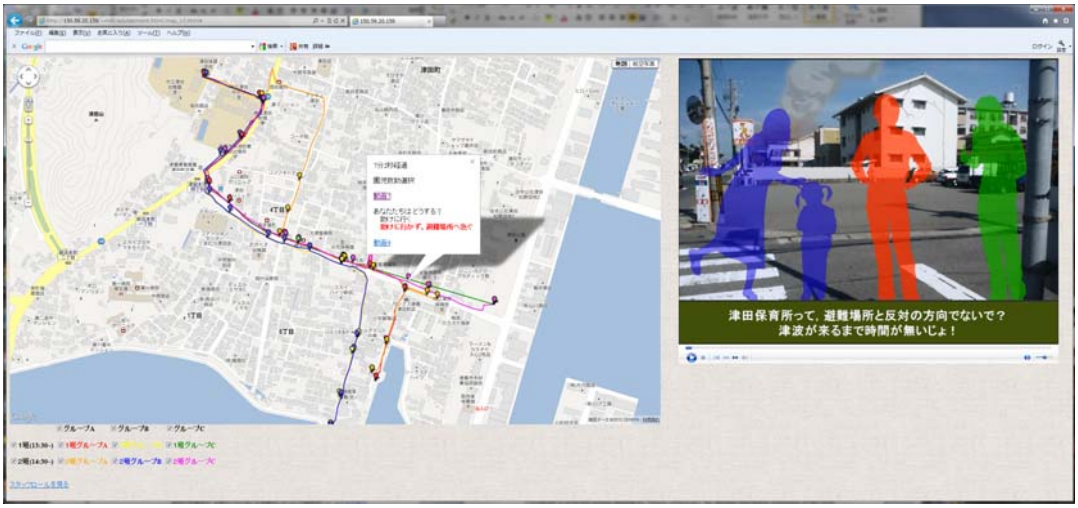

Figure 2. Snapshot of Web-based reflection support system

3. RWE-BASED EVACUATION DRILL

Tokushima, which faces the Pacific Ocean, is expected to be seriously damaged by a subduction-zone earthquake called "Nankai earthquake" and the resulting tsunami. Therefore, many people in Tokushima have understood the importance of EDP. In Tsuda, a coastal area in Tokushima, for example, junior high school students contribute to local EDP by surveying the residents' awareness about Nankai earthquake, making a map of the optimal evaluation route, etc.

In August 2012, we had an opportunity to conduct an RWE-based evacuation drill for 30 second-year students of Tsuda junior high school.

3.1 Aim and Expected Effects

In traditional evacuation drills, many of the participants were lacking their seriousness and could not think enough about dilemmas and dangers that may be encountered in actual evacuation.

In the RWE-based evacuation drill, therefore, we aimed at making participants think enough about the dilemmas and the dangers by virtually presenting possible serious situations in actual evacuation as learning materials based on a game story. Especially, we attached importance to the following dilemma: "Whether should we help others in evacuation or not help others?" This is a tough choice in a short period of time until the tsunami attacks. The RWE system presented two-alternative questions (learning materials) at specific locations (learning scenes) and forced the students to choose between the two (e.g., "Do you help the injured person or not?"). We adopted such questions by reference to Yamori's work on card-game-based EDP education (Yamori 2011). We think that it is effective as a trigger for sustained thinking to expose the students to this kind of dilemma even if the virtual situations are presented.

Moreover, we think that the virtual situations should be linked with the real world as much as possible to utilize RWE's advantages. Therefore, we gave the students real physical loads when they chose to help others and got injured in the virtual situations. This feature will promote the students to think about their evacuation attitude (belief), optimal evacuation routes, disaster kits to be prepared, and other important points, taking into account their experiences through the drill.

3.2 Configuration

The RWE-based evacuation drill consisted of two parts: evacuation experience using the RWE system and evaluation reflection using the Web-based reflection support system. The students who participated in the drill were divided into 6 groups (5 students in each group): A1, A2, B1, B2, C1, and C2. In the group indices, the alphabets (A, B, and C) represent a difference in the story (e.g., different starting locations and different serious situations) and the numbers (1 and 2) represent the time zone for the evacuation experience.

(1) Evacuation experience

All the starting locations (near the coast) were set about 1 km away from the evacuation site (a building at the foot of a mountain). Each group held a tablet PC (the RWE system) and evacuated to the evacuation site on the assumption that Nankai earthquake had occurred. The groups' common goal was to arrive at the evacuation site within a limited time (32 minutes). When the groups visited specific locations in the evacuation, the serious situations corresponding to the locations were presented as videos and two-alternative questions. For each group, the evacuation experience ended when the group has arrived at the evacuation site within the limited time or the limited time has elapsed. Figure 3-left shows a snapshot of a group in the evacuation experience, where the students are viewing a video presented on the tablet PC.

The groups' common goal shown above means competition against time, which is a very important factor in evacuation drills (especially about tsunami). In addition, we introduced the following scoring as a measure of evacuation appropriateness to show the group ranking (the groups' scores). This is because we think that competition against others (classmates) will further increase the students' motivation for the evacuation experience.

- Score about evacuation time
  This score, which was determined by the remaining time, was initially 1,920 and was reduced one point every second—the initial score indicates 1,920 seconds (32 minutes).
- Score about helping others
  This score was determined by how many others (residents in the game story) the group helped (to be more precise, the group chose to help). In each story (for A, B, and C), four residents were waiting for help and each resident had 25 points. If helping all of the four residents, therefore, a group gained 100 points.
- Score about avoiding dangers
  This score was determined by whether the group passed through dangerous streets. In each story, there were two dangerous streets (e.g., ground liquefaction and fallen telephone poles) and the initial score was 20 points. If passing through one of the dangerous streets, the group lost 10 points.

The final score was calculated as the sum of the above scores.

(2) Evaluation reflection

After the evacuation experience, the students gathered in a PC room in the junior high school to reflect on their evacuation behaviors. In the evacuation reflection (about 1 hour), each group's evacuation logs (behaviors) were visualized on the Google map and projected onto the front screen (Figure 3-right). A teacher, an EDP director in the school, required every student to reflect on his/her evacuation behaviors and express what he/she had felt through the evacuation experience. The teacher arbitrarily prompted the students to think by asking questions (e.g., "Why did you behave like that?") and asking for responses from all the students (e.g., "Please raise your hand if you agree on that.")



Figure 3. Snapshots of the evacuation experience (left) and the evaluation reflection (right)

3.3 Game Story

We created three branched game stories (A, B, and C) for the evacuation drill, focusing on Nankai earthquake and the resulting tsunami in Tsuda. The virtual main characters in the story were Tsuda junior high school students in order for the participants to get emotionally involved in the story. The opening scene of the story is shown as follows.

Three of Tsuda junior high school students were gathered near the coast to investigate the actual conditions of EDP in Tsuda. At that time, massive earthquake occurred and one student said with unease, "This is Nankai earthquake!" After 2-minute quake, they started to run to the evacuation site to escape from the tsunami that attacks Tsuda 32 minutes later.

Each story consisted of 22 serious situations. A few of the serious situations were common in the three stories. After the first scene, the group ran along the recommended evacuation route, but was forced to make tough choices at some locations in the evacuation. In the three stories, the group wasted their evacuation time depending on their choice. Figure 4 shows the flow of the story A. The typical situations in the story A are shown as follows.

(1) Helping others

If deciding to help others (virtual residents), the group has to deviate from the recommended evacuation route and spend their evacuation time to help.

- *Should we help children at a nursery school?*
  When the three students (virtual characters: VCs) pass by a nursery school, a teacher (VC) of the school anxiously asks them to take three children (VCs) to the evacuation site. They have to immediately choose whether they evacuate while carrying the children on their shoulder or not—leave the children there and evacuate by themselves. If the group chooses to help, three students of the group carry about 10-kilograms backpack—the average body weight of one-year-old Japanese children is 10 kgs—and then the group evacuates to the evacuation site in the real world.
- *Should we help a physically disabled old man?*

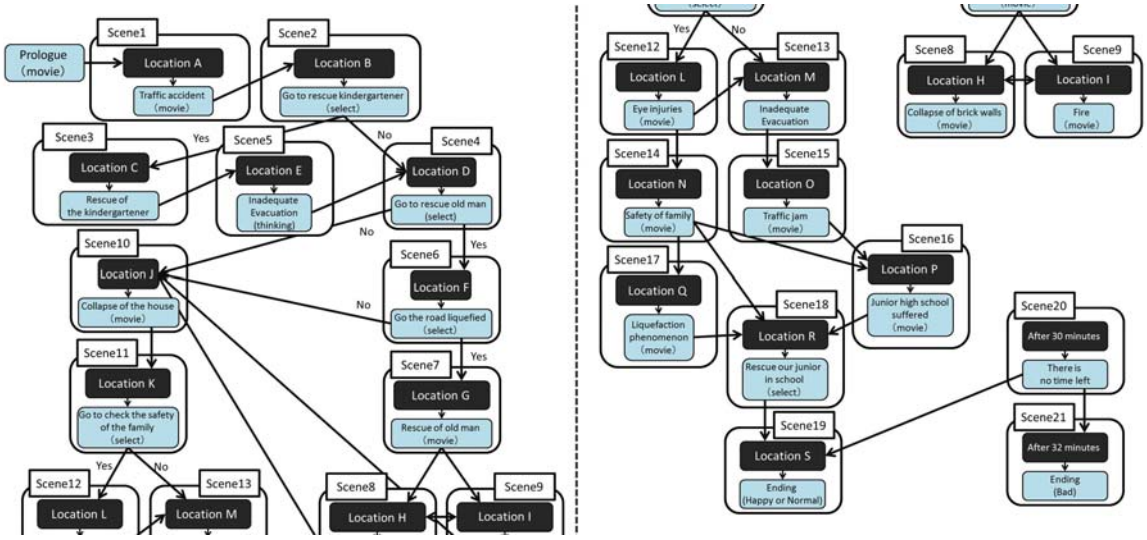

Figure 4. Story flow of the evacuation drill

The three students (VCs) suddenly recall a physically disabled old man (VC) who lives a few minutes away from the recommended evacuation route. They have to immediately choose whether they go to his house and evacuate together with him or not. If the group chooses to help, they go to a designated location (his virtual house in Tsuda) in the real world. At the location, the video is presented where the old man says, "Leave me alone. You evacuate right now! I want you to survive." They have no choice but to say a difficult goodbye to the old man and continue evacuating—as a result, the old man is helped by a passerby (VC).

- *Should we help her younger sister?*
  When the three students (VCs) reach close to the evacuation site, one of them asks to go to her house to help her younger sister. They have to immediately choose whether they go to her house or hurry to reach the evacuation site. If the group chooses to help, they go to a designated location (her virtual house in Tsuda) in the real world. At the location, the video is presented where a young man (VC) says, "Everyone who lives around here has already been at the evacuation site."

(2) Avoiding dangers

Composite pictures of dangers such as ground liquefaction, fire, a collapsed house and a brick wall are presented. If deciding to pass through the dangerous spots (streets), the group wastes their evacuation time. In some cases, one student of the group gets injured.

- *Should we avoid ground liquefaction on a street?*
  When the three students (VCs) pass through a narrow street, they encounter ground liquefaction. They have to immediately choose whether they keep passing unsolicitously or return to a main street or another street. If the group chooses to pass through the street, the video is presented where one of the three students gets injured. In the real world, one student of the group has to attach a 1-kilogram weight or a joint fixator to his/her leg as a physical load—he/she becomes difficult to walk and the group will have a disadvantage for evacuation.
- *Should we avoid fire on a street?*
  When the three students (VCs) pass by a warehouse of combustible materials, they encounter fire on a narrow street. The group is forced to return to the main street and wastes their evacuation time.

(3) Thinking

Composite pictures of inappropriate evacuation are presented as a trigger for thinking. We expect that the students will think and discuss how they should do for people who are evacuating inappropriately.

- *How should we do for people being a lower zone?*
  A lower zone will be attacked by tsunami and people there may die.
- *How should we do for people who are about to evacuate by car?*
  Evacuation by car should be avoided for neighbor residents. This is because there will be impassable roads and a traffic jam, which impedes evacuation, will be generated.

(4) Ending

We prepared the following three kinds of ending. In the video of ending, composite pictures representing Tsuda damaged by the tsunami are presented in common.

- When arriving at the evacuation site within the limited time: Successful evacuation
  1. *When the group helped others (virtual residents)*
     In the ending video, one of the three students (VCs) says, "We helped some residents and survived. We were really lucky. If we made a wrong decision, we might die due to tsunami."
  2. *When the group did not help others*
     In the ending video, one of the three students (VCs) says, "We did not help others, but we did our best to save our lives. Now, we want to think positively about our future without reflecting on the past."
- When not arriving at the evacuation site within the limited time: Failed evacuation
  In the ending video, one of the three students (VCs) says, "To be frank, I do not understand what we should do in evacuation. Now I just hope that my family and friends are safe."

3.4 Questionnaire Results

Immediately after the evacuation reflection, we carried out a questionnaire (5-degree questions) to survey the drill's usefulness. Table 1 shows the partial results of the questionnaire.

The mean values of Q1, Q2, Q3, and Q4 were 3.73, 4.33, 4.00, and 4.27, respectively. These affirmative values may indicate that a good balance between seriousness (education) and game (entertainment) was achieved. Typical opinions from the students were "A real earthquake disaster will be more serious than the virtual game. So, this experience is very valuable in preparedness for Nankai earthquake." and "I want to think more about disaster prevention because I felt that my decision affected not only my life but also others' lives in disaster." Although currently the other data is not considered enough, we think from these values that RWE-based evacuation drill will be useful.

The mean value of Q5 was 3.84, which asked about the pros and cons of fusing game and disaster prevention education. We think that this value is basically favorable. Typical positive opinions were "Small children can understand disaster prevention easily while enjoying." and "If there are no game elements, the drill may be boring." A typical negative opinion was "Students may underestimate the drill because of game elements."

The mean values of Q6 and Q7 were 2.08 and 2.54, which asked about effectiveness of competition in the drill. These values are not favorable. Typical negative opinions about the competition were "It may be difficult to concentrate on evacuation by caring about the ranking." and "The ranking may discourage appropriate decisions in the evacuation."

Table 1. The main contents of the questionnaire, the mean value and standard deviation

Question	Mean (Max=5.00)	SD
Q1. Do you think the today's drill was fun?	**3.73**	**0.71**
Q2. Do you think the drill is useful as disaster prevention education?	**4.33**	**0.55**
Q3. Did you do the drill seriously?	**4.00**	**0.62**
Q4. Did the drill improve your awareness of disaster prevention?	**4.27**	**0.59**
Q5. Do you think the fusion of game and disaster prevention education is appropriate?	**3.84**	**0.86**
Q6. Did you mind your group's rank when evaluating?	**2.08**	**1.09**
Q7. Do you think it is necessary to introduce ranking (competition against other groups) in evacuation drills?	**2.54**	**0.84**

4. CONCLUSION

This paper described network-based Real World Edutainment (RWE) and its application to an evacuation drill as earthquake disaster prevention (EDP) education. We practiced the evacuation drill and confirmed its usefulness and largely positive responses to the pros and cons of fusing game and disaster prevention education.

An important matter in this study is how to adopt the relationship between learners and increase learning effect of EDP education. Through the evacuation drill, we found out that the participants (junior high school students) did not pay attention enough to competition (ranking). Therefore our future work is to make a learner more conscious of other learners by emphasizing competition elements. If the game story changes by other learners' behaviors (e.g., the order of visiting scenes), the learner may get conscious of fast-paced advantage or disadvantage in competition. In the story described in Section 3.3, for example, a scene where a participant is required to rescue an injured person can disappear if another participant has already rescued him/her.

To make sure learning effectiveness of competition in RWE, we have to create game stories including various kinds of possible competition in evacuation and conduct a large-scale practice based on the stories.

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ANALYSIS OF COMPUTING PLATFORMS AS A TOOL FOR COLLABORATIVE LEARNING OF SECONDARY SCHOOL STUDENTS IN THE MUNICIPALITY OF GUIMARÃES IN PORTUGAL

Dalila Alves Durães
Granada University
Guimarães, Portugal

José Francisco Hinojo-Lucena
Granada University
Granada, Spain

ABSTRACT

In Portugal, it seems that the use of ICT in learning on the part of teachers and students remains very limited. It is necessary to invest in this field, so that the teachers can use ICT in the classroom. Its use in classrooms will allow students a more autonomous learning, thereby enabling them to use these technologies outside the classroom, in e-learning contexts, through collaborative learning, either among peers or between teacher and student. With this work, I want to show the use of computing platforms, by students and teachers in secondary education schools in the municipality of Guimarães, in Northern Portugal.

KEYWORDS

Collaborative Learning, Educational Technologies, ICT.

1. INTRODUCTION

With the advent of new technology, pedagogy and education faced a big challenge, since these do not work as a single resource (such as the audiovisual media and the cinema) for school work, but have an enormous power to revolutionize the way of teaching. It is mandatory to do a review of education itself and its pedagogy.

We can therefore say that the new technologies, especially information and communication technologies (ICT), impose a new pedagogy. Only after this point resolved, we can move ahead for teacher training and for the restructuring of schools.

In education, new technologies must be part of a search for new concepts and educational practices that strengthen the role of the teacher with the ability to carry out and to respond to new situations sometimes unpredictable on a school daily basis.

The teacher's role is irreplaceable, since it is essential in the presentation of ideas, building working relationships and creating effective learning environments.

Even when motivated for the use of new technologies, particularly computers and the Internet, teachers are confronted with a great difficulty, either because they don't have specific and appropriate training, or resources are limited. With the introduction of new technologies, students' results turn into a routine and new teaching methods fail to exist. This means that teachers often use new technologies like trivial task support, not adding anything in cognitive terms, i.e. failing precisely in the area in which its potential could be decisive, for example in terms of stimulating and developing top-level skills (Cuban, cutting, 2001; 1996; Jonassen, 1998, 2000; Papert, 1994, 1997, 2000ª; Papert Caperton, 1999; Salomon, 2002), getting its use far short of what would be expected.

With this work, I want to show the use of computing platforms, by students and teachers in secondary education schools in the municipality of Guimarães, Portugal.

The municipality of Guimarães is located in the north of Portugal, at about 60 Km from the city of Oporto. The municipality of Guimarães has 69 parishes and is one of the most densely populated boroughs with around 160,000 inhabitants, who reside mainly in the peripheral areas of the city, being one of the youngest in Europe.

This borough is one of the most highly industrialized regions of the country and, consequently, one that provides a higher rate of employment. Manufacturing industry and the textile sector are the most common, being wiring and cotton and linen weaving one of the most relevant as well as the cutlery industry, the tanneries, and the bauble and crafts (jewellery, pottery and embroidery). It has a young manpower available, particularly women with low skills.

In the primary sector, the highest incidence is in temporary grassland and forage crops, followed by cereals and vine crops.

In the tertiary sector, services are concentrated in the town and in the villages.

It has a pole in the science and technology park with a European Institute of excellence in engineering and regenerative medicine.

2. COMPUTER PLATFORMS IN TEACHING

The use of electronic means in education has, in essence, two different postures which could, in reality, fall into two extremes: one that puts them to the exclusive service of the teachers (as an educator and trainer), serving as a support in the transmission of knowledge and communicative tasks; another, essentially at the service of the student, as facilitators and organizers of learning, regardless of how this is accomplished in every moment (Bouthours, 1987; Costa, 2007).

Therefore, the factors related to technological developments and with the technologies available in each moment, one can add the epistemological issues (Dieuzeide, 1994; Papert, 1985; Scholer, 1983; Turkle Papert, 1992), essentially, with the problem of clarifying the role of these same technologies for educational and school purposes: help in the work of the teacher in teaching new knowledge in schools; or strengthening intellectual capacities of students in their learning tasks by providing tools that help them reflect in a structured, sequential and, thus, better results in relation to school learning (Jonassen, 2000; Papert, 1994, 1997, 2000b; Bridge, 1994).

In the decades of 1950 and 1960, the educational technology presented itself as a generator of learning. In the Decade of 70, it became part of the teaching as technological process. In the mid 90s, it was characterized by the search for new ways of working in the educational field.

Educational technology reflects on the application of techniques to the solution of educational problems. It seeks to control the teaching-learning system as a central aspect and quality assurance, concerned about the techniques and their adaptation to the needs and realities of the students.

In the 21st century, the technologies are beginning to be seen and used in another perspective of the educational process. They ceased to be regarded as mere tools that make more efficient and effective educational models already old, starting to be considered, such as structuring elements of new educations, with the aim of expressing the diversity of cultures and pedagogical processes. In this sense, TV, video, radio, the Internet, printed materials make it possible to articulate new languages and new rationalities in schools. More and more schools and education centers are using online tools and collaborative learning and searching for information. The main tools used and known are aggregation and distribution of content (RSS, ATOM), learning environments such as Weblogs (BLOGs), Wikis and educational objects and WebQuests.

It is important to identify the tools that really can be used as educational tools and evaluate their implementation in order to promote meaningful, critical and effective learning.

We can say that Educational technology is a systematic way to prepare, carry out and evaluate the learning process in terms of specific objectives, research-based learning and human communication, employing a combination of resources and materials to achieve a more effective learning.

Without seeking to be exhaustive, I will present a classification, among vast possibilities of existing ones, subject to essentially functional criteria of teaching: teaching scheduled; asynchronous teaching; synchronous learning; distance learning and face-to-face education.

3. COLLABORATIVE LEARNING

For SIQUEIRA (2003, p. 23) collaborative learning has the following meaning:

Collaborative learning is a *re-acultured* process that helps students to become members of knowledge communities whose common property is different from those communities to which they already belong. It assumes, therefore, that knowledge is socially constructed and that learning is a sociolinguistic process.

This type of learning enables online education. For this to be possible it is necessary to follow the four basic rules of learning among students and teachers, such as: learning to know, in connection with the pleasure of discovering and with curiosity; learning how to make/do; learning to live together, to understand each other and, learning to be. It will be the responsibility of the school and teachers to make possible the development of these basic rules.

It should be stressed that innovative technology is an auxiliary resource for learning; however it is necessary that the teacher has a knowledge with a holistic vision, that is, with a global vision capable of overcoming the fragmentation of knowledge; he/she must also have a progressive approach to social change through dialogue; and, teaching based on research, where teachers and students can produce knowledge with criticality.

Communicating and learning are the key points for the design and development of new approaches and for learning.

Collaborative learning is, in essence, the process of learning in groups or in a community. But to be able to drive and induce learning, implies that the teacher also obtained his/her knowledge through this method.

A group is much more than the sum of its participants. The whole (Group) shows through its integrity and unity, actions that identify each one of the members, by the mutual influence, by the norms and values set, the existing affective atmosphere, by the type of communication that is maintained for the collective satisfaction of needs and aspirations, therefore, for each personal growth.

A team or a learning community consists of a set of people who gather in one place and during a certain period of time. They take up a task that requires them to assume certain functions and interact with each other in order to achieve a particular purpose.

3.1 Virtual Learning Communities

We can then define a virtual community as a space of convergence of interests, in which the involvement of their members allows performances by sharing, problem-solving and the construction of knowledge, thus leading to the understanding of the community as a process of participation in common cultural practices. In this way, participation is a necessary requirement for the realization of learning within the community.

The forms of participation involve conducting a drawing, a common language, goals and practices, aimed at sharing experiences, techniques and strategies. The relaxation time, ways and conditions of attendance, where training and education opportunities can be found, are key aspects of the model that is developed in the network, while approaching space and formation of new bonds between people and between the contexts of learning.

These virtual learning environments create the possibility for the development of social and cognitive interactions, which are organized around the activities and contexts, playing this sort of model an increasingly important role to the understanding of the processes of making education and training to the knowledge society.

However, there must be collaborative and technological mediation of the processes of interaction, that is, it is necessary to organize around the goals, contexts and mediating collaborative learning activities in order to develop the sharing of objects of study in the community. Through collaborative mediation the virtual learning community springs up from the group and individual activities in the representation of the distributed knowledge. It is through the development of distributed knowledge that one can determine the sustainability and own the lifecycle of these communities.

Mediation is the way as there will be participation and collaboration, i.e. the medium as it is conducted the process of cognitive and social interactions are the key factors for the sustainability and the mobilization of the virtual community.

Becoming a member of a virtual community means interacting with objects of knowledge, participating in existing cultural practices, and producing a culture of participation and collaborative construction of knowledge and ideas.

3.2 Social Distance

The dilution of distance establishes a form of openness and promotion of access to and participation in the activities of the communities. However, you might want to distinguish three forms of distance: geographical, social and technological.

Geographical distance disappears with the creation of virtual learning environments, since there is a common language in the individuals' access to the network and participation in the sharing of knowledge and practices. As language is a criterion of access defined initially in the creation of these environments, this type of distance disappears.

The technological distance exists since the speed and access mode can create some restrictions on the use of some individuals who come from technologically less developed means. However, the promotion of fluency of multiple media is a strategy for the digital inclusion and the appropriation of the net as a means of information and communication.

In the social distance, the problem focuses on processes of participation and integration in the activities of the community, since in the era of globalization, all individuals, in groups or individually, may participate in the processes of education and training, even the social and cultural minority groups. In this kind of distance, it is necessary to promote the reconstruction of social interaction processes in the network, through which you can learn about and learn how to become a member of the Community (Castells, 2004).

The boundaries and borders of the face-to-face education were dimmed with the creation of virtual communities, since time and space increased learning, encouraging the development of new perspectives for initial training and lifelong learning.

3.3 Types of Learning Communities

There is a diverse set of virtual learning communities which students in the municipality of Guimarães use on a daily basis. It should be noticed that moodle, wikis and blogs, are the most commonly used.

3.3.1 Types of Learning Communities

The Secondary School of Caldas das Taipas, Guimarães was one of the first schools to join this project, starting in 2005. Moodle has as objectives: to integrate the school in the knowledge society; to improve school performance; to encourage collaborative work between teachers and students; to build a workspace, promoting communication and collaboration between teachers, students, parents and the community.

Regarding to support educational practices is, undoubtedly the great added value of Moodle: teaching class management, through the use of tests, digital book, access control to resources, being a stimulating students ' learning tool. Its constructivist perspective on a collaborative basis, allows you to develop team spirit and ability of learning peer-to-peer; it enables time and spatial continuity in the classroom and allows disabled students to continuously access school.

Teachers have a number of tools that can be used in moodle, some of these examples are: forums, blogs, wikis, chat, polls and glossaries.

4. THE PORTUGUESE EDUCATION SYSTEM AT SECUNDARY EDUCATION AS RESEARCH CONTEXT

The Basic Law of the education system determines that basic education is universal, compulsory and free. The same law created a new organization of the educational system which includes pre-school education, school education and extra-curricular education. The latter covers activities of literacy, basic education and professional training and initiation.

Secondary education lasts for three years, organized according to differentiated ways contemplating the existence of courses mainly geared to working life or for continued studies, containing all training components of technical, technological and professional sense.

4.1 Curriculum Organization of Secondary Education

4.1.1 Scientific-Humanistic Course

The scientific-humanistic courses, aimed at pursuing higher studies (University or Polytechnic), have a term of 3 academic years, corresponding to the 10th, 11th and 12th years of schooling.

Intended for students who have completed basic education (9 years or equivalent qualification), who wish to obtain a secondary education.

The formative offer comprises four courses: Science and technology; Socio-Economic Sciences; Languages and Humanities; and Visual Arts.

4.1.2 Professional Course

Professional courses are one of the secondary-level courses of education, characterized by a strong link with the professional world.

Taking into account your personal profile, learning held in these values the skills development courses for the exercise of a profession, in conjunction with the local business sector.

The professional courses contain courses that meet several objectives: to help develop personal and professional skills for the exercise of a profession; to focus on training offerings that match the needs of local and regional work; to prepare to enter post-secondary training or higher education, if that is the wish of the pupil.

5. DRAWING RESEARCH

5.1 Problem

Through the theoretical reasoning described in the first part of this essay, I tried to provide a broad and general overview of each of the variables or factors that are directly related to this research, which somehow legitimizes the reason of this study.

The field of study that aims to address in this research work focuses on:

“The analysis of computing platforms as a tool for collaborative learning of students in the municipality of Guimarães (Portugal).”

5.2 Objectives

Once described what we will study, another key aspect and decisive character in an investigation are the objectives pursued.

In this case, all my research interest revolves around a general objective and specific objectives that derive directly from the general objective.

5.2.1 General Objective

"To describe the influence of variables present in computing platforms as a tool for collaborative learning in the municipality of Guimarães and the influence of schools locations."

5.2.2 Specifics Objectives

Identification of the school’s location: To know the school’s location and type of population that it covers, from the parishes to the social conditions of the same, and life prospects; Identification of school resources: To learn about the school's resources and how this influences in the use of computing platforms for collaborative learning; Courses existing in these schools: To know the courses existing at each of these

schools and its relationship with the use of computing platforms for collaborative learning; Identification of computing platforms used: To learn about the most used computing platforms by students and for what purpose; Identification of collaborative learning communities: To inquire about what type of collaborative learning communities students use; Satisfaction and students' training needs: To set an overview which students have about the concept of collaborative learning; To define the students' goals at school; To determine the main disappointments in the conduct of collaborative learning; To determine the main satisfactions in the use of collaborative learning; To identify possible training gaps; To propose future research lines, in other regions; and To contribute, with the achievement of this study, to the enhancement of the use of this type of technology in the future.

5.2.3 Sample

In my case, the universe that has directed this research work is secondary school students in the municipality of Guimarães. In this municipality, there are four secondary schools: Caldas das Taipas, Martins Sarmento, Francisco de Holanda and Santo Simões. Secondary education consists of three levels of education (grades) which are the tenth, eleventh and twelfth grades. In these three academic years, there are several classes that belong to some training courses. These options depend on courses offered by secondary schools. The sample can be considered as groups or subset of groups of a population that represents the same, where one studies the phenomenon. All individuals of the population should have the same opportunity to be included in the sample.

Secondary schools Francisco de Holanda, Caldas das Taipas and Martins Sarmento, possessed in the school year 2008/2009, 1614, 1067 and 1119 students, respectively. These students were allocated among various degrees of education. We need to emphasize that in addition to General courses, there were technological courses and professional courses. All courses were diurnal in nature, with the exception of Francisco de Holanda, where technological and professional courses may be diurnal and nocturnal in nature. In the year 2011/2012, the number of students was 1503, 1271 and 1206 in secondary schools Francisco de Holanda, Martins de Sarmento and Caldas Taipas, respectively. All the technological courses ceased to exist in all the schools.

5.2.4 Instruments

Data collection was carried out through the use of three types of varying and different instruments, in line with the descriptive and eclectic nature in my research methodology. They are questionnaires, interview and discussion group.

6. CONCLUSION

6.1 General Conclusions

In relation to the distribution of the sample by the school, it was made fairly and by comparing the total number of students per school. It was not found differences in attitudes, in the use of technologies, platforms, both in relation to the gender of the student. Regarding the requirements for the use by the courses, it turns out that the technological courses have a higher usage of computing platforms in three schools. The fact that a school is not in the center of the city, does not influence significantly the use of computing platforms. In the use of moodle, major platforms used in secondary education years of learning in these schools, there was, in General, a decrease in their use. In General, students understand that the use of the platforms is useful in their study, but not in its entirety, since they continue to prefer to study alone. There are a number of students who normally don't study, hence the low use of computing platforms to collaborative learning. Many students attribute the slow Internet and information dispersal, as one of the main factor which hinders the collaborative learning through computing platforms. Another reason not to use the platforms is due to the fact that the teachers use little or don't even use collaborative learning as support for their teaching. The main satisfaction obtained by the use of these platforms, is to be able to study and obtain information at any time in any place.

6.2 Specific Conclusions

Two of the three schools are in the city center of Guimarães, which are ESFH and ESMS. The ESCT is located in one of the villages of the municipality at 7 Km away from the city center. There are no substantial differences in the ages of students in these three schools. Students from scientific-humanistic courses and professional courses are younger than students of technological courses. The age of the siblings, in the sample treated, is superior, first in ESMS, then in ESFH and finally in ESCT. This means that these students who attend ESFH and ESMS are, in general, the younger siblings of the family, while students who attend ESCT are, in General, the older ones. In the sample, students attending ESCT, have more siblings studying. In ESMS, students almost do not have siblings studying. Those siblings, the ones who are studying, attend the same school at ESFH and ESMS. This actually happens due to age differences, i.e. the students' siblings are attending other degrees in higher education, or attend another school.

As a first step, ESFH had a richer set of features compared to other schools, with the exception of interactive whiteboards, where ESCT detained the greatest number. The use of computer resources in the classroom by teachers depends on the type of resource and school. So, as a first step, the teachers use more laptops and the multimedia projectors, respectively, followed by the Internet. This use in the classroom is mostly seen at ESFH, followed by ESCT. The use of interactive whiteboards is higher at ESCT. The ESMS is the school that uses less computer resources in the classroom. The use of computing platforms relies heavily on the technologies that the students are provided at school. In this sense, ESCT School (outside the city center) has great use of Moodle platform. Schools from the city center also use this platform, but in much smaller proportion. In relation to these technologies, they are used in the three schools. Thus, in the city center, at ESFH, blogs and YouTube are more used. At ESCT, students use the Google docs, hi5, msn and the wikis. Thus, it appears that the platforms are little used for collaborative learning; however, Moodle is used more frequently in the study by the students of ESCT and ESFH. Being the Moodle a learning platform, which enables the collaborative learning, there is, however, a low utilization. The reasons given in the first instance are the low speed of access to the platform and the Internet itself; the low usage by teachers of these platforms, and the fact that students get often more distracted on these platforms. In a second stage, the facts pointed out to explain this are, essentially, the non-use of the platforms on the part of teachers and the fact that students have not yet prepared for this form of learning, getting more distracted with other contents.

It was verified in both phases that scientific-humanistic courses use more computing platforms and technologies than the other courses. However, in the last phase, this difference was toned down, with its increased use by professional courses. Within scientific-humanistic courses, the one that uses the platforms and technologies in collaborative learning more often is the course of science and technology.

The computing platforms which are mostly used by students are Moodle, blogs, YouTube, wikis and msn, Google and the school Page. These computing platforms serve primarily for students to study. Other uses of computing platforms are to chat with friends, seek information, to have fun and work. For entertainment it is included playing, listening to music, downloading music and movies and watching movies.

The main virtual learning communities learning used by students are Moodle, wikis, and blogs. These communities are essentially used to study, do research work and seek information. Its relative low use is related to the fact that they are quite slow, caused by the speed of the Internet, because the teachers make little use of them and, by the fact that many students cannot study in these communities.

7. FUTURES DIRECTIONS

This work, like any other, allows a continuity and a more in-depth study of the use of the computing platforms of collaborative learning by secondary school pupils, since the comparison between schools, from which one can derive different lines of research that may succeed, through constant reflective activity: evaluation of secondary school curricula and how they are prepared for the use of collaborative learning through computing platforms; training and evaluation of teachers in the usability of computing platforms in collaborative learning; assessment of the main reasons for non-use computing platforms in collaborative learning and if they work for all levels of education; evaluation of school structures for the use of computing platforms in higher education through collaborative learning; comparison with other secondary schools councils, for example, of the same district where Guimarães is inserted and subsequently to all districts of the

country; and evaluation of educational policies and how to foster the use of these computing platforms in secondary schools.

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USE OF MOBILES AND LEARNING PLATFORMS AS A MEDIUM TO DEVELOP AND IMPROVE LINGUISTIC COMPETENCIES IN A FOREIGN LANGUAGE COURSE

Juan Rafael Ángel Mendoza
Ecole Mondiale World School, Mumbai, India

ABSTRACT

This research paper presents a study conducted in Mumbai, India. The central part of this work considers the importance of the creation and use of a learning platform that learners are to access though multiple mobile devises in order to work with different techniques and strategies to develop and strengthen their linguistic competences in the foreign language learning process. Using a qualitative approach and data collection tools such as a questionnaire, observations and a survey to document, analyze and present the findings, this evaluation was able to gather information that showed how thoroughly the use of mobile technologies in this environment contributed to the consolidation of linguistic competences, as well as the refinement of cooperation learning attitudes. The methods for collecting and collating data, and the subsequent analysis of these permitted to appreciate how learning platforms as a sole space for interaction that can be accessed in multiple forms is able to operate as a workstation, electronic portfolio and a forum for interaction that positively affects student achievement, and also contribute dramatically and definitively to the consolidation of the literacy skills of foreign language students.

KEYWORDS

m-learning, connectivism, foreign languages, b-learning, collaboration

1. INTRODUCTION

Nowadays, social interaction has acquired nuances that did not exist previously. Now, besides allowing the exchange of ideas *vis-à-vis*, mobile devises, social networks and forums represent a different alternative for the activity conventionally known as interaction. For this reason, taking into account the amount of time students spend in such spaces, utilizing all kinds of gadgets, it would be a waste not to use them as a means for learning.

Being in touch with other individuals through a determined link and through communication channels that do not necessarily require people to be in front of one another represents an endless source of information when thinking of it as a way to practice a foreign language. This statement is pronounced due to the fact that through this kind of interaction, not only does one get to know what other people know and think, but also one can notice how life/learning experiences are built. While interacting, reading and writing one brings about abilities involved in the development of one's language skills. Likewise, the spontaneity factor contributes to the personalization of information, and to the creation of a linguistic channel whereby ideas will navigate comfortable and without prejudice. Thus, the focus in this project does not consider mobile devises, social networks and learning platforms as simple TICs, but also as a source of communication that enhance the learning process.

When contemplating the advantages of a learning platform as a pedagogical tool, it is possible to conceive goals in areas such as class work and evaluation, as well as the creation of an electronic portfolio. Furthermore, if one considers that such spaces can be accessed via a computer, a lap-top, a tablet, a smart phone, or other devises or similar nature, its relevance is undeniable. Essentially, the platform can host a diverse array of tasks to enhance acquisition and development of reading/writing competencies, while also serving as a means to observe, register and quantify the progress being made at each stage, and in different criteria. Similarly, if keen observation is conducted, one can establish patterns where interaction, collaboration, and cooperation play key roles in the learning process.

The vast possibility to stay connected and to create links with others via computers and mobile devises, using a platform as the host space, nowadays, has become a powerful medium to exchange (and consolidate) information; to provide guidance and make suggestions; to criticize and express points of view; and to access the social knowledge embodied in others' interests. In other words, such spaces have generated different means and practices for the usage of language.

Most methods and approaches to teaching foreign languages regard collaboration and interaction as key elements for the acquisition, internalization and execution of the target language. The interaction derived from questions and their responses, from the cooperation that takes place when solving a problem, among others, will always contribute to the enhancement of learning. Thus, considering the high degree of interaction and collaboration that occurs in a learning platform or social network, when accessed through a computer or mobile devise, this initiative most definitely act as an extra resource for all modern methodologies (Martin-Moreno, 2004).

Not only does the work conducted and collected in learning platforms favors technological innovation, but also helps in increasing the opportunities for collaborative work, and for the enhancement of academic achievement. Inevitably, when learners enter their work in these spaces (via mobile or their computers), their work aptitudes and learning attitudes improve and become enriched. This change occurs, as all the participants are able to observe and participate concretely in the way learning is constructed. As they do so, they become aware of their own learning progress, empowering their critical thinking skills. Hence, these actions become processes that multiply the diversity of knowledge acquired and experiences lived.

For this reason, for teachers of the present, this work format represents an opportunity to re-establish which are the actions required to maximize the potential of TIC-based strategies to the fullest. This aim finds its roots in the idea that, from a didactical point of view, teachers must see beyond the fulfillment of objectives, knowledge/language acquisition and the formation of students as social beings. In other words, teachers must strive to find ways to integrate these elements, and consolidate them in a way that allows individuals to build their own learning objectives, considering the realities in which each of them operates.

2. LITERATURE REVIEW

New technologies have transcended the initial utilitarian purpose their creation had, and have turned into everyday and research tools. Parallel to the role libraries played once upon a time, new technologies are the evident, evolved element that at times seems to replace vital instruments such as books, notebooks, pens, and a dozen of white sheets where ideas will be written.

Specifically, foreign language teaching has been enriched and fortified by TICs. Thanks to these, teachers and students can work more efficiently, causing learning to occur in a rapid fashion, and in an innovative and more attractive format. This new manner of learning also lets participants use language in diverse ways and under different conditions.

These evolutionary parameters help in the discrimination of the teaching environments that used to happen in the classrooms decades ago with a teacher, a book and a tape recorder as key elements. For this reason, such items now acquire a more basic and reductive look or consideration in terms of the world of possibilities they represent. This inevitably allows stating that the limitless opportunities that TICs offer nowadays are difficult to equate or surpass.

With these new opportunities in mind, it is easy to recognize the extent to which the implementation of TICs can positively broaden the range of contexts in which tasks can take place. Not only does this array increase the strategies and techniques repertoire a certain curriculum can include, but also becomes the resource bank that hosts hundreds of stimuli, the paper to write thousands of pages, and the space to host an indefinite amount of video diaries and/or voice journals. Evidently, this can be defined, in simple terms, as the conduct that guides students towards experiencing genuine resources while augmenting their contact with the language and enhance skills such as reading and writing (Lenhart, Madden and Hitlin, 2005).

The interest in the use of TICs in foreign language teaching as a means for innovation and not solely as a strategy or complement for a method can be traced back to the mid 90's; however, according to Chapelle (2001), their consolidation occurred when their use was linked to the methodological and disciplinary alignments. The convergence of these elements, consequently, provoked the expansion of the possibilities in which a language can be learned, practiced and enhanced. Unavoidably, this marriage triggered research

interest, and led to studies whose aim was no longer limited to teaching instructors how to use technology, but also addressed the need to create learning environments through TICs (Beatty, 2003).

Thus, considering the new standards and practices that emerged as the Common European Framework of Reference for Languages reached its peak as an indication of language learning tailoring and assessment in 2001,as a global concept, foreign language learning platform-based research went from being a trend to becoming a must-do activity. This transition simply indicated that just as the learning continuum embodied skill progression, the teaching and learning process also needed to distribute specific forms of helping learners explore all aspects of language, one of which, evidently, was accessing information through the internet and operating in virtual spaces (Jiménez, 2011).

New schemes of work demanded the consideration of new scenarios for language practice and execution; students' learning process needed to transport them to situations where not only the need to use the language was created, but also where the surroundings allowed them to feel they were in the place where any given language exchange had to take place. For instance, now, through Google Earth students can easily walk the streets of Buenos Aires as they practice commands to give directions in Spanish.

With such transition in mind, in 2006 Kern formulated comparisons between the objectives that can be achieved in a traditional classroom by making use of teaching methods such as the natural method, the direct method, the communicative method and the other scenario where language learning platforms are used. Kern's conclusions clearly exemplify how, besides contributing to enriching the foreign language teaching / pedagogical need for change, learning platforms also allowed students to use the language for social purposes. This benefit arose as a result of the favorable conditions generated by the learning environment which, at the same time, created bridges between the language grammar, each individual's idiosyncrasies, the multiple situations in which a word or phrase can be used, and, most importantly, the development of students' own voice in the target language (Kern, 2006).

Essentially, Kern (2006) puts into perspective the way in which learning platforms further the acquisition and attainment of linguistic skills. Such development also contributes to the consolidation of knowledge. This growth begins in the shape of a massive language input that later on mutates into a linguistic knowledge intake. As a consequence, the product of this transformation is enhanced as students interact with one another and culminates in a linguistic output that demonstrates how students have claimed ownership of the language they are learning.

Accordingly, it is imperative to mention Sokolik's research (2006) in which not acknowledging the potential embodied in the use of learning platforms could be translated as the loss of a great opportunity to diversify learning environments. Aligned to this research, the idea of wavering a learning style that is an elemental part of the learners of today is similar to not being fully prepared to teach these students.

Suitable with the demands of the modern society of knowledge, Trilling and Fadel's work (2009) stipulates that when a learning platform acquires the characteristic of a social surrounding in which interaction happens with ease, students find fewer complications to construct their own identity through the target language. In other words, their fortresses to access language in social and virtual ambiances, as well as the informed manner in which they can use their communication skills become unified. This unification results in a capability they can utilize outside these scenarios in uncountable situations.

Tomlinson, Brimijoin and Narvaez (2008), also address how a learning platform allows for learning development through strategies, techniques and approaches *à la carte*, both for students and teachers. These authors also inquire on the approach towards understanding the unthought-of situations that develop from operating through this environment, as the amount of tools, Apps, and resources that students can find on the web and are impossible to quantify. Put in a different way, language-learning platforms are a challenge for teachers and students, as both of them need to become adaptable to the evolutionary aspects of working in a virtual classroom.

Authors such as Meskill and Anthony (2010), thoroughly describe how a learning platform truly becomes the space commonly known as classroom, since the concept of deadlines, rules, assessment criteria, format and content of the task are not absent. Similarly, the same authors, in their study entitled *Form-focused communicative practice via computer mediated communication: what language learners can say* (2007), annotate the multiple roles students manage to play in a learning platform, as they are authors, evaluators, communicators, error correctors and suggestion givers. Isn't that the way one operates in daily life?

Nonetheless, it is impossible to claim that a learning platform in which TICs are used sensibly is the key towards a positive impact on the language learning experience. Similarly, it is also untrue to consider that this learning environment is better than any other method. With these thoughts in mind, it is important to reason

on the fact that, in order for the benefits mentioned before to take place, teachers must promote an equilibrated environment where the pedagogy implemented, the strategies and techniques proposed and the response to students work act as one. This coalition will produce gratifying and motivating experiences for all participants. Moreover, in the resulting scenarios both the language and interaction will be genuine and will be easily differentiated from the artificiality of the language produced by textbooks (Falsgraf, 2011).

Proving that a language is learned by being surrounded by an environment in which it is spoken, and by using it with a purpose, learning platforms not only act as evidence of such paradigms, but also are a vivid and realistic representation of the way language is used in real life (Fullan, 2007). Thus, it is inevitable not to understand that a learning platform becomes a box filled with memorabilia and mementos, as it will host samples of the ways in which teachers and students collaborate, receive, provide and act upon feedback, take part in debates, write opinions, ask questions, respond to requests, and formulate solutions for problems. Is this not the final goal of our daily use of language? (Csikszentmihalyi, 2002).

3. METHODOLOGY

This research project was conducted by following a qualitative methodology, as this approach grants opportunities to observe and understand how participants perceive their experiences (Hernández et al, 2011). Moreover, working with the qualitative method enables the researcher to survey and appreciate the favorable effects of working via a learning platform.

Besides, keeping in mind that since this explorations aims at recognizing what learning values appear in this learning environment, and how these become enriched as the project evolves, the concepts of change and adaptability were elements that had to be kept in mind in order to validly, reliably and significantly conduct the study. Not only does this idea help justify the method choice, but also aids the researcher to focus on the objectives the language course to be used as a sample had to cover.

The project took place in Mumbai. The school's population is of approximately 800 students, including all stages from preschool to high school. Out of this total, nearly 90 students form the high school population, and out this figure only 35 were part of the sample used for this study. The students used as sample (ages 16-18) included a balanced number of males and females, and all of them are foundation (basic) language learners with little or no experience in French or Spanish.

The objectives of the *Ab Initio* program these students pursue include 3 major prescribed topics: individual and society; language culture and social leisure; and urban and rural environments in the past and the present. Similarly, upon completion of this program, students are expected to:

a) Be aware and understand cultural elements related to the prescribed topics.
b) Communicate clearly and effectively in a varied range of situations.
c) Understand and utilize the fundamental grammatical structures of the languages.
d) Understand and utilize vocabulary related to the prescribed topics in a clear, effective and appropriate fashion.
e) Use an appropriate register and linguistic format in a varied range of situations pertaining to the prescribed topics.

Therefore, taking into account the course objectives and the correspondence with the intentions of this project, a collection of tasks displaying relevance for students, the program and the project were considered in order for an adequate development of the study.

It is important to mention that this pattern of work was a key element in the study as the path to follow was clear from the beginning. Similarly, the fact that the platform could be accessed either by means of their computers, mobile devises such as iPhones, iPads, Tablets or iPods, increased the level of flexibility while working. This awareness allowed for quick adaptation when changes needed to be incorporated or when difficulties for conducting work arose. Among the changes that transpired the following can be mentioned: the natural language reactions to unfamiliar environments; reactions to situations where language reinforcement was needed; and events where clarification of information, extra practice or differentiation were necessary. Other situations can also be the need to reactivate students' motivations to work in his environment.

Having students value their experience in this study is also a salient element as this also contributes to the development of their role as critical thinkers when working in a setting like this.

4. DATA ANALYSIS

4.1 Foundations Laid by Students and Teacher/Researcher

Determining students' familiarity with the learning / working environment (learning platform) was a step that could not be omitted as this would mark the construction of the platform's architecture. The data obtained from the preliminary questionnaire, revealed that students were going to be able to focus on the acquisition of the foreign language rather than on mastering the tools needed for operating correctly in the language platform. This information served as the foundation for reconsidering the repertoire of activities that had previously been thought of. In other words, students' perceptions of the innovation served as the green light for the study to initiate.

The direct analogy with Facebook indicated that students clearly knew what was expected from them. Likewise, for them, this comparison exemplified the kind of activities that were to take place. The significant difference, however, was that the tasks to be conducted, besides aiming at promoting socialization, also aimed at enhancing language skills.

Realizing what students knew about work and studying via learning platforms gave way to the selection of the best-fitted activities. Students' responses served as the parameter for considering which activities to choose. Such feedback was used by the teacher/researcher when thinking of a way to balance difficulty, variety of tasks, skills to be developed, formats to be promoted, content of the tasks and the objectives to fulfill.

Thus, the activities that became the backbone of the learning platform are a faithful reflection of the objectives that both the course and this study aim at fulfilling. Consequently, acknowledging teacher and students' common understanding of the work to be conducted, it was possible to also consider the strategies and techniques that could be implemented at each stage in order to promote interaction, cooperation, collaboration, language attainment and development, altogether.

The platform was equipped with the following sections: forum, groups, blogs, chat, photos, links and a profile page for each of the students. Most of the activities where students would need to interact happened in the following sections: forum, groups, blogs, and chats. Some of the activities that were implemented are: Google Wave chats; Todaysmeet chats; YouTube videos; photo comments and responses; surveys via Google Forms; case study discussions; group discussions using PBL formats and Gunawaderna models, among others. Students were similarly encouraged to revise their work using websites/tools such as spanichschecker.com or bonpatron.com for French learners. Spanish pupils would operate in the Spanish platform: e-colelingvo.wall.fm, while the French learners would operate in a different platform: panoramafrancais.wall.fm. Moreover, the fact that students could use their mobile devises to access their notes saved on Evernote or other Apps, increased their efficiency while operating. Evidently, the pedagogical methodology to follow can best be described as eclectic, as it would make use of all possible kinds of resources and ways to practice the language in a homogenized atmosphere.

What is more, some of the observers' notes illustrated how the work spirit during all sessions is an indication of personal commitment and responsibility in environment. Values such as cooperation, collaboration, self-access and discipline are to be highlighted; yet, most importantly, the fact that they were using the target language at all times, and that mobile devises served as an extension to their computers and the platform itself, is the key indicator that work of this nature has a positive impact on the learners' language skills. This statement directly demonstrates what Wilber (2010) states as he highlights the way in which students become aware of their own progress and learning styles, hence helping them witnessing their potential for helping others and continuing to enhance their skills.

Therefore, the aforementioned demonstrates how having multiple kinds of access to the use of a learning platform provides students with focus, with a chance to explore different ways of becoming resourceful, with an opportunity to keep track of their own work and performance and with the space to use the language purposefully and with a sense of community. Considering that these behaviors are more difficult to trace in a traditional classroom, it can be said that the learning platform is empowering students to develop their language competencies as a whole.

4.2 Students' Experience

Once students experienced the potential of using computers and mobile devises to work in a platform in all of the scenarios contemplated; and upon exploring the use of the language in multiple situations and contexts for different purposes, they were asked to complete a survey in which they were to express they opinion about the following items:

a) The resources they used the most while working on the platform.
b) The time they invested while working on the platform.
c) The activities that best (and least) helped them improve their language skills.
d) The activities that provided them with the most and the least opportunities to learn with their friends, and
e) Their experiences accessing the platform via mobile or through their computers.

It was paramount to make sure that students had witnessed the potential of the learning platform and the use of mobile devises before asking them to complete the survey, as their experience in it was essential to provide answers that thoroughly helped understand, appreciate and evaluate the learning environment in which they operated. Students were aware of the objectives of the *Ab Initio* program they were pursuing as well as the focus and goals of this study. What is more, they were also asked to be critical while answering, as their insights were crucial. While they were encouraged to respond to the survey in the target language (Spanish or French), they were advised English if they did not know how to express an idea.

As responses to the questions were analyzed, it is paramount to mention that the fact that most of them responded in the target language is a clear indication of the level of comfort in the language they have achieved, as they used the language in a real situation, with a clear purpose, hence seeing beyond the challenge it represented.

Out of the collection of resources they were to sample (Google Wave chats; Todaysmeet chats; YouTube videos; photo comments and responses; surveys via Google Forms; case study discussions; group discussions using PBL formats and Gunawaderna models, blog writing, and working on external websites), the one students used the least was blogs; while the one that fostered the highest level of motivation were the situations where a response to stimuli and/or videos was required. According to them, it was more significant to interact in situations where entries were brief, and where they could respond using their mobiles as well, as doing so would not be time consuming. However, as the course evolved, it was clear that students developed the necessary skills and confidence to produce longer entries.

Regarding the time that they invested in accessing the discussions on the learning platform to improve their language skills, it was thought-provoking to see that a great majority verified the development of the activities on their mobiles as they were driving back home or to school, at the same time that they were disciplined enough to continue interacting with their peers, in their respective platform and language. It is important to highlight that the time investment addressed here refers to the time students' use the platform outside the classroom setup. In the survey, learners were given choices to express how long they accessed the learning platform, and which devises they used to do so.

While a significant majority claimed that they verified what was happening on the learning platform more than five times a week, and that they accessed it during their free time or when they needed to corroborate whether they had tasks to complete, only very few students mentioned that they checked the platform when they were certain work had been assigned and using their desk or laptops. This information clearly shows how working on the platform truly became a habit that evolved into a common practice (or viceversa) for most of them. Similarly, the flexibility in access clearly indicates that the platform served as a forum for communication that stimulated their participation and interaction, and generated opportunities for them to maximize their language production when several devises can be used.

Concerning the activities that best or least helped them to improve their language skills and those that provided them with opportunities to learn with their friends, it was found that those tasks that favored or included interaction ranked as the highest. From these results it can be assumed that using the language purposefully is what provides students with the sense of achievement and belonging they need to stay motivated, as they will find the way to stay connected. This finding clearly illustrates what Trilling and Fadel (2009) state when they mention that a learning platform, when it acquires the qualities of a social forum, promotes and facilitates interaction in a way that students enables students to refer to their peers' contributions and entries to construct their own new meanings and ideas in a natural way.

The relevance of this finding is such that it is possible to highlight the great opportunity mobile devises grant students to enhance their language spontaneity, sense of reality, internalization and personalization, as these are clear indications that a student is truly integrating all skills and competencies to own the language, capitalizing their learning experience in every step. Furthermore, it is impossible to ignore how all interactions occurring in the learning platform provided students with a common ground where their ideas could be exchanged, hence helping them focus their efforts. This is yet another piece of evidence to demonstrate that learning in this kind of environments increases students' linguistic potential while also enhancing their social skills, and also boosting their resourcefulness in the use of multiple resources.

The aforementioned explains, one more time, how those activities that allowed them to experience the nature of language as a means of expression, construction of knowledge and exchange of ideas were the ones that truly became significant and meaningful for them.

Similarly, it is worth mentioning that it is clear how students' intrinsic motivation was triggered by the interaction that was taking place in the platform, which is the defining element in their learning process that encouraged to continue working and evolving.

Hence, upon analyzing the reflections that emerged form the observations and after reflecting on the feedback provided by students, it is clear that the learning platform truly operated as the environment that helped them develop their linguistic skills, while also enhancing their collaboration spirit. This is clear evidence of the degree of positive influence the WALL platform had on students by helping them fortify their linguistic and social aptitudes, turning their learning experience into a solid, consistent, long lasting and reliable asset that they will be able to refer to at any time and place in the future.

5. CONCLUSION

The goal in this study was to find out whether there were benefits in using a learning platform to enhance linguistic competencies while also using it as an electronic portfolio and interaction forum, and, upon the reflections previously presented, it can clearly be stated that the objective was successfully achieved. From the construction of the environment to the process of work, and the time to give feedback, it has been clear how both the practices conducted and the atmosphere that was created illustrate the ideas of Meskill and Anthony (2010). These authors describe with enthusiasm how work and learning in this kind of platforms is lived with the same integrity, intensity, effort and constancy as it happens traditionally in real life.

While all work was conducted in a virtual environment, one cannot say that the sense of reality in it was inferior as the variety of scenarios created were true representations of real life situations. Furthermore, since students themselves decided what to say and how to say it, there is no space for artificiality.

Likewise, this learning environment caused students to witness their own learning style, and performance; to treasure their own efforts and performance; to develop a sense of ownership of the langue they were producing; and to observe how the amount of language production increases in direct proportion to the enhancement of their linguistic skills.

Falsgraf's (2011) statements truly serve as lead-in for the conclusion since they declare the how the familiarization with the language is the element that allows students to develop confidence to construct a significant and meaningful learning experience. They also add how this experience effusively consolidates their language and social potential. Students face and live such consolidation because they confront the evolution of levels of difficulty, and the changes in complexity in each task, and their language adapts to each of these steps accordingly without obstacles.

Yet, in order to truly bring this document to a conclusion, it must be mentioned that not only is the success achieved through this learning environment an evidence of the varied array of modalities in which a language can be learned, practiced and attained, but also a clear indication of the way in which current teaching approaches must respond to modern demands of society and learners.

5.1 Salient Practices and Suggestions for Future Implementations

The study exemplifies the potential of green education and how no limitations can be identified. This automatically represents a positive aspect to consider when budgeting programs as if the amount of money schools spend in papers for printing materials in a year is compared with the investment necessary for

creating a learning platform, the difference is gargantuan. The pedagogical approach implemented supposes a redesign in the curriculum, both in content, methodology as well as the stages in which it is delivered. Likewise, this work questions the relevance of textbooks as the most sought after tool for language teaching. Similarly, teachers' TIC-literacy is a key element to be taken into account if ample implementation is considered. Nonetheless, students authentic productions that provide all learners with the chance to use a wide variety of resources is the main gain implementing this kind of work will generate.

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TEACHER'S EXPERIENCE OF LETTERBOXING GAME ON PORI CULTURAL HERITAGE ROAD

Pirita Ihamäki
University of Turku, Degree Program Cultural Production and Landscape Studies
Siltapuistonkatu 2, P.O. Box 124, FI 28101, Pori, Finland

ABSTRACT

This paper presents six teachers experiences in elementary school of Pori, Finland, who using new education tool letterboxing (treasure hunting) -method. Teacher's use letterboxing -method to teach on 2nd and 4th class of student's, for local history and geography, in Pori Cultural Heritage Road. Letterboxing is mix of hiking, puzzle solving, and treasure hunting, topped off with the thrill of discovery. The study analyzes the treasure hunt activities to determine, how local history and geography were integrated into the learning activity, which extends learning experience in classroom teaching in movable teaching experience. In this case study the treasure hunt game is played through a five of waypoints rooted in the history, culture and landscape of the city. At waypoints, pupils have some educational tasks connected with the history of Pori and with changes in landscape. The application as a new teaching method creates a new innovative educational culture.

KEYWORDS

Letterboxing, Treasure hunt game, experiential education, adventure education, outdoor education, mobile education, Teacher's experience

1. INTRODUCTION

" A Puzzle with a Purpose", treasure hunt games has used in education since 1998. (Sobel 1998, Webb 2001, Webb 2002, Paulus et al. 2007, Christie 2007, Ihamäki 2007, Maherson et al. 2008, Chavez 2009.) David Sobel and Delia Clark co-founded in the Connecticut River Valley of Vermont and New Hampshire, they had been looking for an opportunity to experiment with treasure hunting as an educational program. In 1997 the Valley Quest program received the Montshire Museum Science Education. Valley Quest proved to be a great tool in education, more than fifty teachers, 750 students and 150 community members contributed to the creation of these Quests, which stretch across thirty-one towns in England. Teachers who incorporate questing into their work find that it naturally integrates the curriculum. The borders between field science, mathematics, social studies, language arts, and art blur as students write clues based on observation, collect data in the field, sketch from nature, and interview local experts. Elementary educators have used Quests successfully as thematic units in the curriculum. (Clark & Glazer 2004, 21-22.)

David Sobel of Antioch New England Graduate School, in Keene, New Hampshire, pioneered the first known organized letterboxing activity in the United States. Letterboxing is mix of hiking, puzzle solving, and treasure hunting, topped off with the thrill of discovery. (Hall 2004, VII) Legend has it the letterboxing was born in 1854, when a gentleman placed his calling card in a jar by the remote Cranmere Pool in Dartmoor, England. (Hall 2004, 1) Sobel's Valley Quest program with origins dating to 1989 was started as way to increase of heritage and natural in the Upper Valley region of New Hampshire and Vermont. After few published articles, the two groups discovered each other, and the Letterboxing North America (LbNA) community was born. Boxes were soon being hidden in all fifty states, Canada and Central America, with clues publicly available on the LbNA web (www.letterboxing.org). (Hall 2004, 1-3.)

This study based on project *Treasure Hunting Included in the Teaching of Geography and History*, which aim is to create an innovative educational package with the emphasis on the geography and history of Pori, eventually with some long-term influences on the positive image of town called Pori, in Finland. The Project was lead by University of Turku, Cultural Production and Landscape Studies project, with together for

partners the regional Council of Satakunta and City of Pori in Finland. The Letterboxing application, which use treasure hunt games to environmental education as a new teaching method creates a new innovative educational culture. Treasure hunt games provide pupils with an opportunity to make their own observations and learn things that would have otherwise been read from the books. On the other hand, urban environment is challenging and demanding in many ways. Also, it is now possible for pupils to put their own favourite things first. Thus, the combination of subjects and innovative teaching methods can motivate teacher's to give good teaching results. Thanks to the practical involvement of environment in teaching, students will be educated to be responsible citizens of the information society. With treasure hunt games, new creative learning and activities combine theory with practice.

The letterboxing game, the treasure box often reinforces the story theme, containing small caches of art supplies, or printed materials that help students to better understand precisely where they are. Each quest is built up from three essential elements: a set of clues (poetic clues), codes and lastly a treasure box. This sample clue, excepted from Pori Cultural Heritage Road, demonstrates how clues can be used both for giving directions about movement and for telling a story. (Clark, Glazer 2004, 14.)

In this study treasure hunt utilizes poetic clues, occasional sketched hints to guide self-appointed questers gently and playfully through an environment. Quest clues are usefully written in lively rhyming verse and often tell a story about a local place, character or phenomenon. Quests end at a hidden box, where student find sign (code) and collect the impression of a historical story and exercise that depicts an image related to the site.



Figure 1. Codes from Pori Cultural Heritage Road

This case study research questions is how teachers perceive Pori Cultural Heritage treasure hunt road educational possibilities? What kind of experience to teach by moving on treasure hunt road offer? The analysing the treasure hunt activities to determine how local history and geography were integrated into the learning activities on the road, which extend teaching experience from movement teaching and shows new kind of educational possibilities.

2. OUTDOOR EDUCATION AND EXPERIENTAL LEARNING

While there are many definitions of outdoor education the most comprehensive one seems to be, that "outdoor education is education in about and or, the out of doors". Definition tells that learning takes place outside of classroom and the purpose of the activity**.** Outdoor education is referred as a method for extending the curriculum or a process involving direct learning experiences. (Ford 1986) Experiential education refers to learning by doing or experience. Many experiential education activities are synonymous with adventure activities as treasure hunt. Experiential education means also form of pragmatic educational experience. In many ways, outdoor education may be viewed as experiential, especial when the learning takes place through experiences. (Ford 1986) In this study learning take place for moving on five different treasure hunt places, which offer for students learning experiences and teachers teaching experiences.

Sakofs (1995) definition in experiential education is a philosophical orientation toward teaching and learning that values and encourages linkages between concrete educative activities and abstract lessons to maximize learning. In this study the treasure hunt game is played through a couple of waypoints rooted in the history, culture and landscape of the Pori city. At waypoints, pupils have some educational tasks connected with the history of Pori and with changes in landscape. The game is good for pupils in constructing student's identity, dealing with concept of time and in understanding human efforts, both intellectual and material work. The historical focus is on one's own family and local history. Familiarity with the history of Pori and the application of history to present life gives pupils a possibility to understand both the past and present of the city. Chapman, McPhee and Proudman (1995) have defined experiential learning combine's direct

experience that is meaningful to the student with guided reflection and analysis. It is a challenging, active, student-centred process. Warren, Sakofs and Hunt (1995) have defined experiential education that one must always combine action with reflection in order to have a full human experience. Most definitions include the concept of experience plus reflection on that experience. Experience alone as learning by doing is insufficient to be called experiential education. It's mean that reflection process turns experience into experiential education. (Joplin 1995, Horwood 1995) This study treasure hunt game provides pupils with an opportunity to make there own observations and learn thing that would have otherwise been read from the books. On the other hand, urban environment is challenging and demanding in many ways. Also, it is now possible for pupils to put their own favourite things first. Thus, the combination of subjects and innovative teaching methods can motivate students to give good learning results. With treasure hunt games, new creative learning and activities combine theory with practice. Letterboxing is a worldwide game and each teacher, according to his or her competence, only defines its limits. What pupils will learn depends on how enthusiastic the teacher is about letterboxing. The purpose is to promote the teaching in geography and history with the aid of game-like elements. With a new kind of education and cooperation, it is possible to pave way for information technology and to acquire the skills required today and to be able to meet the requirements of competence in future jobs.

Experiential education is the process, which occurs within the individual students; while experiential education occurs once the student shares the intellectual experience in same manner with others. Experiential education could see as active rather than a passive process. The literature an active learning includes descriptions similar those of experiential education. Active education provides opportunities for students to talk, listen, read, write and reflect through various, interactive experiences. (Meyers and Jones 1993) Characteristics such as experience-based, reflection, high involvement, teacher as guide and interactive refer to both experiential learning and active learning. (Drafke, Schoenbachler and Gordon 1996, Tanner and Roberts 1996, Johnson, Johnson and Smith 1992)

3. LETTERBOXING AS EDUCATION TOOL TO TEACH LOCAL HISTORY AND GEOGRAPHY

The learning is a process (Stuart and Burns 1984, Gaidis and Andrews 1990). The most popular used model of experiential learning is the one developed by David A. Kolb. Kolb's experiential Learning Model suggests that learning occurs through a cyclical process called on Experiential Learning Cycle that encompasses the following four stages. Next table describe of four stages.

Table 1. According Kolb's four stages in experiential learning process

Concrete Experience: An actual new experience in an individual's life.
Reflective Observation: Feelings, emotions, reflection related to the experience.
Abstract Conceptualization: Existing concepts and theories are applied to the experience.
Active Experimentation: New concepts are generated, put in practice and tested and applied in new a situation, which leads to new experiences.

According to Kolb, to be an effective learner, a student needs to be skilled in all four aspects of the process. To learn from any experience, a student must be able to describe an experience, analyse it according to theory, and finally use that knowledge in new situations (Coglan 1993, Frontczak 1998). In other words, all four stages of the cycle must occur for successful learning. Most students need to practice and guidance in this process of learning. That's why teacher's role is important this kind of the action-reflection learning process. Each stage of the cycle actually requires different abilities, but all are necessary for a holistic learning process (Saunders 1997).

This case Pori Cultural heritage road has five treasure hunt places, which are University Consortium of Pori – Central Church in Pori – South Promenade – Park of Kirjurinluoto and Library of University of Turku

in University Consortium. The Road is about 5 kilometres long, which are enough for student on 2nd and 4th class to concentrated history and cultural studies. Teacher's gets education packets for students, teacher's duty is to share culture heritage in Pori city from historical story, which based on history references. The treasure hunt road student's duty is to find codes, which they writing mark in their exercises. We use the map and story to find treasure boxies (five treasure boxes), which have inside of code, what children need to collect to get a key code. The forth of the treasure box give the children last key code, which they need to field on computer in Pori Science Library. When the children field on key code, they get last hint and they find one old silver spectacle case, which they open and get stamp and sweet for the price to conclude the exercise. Teacher's *concrete experience* is to describe story for children, which have two consequences, first is to understand the hints behind of the story and second is to understand history and culture between 1800 to 1920 centuries in city of Pori. Teacher's *reflective observation* based on emotions of exercises, reflection related to the experiences on to teach of student on the move 5 kilometres round. Teacher's *abstract conceptualization* passed on history studies and theories behind on environmental education. Teacher's active experimentation has to take over new concept teaching on the move by letterboxing, which they do in practice and tested on road, which give them new teaching experiences in context of outdoor education.

The paradigm, which successfully incorporates reflection and delineates the learning cycle is the Kolb (1984) model previously described. In teachers consideration of an experiential learning assignment analyse the activity according to the following four stages of Kolb's model:

Table 2. According Kolb's model an experiential learning assignment from teacher's perspective

Concrete Experience: All experiential five learning activities, which include an actual experience. (Experience is a direct observation in Pori Cultural Heritage Road action as a basis of knowledge.
Reflective Observation: The students and teachers ponder their emotions, reactions, questions, observations and judgements related to the experience. (Reflection is the ability to step back, ponder, question and evaluate one's own experiences, then to abstract from them knowledge that is relevant to other experiences. (Hutchings and Wutzdorff 1988)
Abstract Conceptualization: Relevant, existing concepts, theories and information are than applied to the experience and tentative hypotheses or generalizations are formed.
Active Experimentation: The student test applies and puts into practice what has been learned from this experience in new situations, which leads to new experiences.

Student in elementary school have one day the Pori Cultural Heritage Road course incorporated material covered in Pori history and geography into moving a treasure hunt road by five assignments. In the '*concrete experience'* stage, students were five different assignments. This activity certainly qualifies as an actual experience. (Frontczak 1998) First exercise was to draw from Sofia and Wilhelm special part of old Cotton Factory, which are nowadays University Consortium of Pori or continue for drawing of Cotton Factory. Second exercise was described for Central Church of Pori. Student has asked to tell Sofia and Wilhelm what kind of church is? What kind of surrounding has in church? Student has possibility to draw and write explanations from exercise. Third exercise was continuing small new from steamboats year by 1873. News will help from Sofia and Wilhelm to continue to find hints and solve for da Pori codes mystery on the cultural heritage road. Historical story was narrative description for treasure hunt game, which leads children be active participate on the game field. Forth exercise is to write letter or draw comic strip for Sofia and Wilhelm, how do you spend free time on Park of Kirjurinluoto? Fifth exercise was to draw on for old map (1920) of Pori the treasure hunt trip that they was walking and tell treasure hunt places for Sofia and Wilhelm.

Student listen teacher's historical story and get clues from story to find treasure hunt places. Treasure hunt places have exercises, which allowed to student to complete the '*reflective observation'* stage of learning where feelings about the experience are considered. As mentioned earlier, the reflection process is critical to learning. (Frontczak 1998) Treasure hunt road itself exists concept and '*abstract conceptualization'* allowed the student and teacher's applied to the experiences and tentative hypotheses on learning by moving aspect. Then the final stage '*active experimentation*' has been included in the exercises and student has filled

questionnaire, which has asked example what they has learned from treasure hunt road. Although student may naturally proceed through some of the stages of the learning cycle; it is the teacher's responsibility to assist students in that process. The teacher's role is that of a facilitator so that all learning stages are experienced. (Frontczak 1998)

4. RESULT: TEACHERS EXPERIENCES FOR TREASURE HUNT ROAD

Teacher's field trip has in moving by teaching in treasure hunt road using experiential learning techniques. Although students enjoy these experiences and they learn something when the teacher provides specific guidance. The paradigm presented table 3 offers framework for structuring the teaching experience for a field trip.

Result shows that, teachers want more information about treasure hunt road and they want to show student more pictures on the road before they start to teach student on local history. This study was pilot case and project aim was to find innovative way to teach local history and geography. Teacher's think that students exercises was interesting and make students understand for local history but some exercises was quite difficult for certain age of students. Local history and geography seems to be good to teach in those places, tell the history and landscape chances by using treasure hunt –method, which motivates students to listen and make exercises of history. All teachers recommended taking treasure hunt -method for their curriculum programs and treasure hunt road could easily have one-day field trip even other towns. Teachers describe for teaching in treasure hunt road by moving all the time, was interesting, fascinating, make changes for teaching in class and need to repair much more than class teaching (take care of example noise of traffic, safety of children movement, timetable take more time). Teachers describe that road was enough for 2nd and 4th class student, but treasure hunt places could have for more because students seems to be so active to hunting treasures.



Figures 2 and 3. Teachers giving for hints the children to find a treasure

Table 3. Evaluation of Teacher's experiences from Experiential Learning Activities in Treasure hunt road Using Kolb's Model

Stage of learning process	*Learning objectives for each stage*	*Teachers opinion for treasure hunt road*
Concrete experience	Encourage active student participation and involvement in the learning process.	**Teacher's opinion of 2nd and 4th class of student target group in treasure teachers think that target group has right and one think that target group hasn't right. "Perhaps historical story stay unclear, because I want to do things slowly and explain more things, if we don't have so hurry". (Teacher 1)**
Reflective Observation	Allow students the opportunity to express their feelings towards the learning experience.	**"Treasure hunt day gives students an experience day" (Teacher 2). "Students could be as teachers and lead the treasure hunt trip" (Teacher 3). Teacher suggest that, they good easily to teach other subject example biology, mother language and religion. (All 6 teachers)**
Abstract Conceptualization	Assist in student understanding of the relevant letterboxing by local history and geography concepts and theories presented in Pori cultural heritage road.	**"Student learn local lifestyle from past. " (Teacher 4) Treasure hunt are excitements as like adventure and student hunting enjoyable way for codes. Treasure hunt places could even have more, because student learn Pori history and culture easily by treasure hunting. Treasure hunt was good motivation to teach local history and geography.**
Active Experimentation	Improve students' ability to apply what has been learned to new experiences and new moving by teaching experiences.	**"Teacher's like that moving by teaching has variable and challenging because road wasn't not familiar for me". (Teacher 5) Teachers read for historical story and and make student to think historical time, get new experiences by exercises and hunting for codes in historical places**

Further elaboration could give for each of the four parts of the more specific assignment, but this would take the students through the four phases of the experiential learning cycle. Rather than just leading the student through the first stage, concrete experience, the teacher's guide's student through the four phases, which allows a more complete, and valuable learning experience. Perhaps even make all stages each student individual goals as companies use for workers team building day's own goals, same way for students. Students and teachers could together define goals what student will reach on certain stages on treasure hunt road.

5. DISCUSSION

Kolb's model of experiential learning has been suggested as a conceptual framework for elementary school teachers who use treasure-hunting -method in their education. This study is pilot case, which have possibility to increase for other towns. Exercises could think more goals orientated, which have more benefit for students. This case all exercises are individuals exercises, but also group exercises will suggested. Next step is to use theory and solve problems in practice for treasure hunt places. In future we have possibility to use technology like GPS and mobile phones, make more game elements to teach students for local history. In future students and teachers are more involved to designing new treasure hunt concept.

6. CONCLUSIONS AND FUTURE WORK

The focus of this article deals with experiential activities by using treasure hunt –method relevant to elementary school teachers; many of the theories and concepts discussed can be applied to a variety of disciplines. The trend toward experiential, participatory, active learning, treasure hunting by purpose dates back in time to renowned teachers such as Socrates who though by asking questions, not reciting answers, and Dewey (1983) presents that the starting point of education is experience, not abstraction. (Frontczak 1998) This case study tries to extend experiential learning process to bring treasure hunt –method as a tool for teachers. The purpose of this article is to provide a useful paradigm or guide for elementary school teachers in the selection, use and development to experiential treasure hunt activity in their curriculum programs. Result present that teacher's described treasure hunt -method are useful for teaching example geography history and extended other subject such as biology, mother language and religion studies. Teacher's experienced teaching by moving on treasure hunt road as fascinating, variable, adventure and fresh experience. This study encouraging teachers to experience all of the stages of learning cycle will provide them with more valuable teaching experience and better prepare them for successful career in experiential (adventure) educators.

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THE USE OF ACADEMIC LIBRARY DIGITAL SERVICES IN E-LEARNING: PERCEPTIONS OF ACADEMICS AT SQU, OMAN

Ali Al-Aufi (PhD)[1] and Safiyya Al-Hosni (MA)[2]
[1]*Sultan Qaboos University, Department of Information Studies*
[2]*Sultan Qaboos University, Omani Studies Center*
Alkohdh, Sultanate of Oman

ABSTRACT

This study aimed at investigating the status of digital information services provided by the academic libraries of Sultan Qaboos University and their usefulness for e-learning. More specifically, it focused on whether academics at SQU access, use, and integrate the library digital services and e-content in their curriculum, which is enhanced by the course management system platform (Moodle). The study also attempted to identify the challenges and difficulties encountered by academics in the course of using and integrating digital library services and resources in the learning management system. The study used a questionnaire survey to collect data from academics who employ Moodle in their teaching to enhance e-learning practices at SQU. Findings indicate an overall awareness among respondents of the importance and usefulness of using and integrating the library digital services in e-learning. Results also indicate positive average mean scores on challenging issues and difficulties related to the implications, compatibility, and interoperability of the digital library services with e-learning. It is hoped that the findings will help provide an insight for strategic planning on issues related to teaching and learning at SQU and other regional universities.

KEYWORDS

E-learning, Digital Libraries, Academic Libraries, Sultan Qaboos University, Oman, Digital Information Services, Course Management System, Moodle, Academic-Librarian Collaboration.

1. INTRODUCTION

Academic libraries are known for their rapid adoption and use of information and communication technology. Educational technology and e-learning, particularly well-known course management systems like Moodle, WebCT, Blackboards, and many others have prompted libraries to update their services and embed their digital information services and resources into these technologies. Therefore, digital academic library services and resources are no longer solely traditionally accessed from workplace or home via the library website, but additionally through e-learning technology led and managed in university and academic settings by the course management systems. These provide outreach services for the purpose of enhancing both e-learning and library services.

The provision of digital content in classrooms through the manipulation of course management systems has become a total educational phenomenon. As a result, the role of academic libraries in e-learning and faculty-librarian collaboration in issues related to the provision of digital information and supporting e-learning activities has generated intense interest among researchers from both the education and library and information science disciplines.

This study investigates the status of the digital information services provided by Sultan Qaboos University's (SQU) academic libraries and their impact on e-learning from the perspectives of academics who have been using course management systems in their teaching. More specifically, the study aims at investigating the attitudes of academics at SQU on the usefulness and perceived advantages of integrating digital information services in learning management systems. The study also investigates how academics learn how to use digital library services in e-learning. Challenges and difficulties that hamper the

implementation of such initiatives in e-learning are also delineated. The study addresses the following research questions:

1. How useful are the digital library services for e-learning?
2. How do academics at SQU learn to use and access digital information for e-learning?
3- What are the challenges that the course management system struggles with when accessing, using, and integrating digital information?

The academic libraries of SQU were established to support the provision of information for teaching and research. With the implementation of advanced technology both in libraries and learning management, it has become necessary for these entities to collaborate and take advantages of the benefits that integration of digital library services and resources with learning management system can offer the quality of education at SQU. To date, there is no clear evidence or indicative measurement on the ability of these technologies to leverage the use of digital library resources in the course management system. In fact, based on the researchers' experience, the current position tells that there is a lack of efficient faculty-librarian collaboration on issues related to making the most of technological advancements and digital information on e-learning at SQU. No research has investigated this issue, either at SQU, or at other universities or academic institutions in Oman.

The significance of the study also lies on its contribution to the local and international literature on academic libraries and e-learning. It is hoped that findings will help the university libraries and the Center for Educational Technology at SQU to better identify weaknesses, provide improved services, and encourage the integration of digital library services into the learning management system. It is also hoped that findings will assist libraries to develop plans and programs in which they help faculty members provide and maintain digital content in their teaching through using the current system of learning management at SQU.

2. LITERATURE REVIEW

Academic libraries and their impact on e-learning were marginally mentioned in the earliest scholarship that explored e-learning in general. However, recent literature, due to the rapid development in the provision of library services and educational technologies has begun exploring the capacity and interoperability of library services and educational technologies at both user-centered and system- centered levels.

Part of the relatively recent literature has brought emphasis to the potential of digital library services in e-learning. Sharifabadi (2006) highlights the advantages of digital library services and their impact on the e-learning environment. He also comments on the existing barriers and challenges. Marketing, awareness and adequate access to digital resources are among the most constant challenges to the delivery of digital information to e-learners. Black & Blankenship (2010) emphasize the difficulty of using and accessing digital information by e-learners. They discuss an experiment that the Ohio State University used to deal with this problem. The Carmen Library Link that the Ohio State University has established was a successful endeavor for embedding library materials into the course management system.

Research funded by Mellon Foundation with participation of librarians, course management system developers, and publishers came up with solutions to improve access and use of the digital information in course management systems (Flecker & McLean, 2004). It suggested certain means for instructors to gather information from digital libraries and repositories and link them to the course management system. Barriers and difficulties were discussed and possible solutions were also proposed to encounter the difficulties associated with accessing and using digital information in course management systems.

Nfila (2008) discusses the potential of digital library resources on e-learning at the University of Botswana. Practical initiatives are discussed and opportunities to alleviate barriers and difficulties were also presented. Integrating library resources and services to e-learning systems at the University of Botswana is regarded as a successful implementation in this field. Fontanin (2010) also discusses the practical experience of the learning management system at the Italian University of Trieste and the role of the university academic library in blended and collaborative learning environment.

Papić and Stričević (2012) investigate how academic libraries can make the most out of their digital resources and integrate them efficiently into a university's learning management system. The findings indicate positive students' attitudes on the current integration of library services to the university learning

management system. The positive particularly strong attitudes of student are on issues related to integration, collaboration, empowerment, and the development of information literacy skills.

Viewing the overall Arabic literature revealed a scarcity in practical studies that examined the integration of academic library digital resources into learning management systems. There are, however, a few relevant studies which basically investigate the potential of the digital library services on distance learning. Two examples of studies that investigate the roles of Arab academic libraries on distance education are Hafidh (2008) and Al Zamel (2002).

Hafidh (2008) investigated the role of Saudi university libraries in distance education programs offered by the King Abdulaziz and Imam Muhammad bin Saud Islamic University and from the point of view of faculty members who carry on teaching in qualified courses organized by the two universities. Findings indicated negative attitudes on the support that libraries offer for distance learning in terms of capacity, readiness, and technological infrastructure. Al Zamel (2002) also discusses the role of the Internet in assisting the delivery of library and information services for distance education programs. He quantitatively researched academics from the library and information science discipline and investigated their attitudes on the perceived advantages of delivering digital information through distance learning programs. Findings indicated positive attitudes among the respondents on the usefulness and impact of the Internet on the delivery of distance education.

The overall literature indicates a large variation about digital information services and its role in supporting e-learning. While non-Arabic-based research has been gaining popularity, Arabic research overall suffers from scarcity on the question of academic libraries and e-learning.

3. SULTAN QABOOS UNIVERSITY

Sultan Qaboos University was opened in 1986 as the first public university in Oman. It is located in the capital of Muscat, and is less than 10 km. from Muscat International Airport. Currently, the University consists of nine colleges: Agriculture and Marine Sciences, Arts and Social Sciences, Commerce and Political Sciences, Education, Law, Engineering, Medicine, and Sciences. SQU has signed many collaborative agreements with regional and international universities and academic institutions. Today, the university has 15,496 registered students and offers more than 68 Bachelor's degree courses, 59 courses at Masters Level, and nearly 29 PhD research programs with more under consideration (SQU, 2012).

Education is provided free for all undergraduate students at SQU, including tuition fees, text books, on campus food, and accommodation. The University provides various educational support centers to assist students' learning, such as the Centre for Educational Technology, the Language Centre, and the Centre for Information System. The Language Centre plays a major role in preparing students to commence their higher education by providing intensive English language instruction. In addition, the University provides and supports various research centers and laboratories such as those dedicated to water, environment, oil, telecommunications, remote sensing, earthquakes, seismology and Omani studies. In recent years the University has also been expanding substantially in terms of its physical facilities. Notably, a cultural center with a huge multi-purpose hall and a bigger main library were both opened in the last few years.

The Internet was made available to SQU late in 1997. Since that time the use of networked information and related technologies at SQU has become common, and is now considered an essential asset in enhancing the University's teaching and research outcomes. Every academic staff member in the university has a computer with access to the Internet and other networks on his/her desktop. Information and communication technologies at SQU are closely tied with teaching and learning activities. The majority of classrooms and laboratories at SQU are wired and linked to advanced technologies and Internet services. Academics are encouraged to use Moodle; the Course Management Systems as part of their teaching practice. Frequent Moodle related training and workshops are provided to academic staff throughout the year.

The University, with government support, has been attempting to improve its research productivity. In 2005, His Majesty Sultan Qaboos endorsed an annual grant of more than one million US dollars with a goal of enhancing the University's research output. This brings the current budget for research at the University to approximately 5 million US dollars per annum (SQU, 2012).

3.1 E-learning at SQU

In 2001, the Center for Educational Technology at Sultan Qaboos University launched a project of e-learning as part of the function of the Centre for providing services to the process of teaching and learning and achieving the educational development and educational outcomes of the university.

The vision of the project was to achieve excellence and leadership in the areas of education and e-learning at both local and regional levels and to encourage creativity in the academic environment. It aimed to employ new technologies to serve the educational process at the university and to develop the skills of faculty and students in the use of e-learning systems. It was also intended to spread the culture of e-learning at Sultan Qaboos University, design and develop e-courses to complement e-learning system, and provide technical assistance and support for faculty and students in the use of e-learning.

Sultan Qaboos University bought a license in 2001 for using WebCT as a course management system and began providing and assisting with its at specific colleges including Education, Medicine, Science, and the Language Centre allowing a total of 1200 students were initially allowed to use it.

At the beginning of 2005, an open source software Moodle was introduced as a parallel choice for use by academics and learners. As Moodle swiftly gained popularity among users, SQU decided to discontinue supporting the commercial WebCT software.

3.2 Library Services at SQU

Networking technology has reshaped the traditional access to scholarship, management of services, and the delivery of information. Academic libraries have been not only enthusiastic adopters of technological innovations, but also leaders in the implementation and promotion of innovations in the wider academic environment.

SQU has four major libraries. The main library of Sultan Qaboos University was established in 1986; the same year the university was opened. The library is known as the biggest and most advanced academic library in Oman. It serves the whole user community of the University. The library places strong emphasis on integrating technology into services and resources. The majority of its 65 staff members are specialist librarians with graduate certificates from SQU. The collection size of the library is nearly 200,000 printed books, 90,000 e-books, and more than 35 bibliographic and full-text electronic databases.

The main objectives of the Main Library of SQU, as presented on the Library's website (SQUL, 2012) are to provide an adequate environment for educational & research activities, provide a comprehensive and balanced collection of print and digital information resources related to educational & research programs, provide excellent library services of various types in parallel with user needs and aspirations, and raise information awareness among library users through the preparation of information services and marketing programs.

Notably, those objectives indicates the extent to which the library aims to provide access to digital collections and services (i.e. "adequate environment", "various types", "digital information", and "information awareness"). The Library's website provides direct links to the web-based catalog, journal databases, e-books, e-reference resources, and a digital video library. All e-journals and e-books are outsourced services provided by external information suppliers and vendors. Information services can now be accessed from outside the campus with user authentication (SQUL, 2012).

The other three libraries provide subject specific collections and services. The Medical Library, which is located adjacent to the College of Medicine, serves students and academics in the college as well as the staff of the University Hospital. The Information Centre, which is located in the College of Commerce and Political Sciences, provides customized services for the college. The Mosque Library provides collections and services that are religiously oriented. In addition, small college libraries have been established to provide each college with basic reference collections.

4. METHOD

An online questionnaire survey was used for data collection. The questionnaire was designed to elicit demographic information about the subjects and answer the research questions. The content of the

questionnaire was reviewed by colleagues from the department of information studies at SQU and pre-tested with a smaller group. 654 academics who use course management system for their teaching were identified out of a total 1107 employed by SQU. Only 97 academics responded to the survey corresponding to almost 15% of the target group. The definitive response rate is considerably low, although reasonably expected from online surveys. Such a low response rate could, however, threaten the validity and the representativeness of the target population of the study. Data were imported and manipulated through SPSS software. Descriptive and Inferential analysis was then enabled to answer the research questions and draw conclusions.

5. FINDINGS

5.1 Demographic Data

The first part of the questionnaire began with demographic data about the respondents. The independent variables of gender, age, and academic rank were also deemed important for the purpose of inferential analysis. Only academics using Moodle or other course management systems in their teaching were selected to participate in the online questionnaire.

The sample included more male (72.2%, n=70) than female academics (27.8%, n=27). The dominant male representation is in line with the fact that the majority of the university's academic staff was male according to statistics of the academic year 2010/2011 (SQU, 2011).

The larger group of the respondents (35.1%, n=34) in a ten years scale was relatively younger (age= 23-32), which suggests that younger academics are more likely to implement educational technologies than their older counterparts (age= 43+) of whom only 18.6% (n=18) use e-learning technologies in their teaching.

Of the respondents, the majority (70.1%, n=68) had PhD degrees while 29.1% (n=29) had master degrees as the last earned degrees in their academic profession. More than half of the respondents (50.5%, n=49) earned their last degrees from English-speaking countries while 35.1% (n=34) earned their last degrees from Arabic-speaking countries and 14.4% (n=14) from other countries such as France, German, Russia, India.

According to the academic rank of the respondents, the majority (38.1%, n=37) identified themselves as Assistant Professors while the minority identified themselves as Professors (9.3%, n=9).Percentages for Associate professors were 20.6% (n=20), Lecturers 14.4% (n=14), and Teacher Assistants were 7.2% (n=7). In terms of language of teaching, the majority of the respondents (74.2%, n=72) indicated English as their language of teaching while 19.6% (n=19) used Arabic, and only 6.2% (n=6) indicated that they use both English and Arabic for teaching.

5.2 Academics' Perspectives on the Usefulness of Digital Library Services in e-learning

In a five-point scale (not at all useful, somewhat useful, neutral, useful, very useful), the respondents were asked to indicate the usefulness of the services that can be provided through the library digital system to support e-learning during their use of course management system.

Table 1. How useful do you find the following digital information services for e-learning?

Rank	Statement	Mean	SD
1	E-mail	3.74	1.31
2	E-journals	3.55	1.47
3	E-books	3.55	1.24
4	Online tutorials	3.52	1.23
5	E-reference services	3.30	0.98
6	Full-text resources other than e-journals	3.27	1.44
7	Online training	3.27	1.15
8	Web-based OPAC	3.18	1.20
9	Selective dissemination of information (SDI)	3.13	1.09
10	Current awareness service	3.08	1.21
11	Multi-media services	2.98	1.25
Total		3.32	1.23

The average mean score (3.32) of the entire list of services as suggested in table 1 was relatively positive with e-mail indicated as the most useful (3.74) and multi-media as the least useful digital information services for the support of e-learning at SQU.

5.3 Getting started: Methods of Learning

The respondents were also asked to indicate the different methods that they used to learn how to use the digital services provided by the library for the purpose of supporting e-learning. A five-point scale (1. Never Used, 2. Rarely, 3. Sometimes, 4. Often, and 5. Always) was used to measure the frequency of using each or some of the suggested methods of learning as indicated in table 2.

Table 2. How do you learn about the use of digital information services for e-learning?

Rank	Statement	Mean	SD
1	Browsing the library website	3.49	1.43
2	Receiving e-mails	3.33	1.34
3	Asking colleagues or friends	3.14	1.23
4	Visiting the library building	3.08	1.44
5	Asking librarians	2.97	1.12
6	Using social media	2.73	1.28
7	Subscribing in electronic bulletins	2.55	1.13
8	Subscribing in mailing lists	2.53	0.98
Total		2.98	0.90

Results in table 2 indicated that browsing the library website was most frequently used to find about using digital library services in e-learning with an average mean score of (3.49). By contrast, subscribing to electronic bulletins (2.55) and mailing lists (2.55) were less frequently used techniques for learning about using digital library services in e-learning.

5.4 Perceived Advantages of Digital Library Services in e-learning

The respondents were asked to indicate the level of support that digital library services offer for academics for the purpose of e-learning. Five-point scale was used to measure this level as follows (1. Not Helpful at all, 2. Not very helpful, 3. Not certain, 4. Somewhat helpful, and 5. Very helpful).

Table 3. What is the level of helpfulness that digital information services offer for e-learning?

Rank	Statement	Mean	SD
1	It helps me carry on my teaching duties effectively	3.33	1.32
2	It helps draw my attention to new sources of information	3.29	1.24
3	It helps link the course to additional sources of information	3.10	1.40
4	It encourages students to suggest new sources of information	3.05	1.20
5	It helps me design the curriculum	3.01	1.25
6	It helps make direct contacts to librarians through ‘ask librarian’	2.90	1.14
Total		3.11	1.07

The overall results on table 3 positively indicated that the respondents perceive advantages in the use of library digital services to support e-learning activities. Carrying on teaching duties effectively recorded the highest average mean score (3.33), followed by the impact of library digital services on drawing academics’ attention to new sources of information (3.29). The lowest average mean score was recorded on the use of ‘Ask Librarian’ service to support e-learning with an average mean score of (2.90).

5.5 Challenges and Difficulties

On a five-point scale (1. No Challenge, 2. Low, 3. Medium, 4. High, 5. Very High Challenge), the respondents were also asked to rate the challenges and difficulties that might hamper access to, and use of, digital library services in e-learning.

Table 4. To what extent do you consider the following statements as difficulties or challenges?

Rank	Statement	Mean	SD
1	Lack of adequate training for academics	3.32	1.186
2	Lack of online tutorials for library instructions	3.28	1.179
3	Lack of online forums or blogs for SQU libraries	3.12	1.053
4	Lack of relevant links that support students and faculty in e-learning	3.11	1.126
5	Lack of faculty-librarian collaboration in e-learning	3.10	1.168
6	Lack of sufficient digital information that support e-learning by means of Arabic.	3.10	1.094
7	Absence of efficient mechanism to integrate librarians in the e-learning process	3.09	1.109
9	Lack of integration between the library website and e-learning website	3.07	1.293
10	Lack of collaboration between the librarians and e-learning specialties	3.02	1.155
11	Lack of sufficient experience that librarians possess for supporting e-learning	2.97	0.994
12	Lack of the library catalog (OPAC) integration in e-learning.	2.90	0.95
Total		3.10	0.727

The overall findings in table 4 indicated that the respondents considered the following statements as difficulties or probable difficulties. “Lack of adequate training for academics” was considered as the highest challenge or difficulty with a recorded average mean score of 3.32 while lack of the Online Public Access Catalog (OPAC) integration in the course management system was considered as the lowest challenge with an average mean score of 2.90.

6. CONCLUSION AND RECOMMENDATIONS

Digital library resources and services at SQU have been constantly increasing, but the use of these resources and services to promote e-learning at SQU has not been, subject to research for the purpose of measuring quality or assuring efficiency. The current research was an attempt to investigate the perception of academics who actually implement course management systems in their course teaching at SQU. It aimed to descriptively discover the extent to which academics at SQU recognize the potential of accessing and using digital library services with the Moodle course management system platform.

It is, therefore, suggested that faculty-librarian collaboration for facilitating and increasing the use of digital library resources in e-learning is a necessity. Some direct links to relevant full-text databases and temporal availability of subject librarians in the course platform of Moodle would improve and enrich the flow of relevant digital resources for instructors and e-learners. The university’s information system lacks a local digital repository. Such repository would certainly help academics retrieve categorized digital information quickly for the purpose of building digital content for e-learning. It is also essential for the university to provide more customized training programs that aim at expanding information literacy and use of digital library services in e-learning. Moreover, the library needs to constantly develop its website and take advantages of the web 2.0 applications to maximize its usability and integration with learning management system.

Taking into consideration the low response rate associated with this study, external validity is such a concern and generalization may only be limited to some categories such as usefulness and implication. Its representation might not be adequate for universities other than SQU and regional universities. The strength of this scope, however, lies in its dynamic capability of providing suggestive conclusion about a phenomenon that has never been locally investigated. Findings might assist future research by providing basis about the usage and accessibility of digital library services and the value of integrating digital resources and services in the course management system at SQU. Any future research in the area shall consider methodological variation and qualitative exploration of academics’ patterns and practices in order to deeply scrutinize the potential of digital library services on e-learning at academic settings.

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E-LEARNING SYSTEMS AND LEARNER DIMENSIONS: AN ITALIAN CASE STUDY

Cecilia Rossignoli[1], Maria Ferrara[2] and Luisa Varriale[2]
[1]*University of Verona, Verona, Italy*
[2]*University of Naples Parthenope, Naples, Italy*

ABSTRACT

This study focuses on e-learning systems and the specific individual and organizational factors that can affect the adoption process of effective e-learning platforms. We consider the main studies on this topic to evidence which characteristics e-learning systems need to present in order to offer useful and competitive learning and training services supported by technology. In the last decades many organizations have faced many difficulties, in particular in terms of costs, to achieve educational requirements. These organizations are forced to ensure their services adopting an educational model alternative to traditional face-to-face learning. Basing on a qualitative approach, we investigate the case of "Bank Alpha" in Italy. The study highlights interesting theoretical conclusions and managerial implications in order to successfully design and develop e-learning platforms.

KEYWORDS

E-learning systems, learner dimensions, organizational change.

1. INTRODUCTION

In the last decades, new technologies have played a key role in supporting the learning and teaching processes within any organizations facing different challenges, especially in terms of costs reduction. In this perspective, most previous studies have evidenced that organizations adopt e-learning solutions because of the cost dilemma (Alavi & Leidner, 2001; Alonso et al., 2005): public and private organizations, such as public-law banking institutions, use e-learning tools as its costs are lower than traditional education. Although the cost dilemma affects the decision of many organizations to adopt e-learning platforms, it is difficult to identify the main characteristics that make e-learning platforms successful and respondent to educational needs; for this reason, it is useful to investigate the point of view of the main organizations adopting e-learning platforms, and not only directly the user's perspective. One of the most used technologies to support distance education is represented by e-learning. Most studies define e-learning as "the use of new multimedia technologies and the Internet to improve and facilitate the quality of learning by facilitating access to resources and by favoring the remote change and the collaboration". This paper examines e-learning platforms exploring and defining individual (learner dimensions) and organizational characteristics (organizational model and governance model) required to offer effective and competitive e-learning services, showing advantages and challenges of e-learning programs. More specifically, by investigating the main steps in the decision making process concerning e-learning platforms, we want to evidence how some factors, such as organizational structure of actors involved, or different user's learning style, can affect this process and the effectiveness of e-learning platforms and services. We conduct a descriptive and exploratory study using a qualitative approach. In particular, we analyze the case of Bank Alpha in Italy. We begin by deepening e-learning literature to highlight how e-learning solution could enable organizations to face greater difficulties to achieve education requirements (learning and training needs for the employees within organizations) and to evidence the main perspectives of studies on this topic. Then we analyze the case study to emphasize how this organization can design and develop effective e-learning platforms.

2. E-LEARNING PHENOMENON IN THE LITERATURE: A REVIEW

"E-learning is an alternative method of learning based on use of multimedia technologies and the Internet to deliver information and instruction to individuals" (Alonso et al., 2005). E-learning represents a personalized learning process according to knowledge and needs, facilitating also the access to resources (instructional materials in various formats such as text, pictures, sound, video on demand, and so on) and services (forum, social groups, support, experts counseling, and so on) anytime and anywhere also across the country (Sampson et al., 2002; Brusilovsky, 2004). Hence, "e-learning is basically a web-based system that makes information or knowledge available to users or learners and disregards time restrictions or geographic proximity" (Sun et al., 2008: 1184). E-learning has various and significant advantages over traditional face-to-face (F2F) education (Piccoli et al., 2001), such as time and labor intensiveness and the reduction of the material resources involved in running e-learning environments.

Literature has highlighted two main kinds of e-learning: asynchronous and synchronous e-learning: the first refers to e-learning available to learners anywhere and anytime, representing the most common kind used within organizations. For example, people could use e-mail, mailing list, forum, as well as downloading slides and audio-video materials to favor learning process. Synchronous e-learning, contrarily, refers to a "living" process, that requires both teachers and students to use computers at the same time (Zenger & Uehlein, 2001; Elliot, 2002).

E-learning phenomenon, because of its multidisciplinarity, has received an extensive attention by academics in different fields.

Engineering research has focused on e-learning design and architecture (Sampsonet al., 2002; Brusilovsky, 2004). Other research, instead, has investigated the factors that lead e-learning solutions in organizations (Welsh et al., 2003). In particular, according to Welsh and colleagues (2003), organizations decide to adopt an e-learning solution because it provides consistent worldwide training, reduces delivery cycle time, increases learner convenience, reduces information overload, improves tracking, and reduces expenses (Bassi, 2000; Fielden, 2002; Welsh et al., 2003; Weller, 2004). Some studies argued that online education is more expensive than traditional education and, above all, its development time presents high costs (Fielden, 2002), also claimed that the cost of e-learning is highly dependent on the number of learners involved (Bassi, 2000). The choice to adopt an e-learning solution by organizations may also be the result of environmental features characterizing the context, rather than the market conditions. In this perspective, the decision to adopt an e-learning solution might depend on the specific characteristics of its platforms.

Besides, e-learning is frequently used to get innovation diffusion (Rogers, 1983). This is also the reason why it constitutes a multidisciplinary field study which implies marketing and organizational themes besides, in particular, communication theories (Deshpande, 1983). Researchers from Information System (IS) field try to identify important variables related to e-learning, considering basic models such as the technology acceptance model (Ajzen & Fishbein, 1977; Oliver, 1980; Davis et al., 1989), and the expectations and confirmation model (Bhattacherjee, 2001; Lin et al., 2005; Wu et al., 2006). Among some vartiables investigated, for instance, in the learner dimension, specific included factors are "learner attitude toward computers, learner computer anxiety, and learner Internet self-efficacy". Following this direction, Sun and colleagues (2008) developed an integrative model, focused on the main six dimensions, in order to investigate and explain why many users of e-learning tend to stop their experience almost at the beginning of the process. Other researchers, especially from the field of psychology, tend to focus on specific dimensions such as the personality traits, individual characteristics, achievement and so on (Wang, 2003; Rovai, 2003; Kim & Schniederjans, 2004; Schniederjans & Kim, 2005; Liaw et al., 2007; Liaw, 2008; Liaw et al., 2008; Solimeno at el., 2008; Ozkan & Koseler, 2009). In general, psychological and pedagogical research has mainly focused on learning process arising from e-learning tools by learners respect than traditional approach, highlighting issues about it (Govindasamy, 2001; Zhang et al., 2004), especially positive pedagogic findings for the students involved (Ravenscroft & Matheson, 2002; Zhang et al., 2004; Selim, 2007); in particular, some studies evidence the differences in terms of typical aspects (individual characteristics, personality traits, and so on) that can affect the effectiveness and success of e-learning process, mainly expressed in terms of learner's satisfaction.

Regarding personality traits, only few studies have explored the relationship between personality traits and online learning but they report contradictory findings. Carey and Kacmar (1997), using a Jungian theoretical framework, evidence that a higher level of satisfaction with teleconference communication is

related to individuals who use a combined sensing-thinking type approach than intuitive-feeling types; in this model, in fact, they measure four dimensions of personality: extroversion-introversion, intuitive-sensing, thinking-feeling, and judging-perceiving. However, Mawhinney and Lederer (1996) evidence differences in time spending behavior using computers between intuitive-feeling managers and sensing-thinking managers: the former spend more time than the latter. On the contrary, Wilson (2000) documented opposite results: sensing-thinking individuals showed mainly greater computer-mediated communication systems (CMCS) usage than intuitive-feeling individuals. Another research found that students more comfortable with online learning systems need more time to think and reflect in their activities (Palloff & Pratt, 2001), or reticent students tend to refuse connections with other students in any ways and they do not participate (Day & Batson, 1995). Ellis (2003) evidenced the following results in asynchronous learning: introverted thinking students demonstrate higher willingness to contribute than outgoing thinkers, while feeling judgment (dominant or auxiliary) prefer more the F2F environment. Conflicting results came also from studies based on standardized measures by comparing online and traditional forms of training (Santo, 2001; Zobdeh-Asadi, 2004). Starting from the above considerations, in most studies, authors investigate the effects of e-learning and blended learning on students' achievement (Al-Qahtani & Higginst, 2012) or on learners' satisfaction and behavioral intentions (Liaw, 2008; Sun et al., 2008). Indeed, Liaw (2008) and Liaw and colleagues (2007) find out that the most critical factor that positively affected learners' satisfaction toward e-learning was perceived self-efficacy of using e-learning, among learner characteristics. Otherwise, authors recognize that "personal attitudes are a major factor to affect individual usage of information technology" (Liaw et al., 2007: 1067), for this reason it is necessary to identify and understand targeted population in developing e-learning systems. Other authors (Schniederjans & Kim, 2005) support the conclusion that four personality characteristics (i.e., conscientiousness, openness to experience, emotional stability, and agreeableness) of the Big Five are highly correlated to student achievement in college Web course work.

In the last decades, however, more studies on e-learning issue try to investigate and identify the main critical success factors (CSF) of this specific type of learning, frequently used in educational institutions and training work environments, based on the use of information and communication technologies instruments (Garavan et al., 2010; Nathan, 2011; Cox, 2012; Kim et al., 2012).

Kim and Schniederjans (2004), investigating the relationship between personality characteristics and performance in online learning courses, demonstrated that in online courses teamwork and integrity have close relationships with low levels of grade performance for online students, instead, learning orientation and commitment to work are related to high grade performance. In Ozkan and Koseler study (2009), the learner perspective and the instructor attitudes are the most interesting dimensions explored to evaluate the effectiveness of e-learning systems in the higher education context. Otherwise, these results overlap and confirm previous contributions in the literature (Arbaugh & Duray, 2002; Thurmond et al., 2002), stimulating more attention to personality characteristics of instructors and learners in order to identify the main success indicators of e-learning systems. Indeed, some authors analyze the impact of specific individual differences, such as gender and job status, on the perceptions of the quality and satisfaction with e-learning systems or the relationship between learning styles and e-learning systems (Santo, 2006; Popescu, 2010).

There are many multidisciplinary theories of learning; from a psychological and cognitive perspective scholars distinguish four learning style models: Myers-Briggs Type Indicator (MBTI) Model (Lawrence, 1994); Kolb Learning Style Model (McCarthy, 1987; Kolb, 1984); Herrmann Brain Dominance Instrument (HBDI) Model (Hermann, 1990); Felder-Silverman Learning Style Model (Felder, 1996; Felder & Silverman, 1988). The way in which a person learns is defined learning style and it is linked with personality typologies: Some people focus on facts and data and prefer to learn mathematical contents and models; other individuals like to visual schema, pictures and diagrams; others prefer verbal forms of learning and written/oral explanations; some people learn better interacting actively with others, someone else prefers to learn in an individually and introspectively manner (Felder, 1996).

Following upside specific learning styles schemas, we can underline that not all people learn functionally by IT instruments and not all instructors teach correctly using them, basing on the fact that each one has a specific main learning style. Virtual professors at online faculties or online training courses have to be able to create and manage efficacy and efficiently asynchronous learning networks (ALN), that support virtual class activities and learning process (Coppola et al., 2002).

3. CASE STUDY: BANK ALPHA[1]

Bank Alpha in Italy is a public-law institution operating in financial and banking sector. Data were collected from its archives and documents in Italy, and three semi-structured interviews with the main managers responsible for "learning and training process" inside the bank in the HR management area. In detail, we interviewed the Learning Unit Director, and her two collaborators, one manager responsible for e-learning process (E-learning manager) and another one responsible for technical aspects concerning e-learning process (e-learning platform manager). In particular, the interviews allow us to investigate the main characteristics that affected the decision making process regarding the adoption and implementation of e-learning platforms, considering the most important advantages related to e-learning platforms and future directions of this organization; the analysis of documents and the official website was crucial to investigate the aims and different steps of the decision making process concerning e-learning platforms and also details about the historical and organizational structure of the Bank.

The organizational structure reflects the three levels at which it operates: international, national and local. The strategic, management and operational policies are drawn and implemented from the Head Office. Bank Alpha has about over 8.000 employees, of whom about 665 units are managers, employees with high functions and responsibilities.

The Bank Alpha adopted an e-learning platform after a long and relevant decision making process, considering its organizational structure. In fact, the Bank is present in a wide area in all Italian territory with one central head office and sites in all the country in each main town and most important centers, the staff is located over a wide area included the central office and branch offices; because of this structure, there was the need to ensure uniform training and learning process for all the staff, but at the same time the organization must minimize the costs. For this reason the Bank started to think of the different solutions they could adopt looking and investigating other experiences in the economic sector, not only banking system. One solution was the adoption of e-learning systems to assure homogeneous standards for all staff in their training process by reducing the costs.

E-learning platform was adopted in 2004 after a long period of investigation about the experiences in this area, in fact, the organization started to explore in 2000 all the companies in different economic sectors that had adopted (successfully or not) e-learning platforms to identify the main factors that can affect the effectiveness of this innovative solution. They tried to understand the main reasons behind pushing companies to adopt e-learning platforms and how they managed this innovative solution. Thanks to this investigation about Italian and also European market, Bank Alpha could evidence some important considerations. Learning Unit Director, in fact, says: "We did learn from mistakes of others, we have reached important conclusions about our choice: the e-learning system cannot completely replace the traditional learning system (t-learning) but it must enrich and complete the t-learning". They found out that the main criticism about e-learning programs concerns the risk that individuals (learners) feel alone to manage the program (online courses, virtual classes, etc.); the isolation represents the main problem.

Many experiences have failed for this reason, because after the initial enthusiasm the learner felt alone and abandoned like they had to stay just with the personal computer without interacting with other individuals; within companies the employees said that after the first phase of enthusiasm and pleasure to participate into e-learning programs, they recorded a big decrease in terms of attention and happiness to participate. This happened because many companies had just replaced completely t-learning (traditional learning in presence) with e-learning; they had completely abandoned the t-learning by applying massively and exclusively e-learning programs by leaving individuals to use this instrument without promoting interaction, comparison, and so on. So the first point regarding the decision to adopt e-learning programs was that their option was to consider both the solutions in the learning and training process, e-learning solutions cannot completely replace t-learning programs. The organization adopted and still considers a blended learning model, in which the educational system is a combination between face-to-face classroom methods and computer-mediated activities, in the last years also innovative channels like mobile-learning (m-learning). According to the typical proponents of blended learning model, the Bank strategy pointed on the creation of a more integrated approach for both instructors and learners, because, as evidenced by the

[1] Bank Alpha represents a blind case study for the respect of privacy of the organization and its dependents. We chose a name of fantasy.

Learning Unit Director, e-learning system does not have the added value compared to t-learning, thanks to the direct exchange and meeting between instructors and learners.

The adoption process of an e-learning platform within the organization takes a long time and was carried out gradually and carefully, in fact it is articulated in two main steps:. 2004-2008: timing experimentation with outsourcing; 2009-today: definitive e-learning decision trough internalization process.

In the first step, Bank Alpha outsourced the design and implementation of an e-learning platform in order to evaluate first the e-learning service and the satisfaction level of participants. An external company, specialized in e-learning platforms and services, designed and implemented e-learning units inside the Bank structure creating an area only dedicated to the e-learning program, so there were specific "learner-points" in the Bank where all the employees on the basis of a specific timing plan could take e-learning courses differently articulated. These learner-points were not connected to the Bank website and network, they worked without external and internal connections.

After the four years experimentation, they carefully evaluated the results and found out that the experience was positive, the participants to e-learning programs were enthusiastic and satisfied, they appreciated the mix of these innovative way to make training and learning. In conclusion, Bank decided to invest much more time and resources on the e-learning solution, so it internalized all the designing and implementation services, always keeping the blended learning model. The organization bought an outdoor deck SAP[2] and then customized it even if not at a very high level. They purchased a SAP platform according to a strategic choice of the top management; SAP modules (ERP system) can interact, interface and share information within the organization, for this reason they bought several modules such as training, accounting, expenditures area, human resource management. This choice gives them important benefits, because e-learning modules could receive information and data from other modules, i.e. registry staff, this is an integrative an unique information and data sharing system. This is useful and effective because, for instance, e-learning module regarding registry staff, on the basis of the length of service of employees, can design and plan an appropriate training course.

Behind the internalization of the design and implementation of the e-learning platform, the Bank also decided to eliminate the isolated learner points and brought them directly at workstations, in this way, all employees can take e-learning courses without changing their workstations, each computer has a connection to the training portal and through this you can connect to the platform with audio and video supports (webcam, audio channels, etc.). About 500 users can simultaneously use the platform choosing directly online courses on the basis of their needs, more specifically their learning program, including e-learning program too, is defined together with the organization, it means that each employee/user evidences his/her needs and desires in terms of learning also for online courses, then the organization trough the direct responsible area/office manager, can plan the final learning/e-learning program. Each user can access from his own workstation to e-learning courses anytime with respect to workload and work tasks. This is a typical example of "sharing and participated" e-learning program, in which each user can communicate and share his/her learning needs with the organization.

E-learning platforms provide different kind of courses and materials. There are two different types of on-line courses: typical "catalog on-line courses", that are already defined and available and are no specific to the Bank organization, like MS Office package course or English lessons; "tailor-made online courses", i.e. specific courses about some topics directly related to the organization, such as banking and finance activities, management area, and so on.

In this e-learning platform, "virtual classrooms" are also provided, they are in fact available and accessible in e-learning courses portal. "Virtual classrooms", also provided at workstation, are more difficult to manage both for technical aspects, they request audio and video supports, and for teaching aspects in terms of pedagogical and psychological aspects, i.e. the choice of virtual professors, some instructors are not comfortable to teach online and so their performance can affect the learner's satisfaction and enrichment, also for this reason, in order to find virtual professors more competent and in possess of specific skills and knowledge, virtual professors are internal or external, it depends on the specificity and content of the online course. Regarding "virtual classrooms", two are the critical elements clearly and carefully defined: the number of users (not more of 10 units for each online classroom) and the timing (not more than one hour for

[2] SAP is a multinational software corporation that makes enterprise software to manage business operations and customer relations.

each user). At the moment e-learning platform has more an operative aspect, but the organization is working in order to improve it in terms of informative/content aspect and also the technical/operative aspect.

The adoption of this e-learning platform, especially online courses, totally and completely changed the training and learning process inside the organization. The traditional learning, like traditional classrooms, requests to move from the workstations, instead thanks online courses and all the e-learning platform employees do not lose the direct contact with the work, they can access and use e-learning services anytime at their workstations and are more responsible because they have to respect the work tasks and plan their e-learning activity. There is in fact the risk the e-learning activity can be in conflict with ordinary work activity, but in this case each employee is responsible and also can monitor his/her use of the platform, the organization also can monitor online learning activity and all the learning process, also each user can receive support from tutors online, especially in virtual classrooms.

In summary, e-learning platform (e-learning concerns 22% of total learning and training process), as pointed out from the three interviews, represents a positive experience for the organization, and they are still working to improve it in terms of content and graphical aspects. Otherwise, the adoption of e-learning platform came in a historical moment characterized by a particular period in which the Bank was involved in a critical organizational change, involving the redesign of the organizational structure. This organizational process concerns two main guide lines: the reduction of internal administrative functions and the rationalization of processes. In this direction, e-learning platform represented an innovative instrument to make the organization for the learning and training area, more flexible and respondent to the new guide lines.

The starting point is that the personal development is the result of individual choice, the employee and his/her direct manager, for this reason e-learning programs, inside the wide learning process, is only the instrument to achieve this goal. Online courses are targeted, the Bank defines e-learning programs simplifying any administrative aspects, reducing bureaucracy and formal procedures. In fact, from this point of view, each user can decide independently how to benefit online courses in terms of sequence of the three parts designed (theoretical part, applicative part, and interactive part). At the beginning, the organization "enforced" its structure of online courses with a specific sequence, such as theory/application/interaction, but after exploring more learner dimensions in terms of personality traits and learning style, the process changed.

4. CONCLUSION

This study has highlighted some important issues regarding the use of e-learning within organizations for the development of employees' skills and competences, but there is clearly a need for further research in this area. This paper shows the viability of e-learning services in the training and learning process inside organizations but, at the same time, it highlights that it is necessary to introduce e-learning programs to integrate t-learning and not to substitute it, applying hence a blended learning model.

Findings are:

- The use of information technology (IT) can create valued-added relationship between virtual professors and employees as users of e-learning platforms;
- the employees have an innovative learning experience with multiple sets of resources and technology and the possibility to consider new skills and knowledge;
- the final results in terms of success and effectiveness of e-learning platforms depend on the specific services provided by the organization in terms of caring of the relationship between employees and their direct chief through easy and frequent communications, continuous interactions, and information and knowledge sharing; the organization shows the important to explore e-learning phenomenon in other previous firms' experiences to create a kind of benchmark (successful e-learning platforms) to follow in its choice;
- finally, it is clear the need to design and implement e-learning platforms only after exploring carefully the impact of learner dimension (such as personality traits or learning style) on satisfaction perception and, hence, on e-learning success, it means that we need to design "customized" e-learning platforms, which consider specific characteristics of users but also of the organization, i.e. sensing-thinking users need more online courses with an excellent graphic, at the same time e-learning platforms have to follow the different phases of the relationship between the employee and the organization.

However, this study has many limitations. First, it is an exploratory study that utilizes a qualitative technique, we consider a specific organization. Second, we do not specifically analyze aspects within each relationship between the organization and the users. Furthermore, this study did not investigate if there is a linear relationship between learning styles of users, effectiveness of e-learning platform, and quality and satisfaction perceptions by users. This study can be considered as a starting point for the future research to examine through a quantitative method the success and effectiveness of e-learning platforms with the application of an evaluating model by adopting a wider theoretical framework that integrates both individual and organizational factors.

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IMPLEMENTATION OF E-HEALTH RECORDS FOR VIABLE HEALTH CARE IN MEDICAL COLLABORATION AND CONSULTATION SYSTEMS

Hussein Karam Hussein Abd El-Sattar
Ain Shams University, Faculty of Science, Mathematics Department, Abbassia 11566, Cairo, Egypt
Al Yamamah University, College of Computer & Information Systems, Riyadh 11512, KSA

ABSTRACT

Rapid advances in information and communication technology (ICT) led by the Internet have opened up new areas for researches and developments. Healthcare information system (HIS) is one of such important areas which concern all of us. The implementation of e-health records and services in all countries is a challenge shared by United Nations agencies and health authorities at the international, national and local levels. This paper attempts to investigate and study two items. The first is to answer the following question: Does the impact of using the Internet for health purposes differ from the impact of other types of Internet use? The second is to consider the rapid advances in ICT afforded by Web technology for designing and implementing a Web-based e-health Record System to facilitate health care delivery during the course of referring patient transfer. Providing medical doctors with such Web-based system in diagnosing diseases will help to improve the quality of patient care and safety, reduce costs in health services, deliver equally good healthcare for everyone, anytime and anywhere. A case study prototype applied on some medical center has been implemented. Comparisons with existing techniques are included. Evaluation and practical performance results are also demonstrated.

KEYWORDS

E-health, Information and Communication Technology (ICT), Software Engineering, Dynamic Web Applications, Electronic health Record, Human Computer Interaction (HCI), Graphical User Interface (GUI).

1. INTRODUCTION

Today, the demand for e-health records to improve the quality of patient care, and to reduce costs in health services is generally recognized. Since a medical consultation system is extremely critical as decision taken by doctors are life critical, therefore, the data manipulations and user interaction in such a system are extremely broad and quite demanding. Nowadays, it is essential to have a proper health care delivery system for the efficient management of clinical resources for a nation. Today, the demand for computer-based patient records to improve the quality of patient care and to reduce costs in health service is generally recognized (Mugdha R Oak, 2007). With the emergence of web enabled applications, that technology is now available. The WWW grows by roughly a million pages per day with a significant number devoted to some element of healthcare. Therefore, there is a need for easy-to-use tools for creating WWW-based health - related environment that are otherwise beyond the ability of the non-computer programmer. These tools should not only produces web pages for physicians on the WWW, but also create web-based communities that allow sharing of information between health professionals as well as between health professionals and the public. Information and communication technologies (ICTs) are increasingly providing us with the tools and knowledge that we need to improve health care, enabling solutions that benefit patients as well as healthcare professionals and institutions in both the private and public sectors worldwide. This paper aims to consider the rapid progress in ICT afforded by web technology for designing an online portal contains all the electronic health records, and grant permission to all health facilities operating in the health field to gain access to these records with good healthcare for everyone, anytime and anywhere. Consequently, improves the quality of patient care and safety, reduces costs in health services, supports patients in normal and/or emergency situations, facilitates the conduct of the proceedings and reduce the waiting time for patient, contributes to the elimination of medical errors, especially due to the lack of clarity in writing prescriptions,

access to medical expertise irrespective of the geographical location of the person in need, paperless documentation and reliable patient data transfer.

This paper is organized as follows. Section 2 briefly summarizes the problem statement, motivation and objectives. A definition of e-health and its components as well as the main different players in the field of e-health are discussed in section 3. Section 4 reviews some related work. The development processes of the proposed system, including system structure, methodology, design, analysis, etc. are discussed in section 5. Evaluation and practical performance results are given in section 6. Section 7 concludes this paper and outlines some directions for future work.

2. PROBLEM STATEMENT, MOTIVATION AND OBJECTIVES

During the last decade, the Internet has become increasingly popular and can be applied to facilitate communication between health care provider and caregiver in different situations (Robert Kraut, 2010). Because the Internet created new opportunities and challenges to the traditional health care information technology industry, the use of a new term to address these issues seemed appropriate. These "new" challenges for the health care information technology industry were mainly (1) the capability of consumers to interact with their systems online (B2C = "business to consumer"); (2) improved possibilities for institution-to-institution transmissions of data (B2B = "business to business"); (3) new possibilities for peer-to-peer communication of consumers (C2C = "consumer to consumer"). Based on a case study prototype applied on some medical center, this paper aims to address these challenges and discuss the effects of Internet use on healthcare information system. Moreover, attempts to answer the following question: Does the impact of using the Internet for health purposes differ from the impact of other types of Internet use?

3. DEFINITION OF E-HEALTH AND ITS MAIN COMPONENTS

E-health is an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies. E-health (Eysenbach, G., 2001; Ramkumar P., 2011) is used to characterize not only "Internet medicine", but also virtually everything related to computers and medicine. The term was apparently first used by industry leaders and marketing people rather than academics. They created and used this term in line with other "e-words" such as e-commerce, e-business, e-solutions, e-learning, e-governance and e-transport, and so on in an attempt to convey the promises, principles, excitement around e-commerce (electronic commerce) to the health arena, and to give an account of the new possibilities the Internet is opening up to the area of health care. The "e" in e-health does not only stand for "electronic," but implies a number of other "e's," which together perhaps best characterize what e-health is all about. The 10 e’s in the e-health are (Jean-Claude Healy, 2008): Efficiency, Enhancing quality of care, Evidence based, Empowerment of consumers and patients, Encouragement, Education of physicians through online sources, Enabling information exchange, Extending the scope of health care beyond its conventional boundaries, Ethics, and Equity. The "Electronic health record" (EHR) is a frequently quoted term in many areas of healthcare which is defined as a longitudinal electronic record of patient health information generated by one or more encounters in any care delivery setting. The EHR-system consists of three main elements: Data-storage facilities, a Web-server and a user-interface. EHR-system requires coordination with a group of players whose culture and objectives are different given by: United Nations agencies, government authorities, academic and research institutions, consumers, patients and their associations, donors, and the media. The EHR in Fig. 1depicts the integration of healthcare data from a participating collection of systems for a single patient encounters.

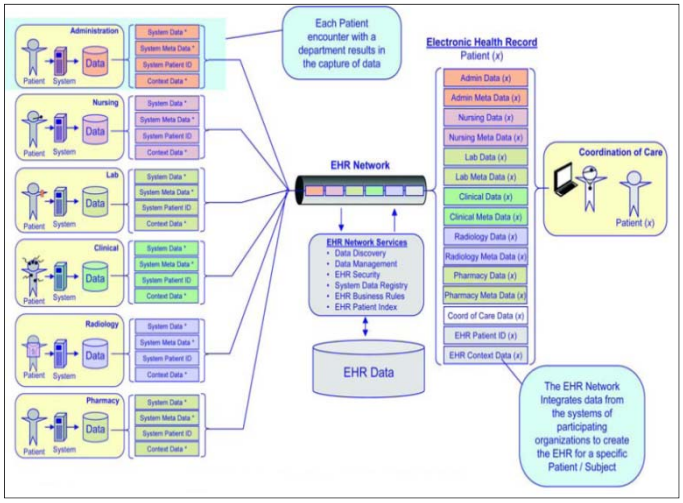


Figure 1. EHR Concept and Components

4. RELATED WORK

For achieving our goals and objectives, it is necessary for us to study other related Web sites in order to: (i) see how they are functioning then try to emulate what we see by creating prototype pages for our system; (ii) avoid any error may occur in our system; (iii) choose the suitable tools and toolsets; and (iv)attempts to enhance and add more functions that are not exist in the others (e.g. sending SMS for patient of the analysis results as well as doctor's diagnosis when laboratory analysis is required). The following are some Web sites that we have visited: (i) Artemis (http://www.srdc-.metu.edu.tr/webpage/projects/artemis/ index.html); (ii) dbMotion (http://www.medicexchange.com/listing/dbMotion-IHE-Integratio-n-Brochure.html); (iii) eClinitek (http://whois.domaintools.com/eclinitek.com), and (iv) Instant Medical history (http://www.medicalhistory.com).

5. SYSTEM DEVELOPMENT AND IMPLEMENTATION

This section briefly outlines the main design principles and methodology used in implementing our system from the earlier design phase called process model or software development lifecycle model up to the final product system. Process model consists of a series of sequential or concurrent steps or phases in the software development process.

5.1 Software Development Lifecycle Model

A software lifecycle model is either descriptive or prescriptive characterization of how software is or should be developed. It is the macro-process that shapes the general approach and strategy that the software team will follow to carry out the system (Toth K., 2005; Walt S., 2001). Such strategies include some version or subset of the following activities: System initiation/planning, requirement analysis and specification, prototyping, partition and selection, architectural design, detailed component design specification, component implementation and debugging, software integration and testing, system delivery, installation, training and use, and software maintenance ((Toth K., 2005). Most system development process models in use today have evolved from three primary approaches: Ad-hoc process, Waterfall model and Spiral model (Alan Dennis et al., 2010). S. Bell and A. Wood-Harper (Bell S. et al., 1992) point out that with Ad-hoc process, schedules, budgets, functionality and product quality are generally inconsistent. The Spiral model is better suited for projects with risks and unknowns. Because the requirements of our system are well defined as we

have spent a lot of time gathering it in order to know the feasibility of producing our system, waterfall model has been used as shown in Figure 2.

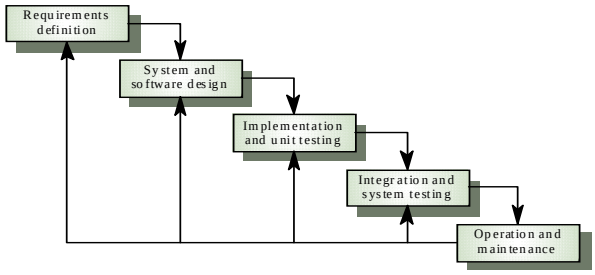


Figure 2. Waterfall Process Model

5.2 Architectural Design

Architectural design defines the interconnection and resource interfaces between system subsystems, components and modules in ways suitable for their detailed design and overall configuration management. Figure 3 shows a sample architectural design overview of our EHR system structure. Figure 4 shows the context-level data flow diagram which provides the interaction between the system and external agents which act as data sources. On the context diagram the system's interactions with the outside world are modeled purely in terms of data flows across the system boundary. The context diagram shows the entire system as a single process, and gives no clues as to its internal organization.

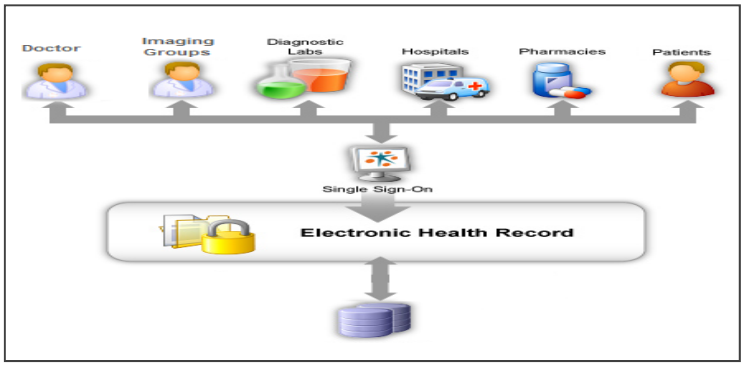


Figure 3. EHR Architectural Design of Our System

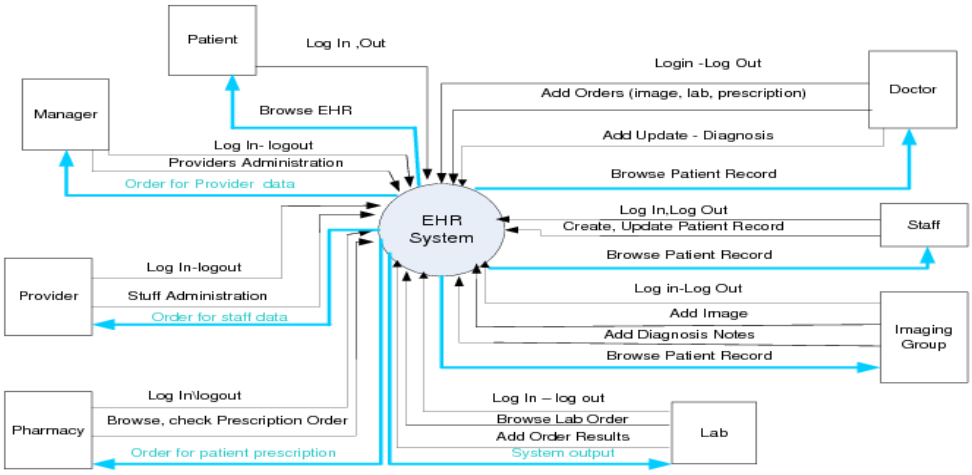


Figure 4. System Context-Level Data Flow Diagram

5.3 Entity Relationship Diagram (ERD) and Use Case

An entity-relationship diagram (ERD) is a graphical representation of an E-R model that illustrates the interrelationships between entities in a database. E-R model is used in Database analysis as a tool for communication between database designers and end users during the analysis phase of the database development. It is a detailed, logical representation of the data and is used to construct a conceptual data model which is a representation of the structure and constraints of a database. It is expressed in terms of: entities, attributes and relationships among those entities. Figure 5 shows the ERD related to our system, where Entities are represented by the rectangle symbol and the relationships between entities are represented by lines connecting the related entities.

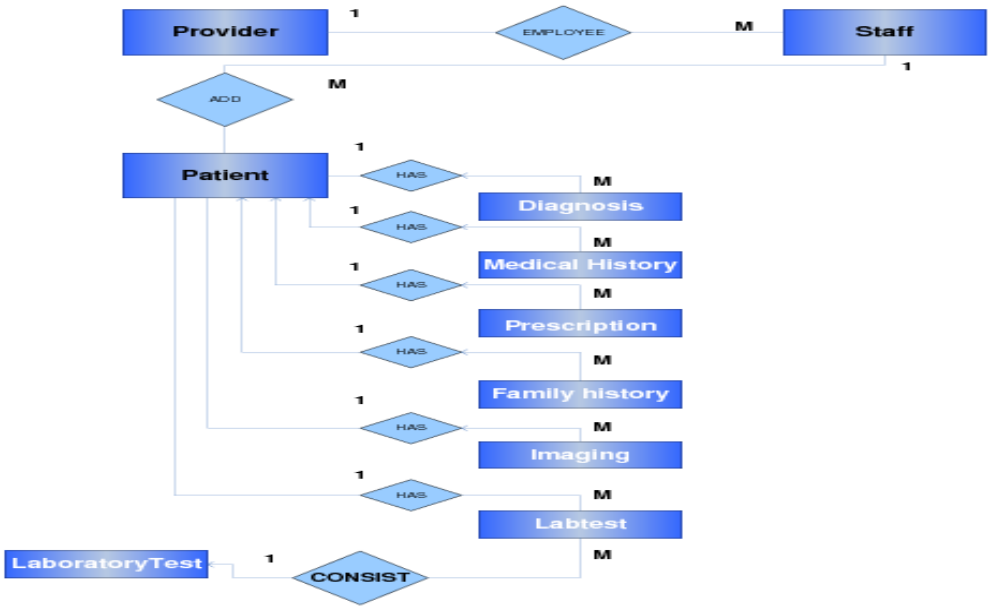
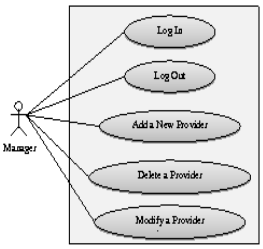
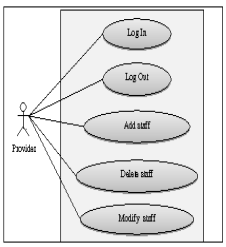


Figure 5. System ERD

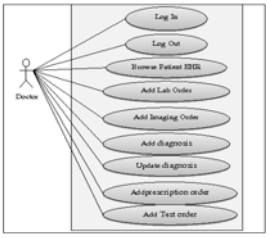
On the other hand, Use cases are a unified modeling language (UML) technique for documenting the possible requirements of a new system or software change. Each use case provides one or more scenarios that express how the system should interact with the end user or another system to achieve a specific goal. Figure 6(a)-(d) show some different use cases for manager, provider, doctor and pharmacy.



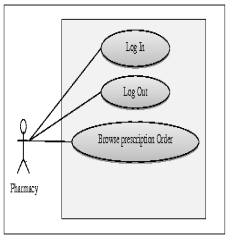
(a) Manager Use Case



(b) Provider Use Case



(c) Doctor Use Case



(d) Pharmacy Use Case

Figure 6. (a)-(d) Some different Use cases for Manager, Provider, Doctor and Pharmacy

5.4 System Definition

System definition is one of eight stages under the database development life cycle which identifies the scope and boundary of the database system, including its major user views. User view defines what is required of a database system from the perspective of a particular job (such as Manager or Supervisor). User view defines what is the users will do with the data (user views data relationships). Identifying user views helps ensure that no major users of the database are forgotten when developing requirements for new application. Our system definition is given in table 1.

Table 1. EHR System Definition

User View	Requirements
Manager	• To maintain (enter, update, and delete) data on providers. • To perform searches for providers.
Provider	• To maintain (enter, update, and delete) data on provider's staff. • To perform searches for staff.
Staff	• To maintain (enter, update, and delete) data on patients. • To perform searches for patient EHR.
Doctor	• To maintain (enter, update, and delete) data on diagnosis. • To maintain (enter, update, and delete) data on Lab Order. • To maintain (enter, update, and delete) data on Image Order. • To maintain (enter, update, and delete) data on prescription Order. • To perform decision support on checking prescription items. • To perform sends alerts to diabetes patient every period of time.
Laboratory	• To maintain (enter, update, and delete) data on lab tests. • To perform sends alerts about adding new lab results.
Imaging Group	• To maintain (enter, update, and delete) data on images. • To perform sends alerts about adding new image.
Pharmacist	• To maintain (enter, update, and delete) data on prescriptions. • To perform checking prescription items.

5.5 System Design and Graphical User Interface (GUI)

Design involves decomposing the system into modules. The result is a design specification document, which contains a description of the software architecture: what each module is intended to do and the relationships among modules. In addition to designing the required functionality to be achieved we have to design an appropriate user interface (UI) for the database system which should present the required information in a user-friendly way (Benshneider M. et al., 2010). The UI design defines the way in which the users will interact with the system and the nature of the inputs and outputs that the system accepts and produces. It includes three fundamental parts: navigation mechanism, input mechanism, and the output mechanism. We follow a three-click rule for designing our user interface in which the users should be able to get to the pages they need within three mouse/keyboard clicks. Some screenshots for our system user interface is shown in figures 7(a)-(d).

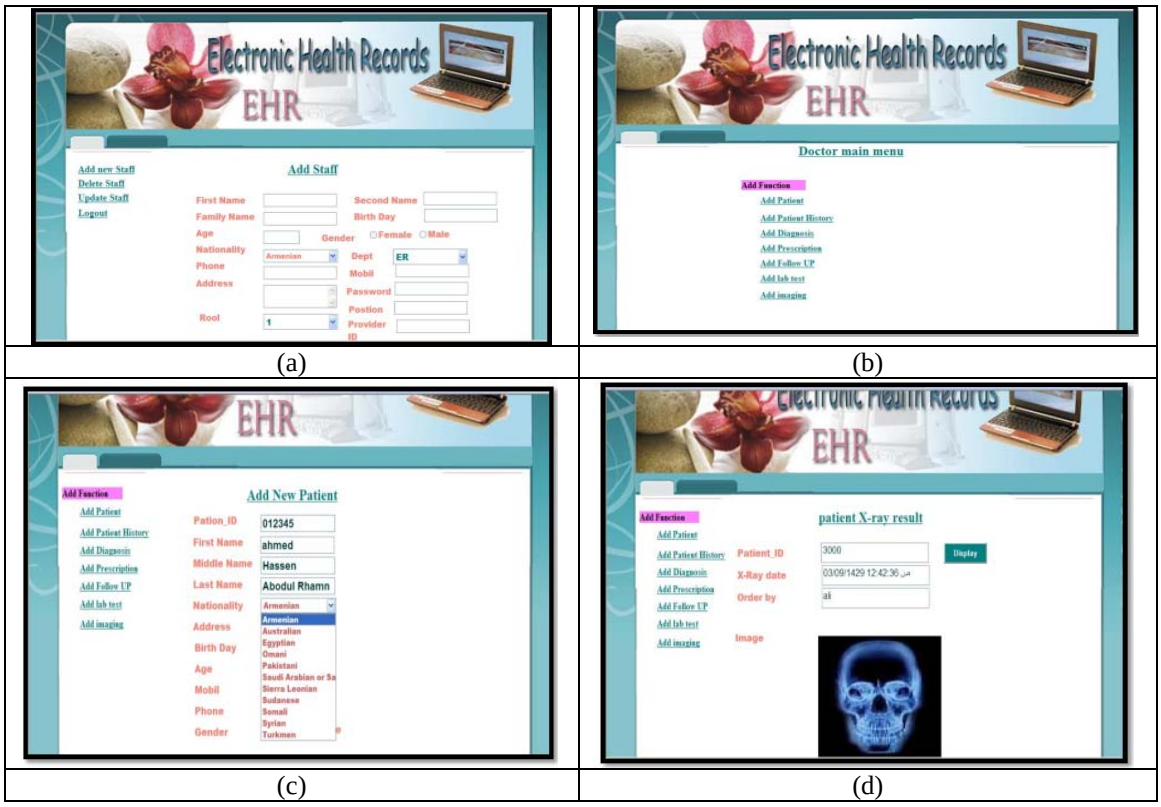


Figure 7. (a)-(d) Some Screenshots for Our EHR System User Interface

6. EVALUATION AND USER-TEST

One of the most important phases in the software development lifecycle is the system implementation and testing phase. To evaluate the functionality of the system, we have distributed a questionnaire evaluation form among some doctors related to the field. The results of the collected answers were in the positive side and few of them in the negative one. The majority of the doctors showed that the quality of the system against the standards is quite high. The initial summative data collected from them showed that, the system is very useful and the outcomes are given as follows:-

1) Most of them agreed that the system is useful, easy to use, user-friendly, and have simple content with a good flow of topics. They found out that it needs to be used more than once to get the idea behind some icons and navigation process.
2) The majority of the doctors saw that the examples used in explaining each topic are highly understandable. The collected results shows that 82% respondents was fully satisfied, 11% were partially satisfied, and 7% pointed out some areas of improvements.

7. CONCLUSION

The use of information and communication technologies ICT in healthcare is seen as an essential for high quality and cost-effective healthcare. This paper attempted to investigate and study two items. The first is to answer the following question: Does the impact of using the Internet for health purposes differ from the impact of other types of Internet use? The second is to consider the opportunities afforded by web technology for designing a Computer-Based health Record System applied on some medical center which satisfy the following objectives and goals:

- It promises equally good healthcare for everyone, anytime and anywhere.
- Reliable patient data transfer.
- Support patient in normal and/or emergency situations.
- Access to medical expertise irrespective of the geographical location of the person in need.
- Improve the quality of patient care and safety.
- Reduce costs in health services.
- Facilitates the conduct of the proceedings and reduce the waiting time for patient
- Paperless documentation.

Additional research is needed to determine what leads individuals to seek out health resources online, whether the information that they discover (and believe) is factually correct, and what actions ensue.

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INVESTING IN E_HEALTH: EVALUATING EHR SYSTEMS

Renata Paola Dameri
Department of Economics, University of Genova, Italy

ABSTRACT

EHRs are information systems aiming to collect health information regarding both individuals and population. EHRs are also communication systems, as data collections could be shared and used to better support medical cares or health institution processes, performance and services. During the last decade, EHR diffusion has been increasing, but the goals of its use have not ever been clearly defined, nor the expected results have been quantified in advance. Therefore, even if many researchers have published more and more papers regarding EHR evaluation, the meaning of the word "evaluation" is not unambiguous. Thanks to a large survey including academic peer review papers, the author defines the different meaning of EHR evaluation. Afterwards, she classifies the different evaluation practices and methods in a scale, from the less to the more meaningful for the citizens' wellbeing. Finally, she puts together different evaluation practices, to build a comprehensive evaluation framework for EHR.

KEYWORDS

EHR, ICT evaluation, ICT investments, e_Health investment

1. INTRODUCTION

Electronic Health Record (EHR) systems are information systems aiming at collecting, processing and communicating health information, to support better health services for patients, a better work environment for physicians and cost reduction of health (Häyrinen et al. 2008, Lobach and Metner 2007). During the last decade, EHR has been more and more widespread in industrialized countries. EHR is seen as a key instrument, to reach several important goals in contemporary health systems. Indeed, thanks to their nature and functional characteristics, EHR systems are able to support different best practices and improvements in health services. We could classify the EHR role in two main aspects: the one regarding the health service cost, and the one impacting on the health service quality.

EHR could be able to positive impact on health service cost, because it changes health processes and supports a more efficient and effective delivery of health services to patients. Indeed, cost control in health services is one of the most critical challenges for government in industrialized countries, as people ageing and the higher expectations of health services quality drive higher cost. EHR could create savings in health cost, but maintaining the service quality or also improving it, if it is able to positively change the health service delivery process. Indeed, EHR could automate some administrative operations, not directly regarding the medical care, but able to reduce time and to improve the effectiveness and efficiency of the whole health service. It produces also a higher satisfaction of both patients and physicians, because they can better focus on the medical aspects of the health service (Buccoliero 2010). Moreover, EHR could improve the efficiency of health cares, supporting the sharing of best practices, the diffusion of medical standards and the automation of administrative operations, saving human and financial resources and reducing delays and mistakes (Salomon et al. 2009).

EHR is nevertheless very important to improve the quality of health services. Some improvements directly derive from the higher efficiency: to reduce time, mistakes, cost of labour, means not only saving money, but also delivering better services to the patients. However, the higher improvements in health care quality are not expected from the service automation, but from the smart use of the collected information, both regarding individuals and populations (Rossi Mori et al. 2012).

The role of EHR in improving health care quality grows stronger and stronger, the more is the diffusion of EHR among the medical community. Indeed, network economies are generated, thanks to the large adoption of EHR systems among both physicians and patients. The first ones could use EHR information

collections to support better decisions and quicker diagnosis, especially in first aid. The latter ones could use their personal EHR to know better information about their own medical status, or to communicate with their own family doctor or to share the same information with specialists. The more are the users, the higher are the value of the system and the positive impact on the well functioning of the medical care system (Miller and West 2011).

However, not ever EHR goals are well defined. The heterogeneity of EHR impact on health services is generally underestimated. Both public health agencies and physicians are not aware of the wide scope of EHR. For this reason, we could find several EHR applications, often very different each others, aiming at reaching some goals, but neglecting several others. This situation influences also the correct evaluation of EHR benefits. Indeed, to consider only some aspects and some goals of EHR adoption means also to undervalue its benefits and to reach wrong conclusions about the cost-benefits evaluation of such systems (Kaushal et al. 2011).

In this paper, the author aims to clearly define the whole range of EHR goals, classifying them respect to the higher or lower impact on the final stakeholders: physicians, patients, health institutions. Indeed, EHRs have a large spectrum of impacts, of different nature. Some goals are tangible, measurable and easy to evaluate by quantitative and monetary indicators. Some others, on the contrary, are intangible, not easy to measure and not linked to monetary indicators, but impacting on the quality of cares or on the patient satisfaction. Therefore, to have a correct perception about the role and impact of EHR adoption and the cost-benefit relation, a comprehensive evaluation framework is suggested, to better support EHR evaluation practices.

2. EHR EVALUATION: WHAT DOES IT MEANS?

Evaluation is a systematic practice aiming at the determination of a subject's merit, worth and significance, using criteria governed by a set of standards. The main aims of evaluation are not only to measure, but also to enable reflection and to assist in further decisions and actions. For these reasons, the evaluation of EHR systems is one of the main drivers to improve their adoption. Indeed, to evaluate means not only to assess the quality or the diffusion, or the effectiveness of these systems, but also to be aware of their functions, scope and usefulness for stakeholders. However, as EHR is a complex application, the evaluation process is complex too. Also the meaning of "EHR evaluation" is not unique and both the international literature and the professional practices attribute different scope and sense to this phrase (Nohr 2006).

As we have just seen in the previous paragraph, an EHR is a software application, used to collect, process, share and communicate health information, both regarding a single patient, a group of them or a whole population. The EHR system is a software, with different functions, working both on databases and on networks and interfaces, used by several different types of users: administrative workers, physicians, patients, politicians and so on. EHR is therefore an information system, used to support both medical decisions and administrative processes, both professional aims and relational ones.

Exploring the international literature, a lot of papers regarding EHR evaluation are found, but meanings and methods explored in these papers are often very different each others. I concluded that to evaluate EHR is not only a complex task, but also a multi-layer task; it should involve different points of view to build a structured, comprehensive model to evaluate EHR, aiming to furnish a clear understanding of its role, functioning and potential benefits for users and stakeholders.

Literature analysis has been performed, by searching on research papers databases, selecting paper regarding both EHR and e_Health evaluation. To classify all the different points of view and methods regarding EHR evaluation, a grid was built, based on two dimensions: the more or less technical contents of the evaluation, and the more or less technical competences required to EHR users. Indeed, the authors discovered that researchers consider EHR like a software, but delivering social services, with cost and benefits for health institutions, physicians and patients. Therefore, EHR could be evaluated by the technical point of view, by the economic one or finally by the social one. In this grid, I put at the lower level the technical aspects of EHR, and at the higher its social aspects. I built finally this classification of EHR evaluation topics (Fig.1):

- EHR as a software;
- EHR software usability;

- EHR adoption rate;
- Cost savings thanks to EHR;
- EHR social benefits.

The lowest level of this grid regards the technical evaluation of EHR as a software (Russ et al. 2010). In this case, the aim of the evaluation is to understand which are the functionalities of the application, to assess its quality, scalability, technical resilience, and so on. The technical evaluation is also used to compare different EHR solutions (Piliouras et al. 2010). An important focus of the technical evaluation is the data quality measurement (Hoffman and Podgurski 2012), regarding for example the simultaneous searching, the accuracy of patient data and so on (Ahmadi 2010). In this sense, to evaluate an EHR system is not so different respect to evaluate another software; it is nevertheless necessary to adapt generic guidelines and standards for the process of software evaluation applied to EHR applications (Lawlis et al. 2010). Li, Land et al. (2010) suggest to merely emphasize COTS criteria, to take into account the specific nature of EHR systems.

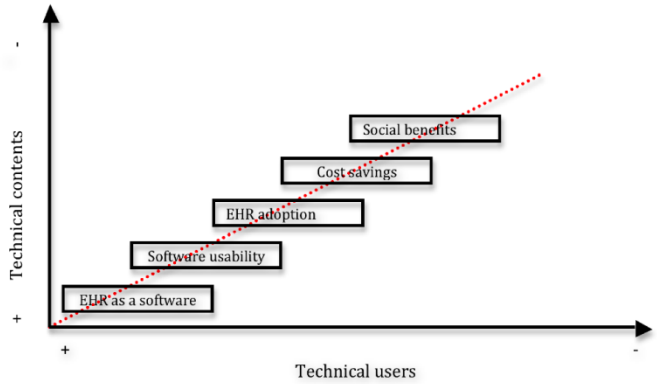

Figure 1. The grid to classify different EHR evaluation concepts

One of the most important aspects to evaluate is EHR usability. Indeed, EHR is a complex application, addressed to a plurality of different users, with both different expectations from the system and different technical competences (Edwards et al 2008). Usability evaluation should be conceived to support a better, user-centered software design and development, involving users in a continuous-improvement EHR life cycle (Horsky et al. 2010). The goal of the usability evaluation should be a better meeting to user expectations, and also an EHR effectiveness improvement, thanks to a higher safety of the system use and a higher physician focus on patients instead of on technology. Despite the topic importance, not optimal usability evaluation methods are available (Don et al. 2007), but only a clear user orientation, even if not ever the "user" is clearly defined: indeed, EHR has several different user categories and usability should be evaluated respect to each of them (Belden et al. 2009).

Rising into the grid, the evaluation of EHR adoption is applied, to measure quantity and quality of EHR diffusion among physicians and patients. To evaluate the adoption rate doesn't mean only to know how many physicians, patients or hospitals adopt this system, but to understand which are the most important adoption drivers and barriers to be taken into consideration (Bower 2008). Indeed, the EHR adoption evaluation aims to help predicting its diffusion, for example designing a diffusion curve over time; it aims also to measure the adoption speed rate, because it heavily impacts on the relationship between investments and expected returns. A well-defined adoption curve is very useful to sustain and justify EHR financial investments, as it is able to evaluate the investment returns. EHR diffusion estimation supports the definition of policies and strategies to drive a faster and deeper adoption and to struggle against resistance to this system, especially by physicians (Ford et al. 2006, 2009). Moreover, EHR adoption evaluation could imply not only a quantitative measurement, but also a qualitative assessment, for example to discover best practices able to support a higher and faster adoption rate, or to grant a better EHR success thanks to large diffusion and positive network effects (Keshavjee 2006). Morton and Wiedenbeck (2010) consider also the important link between adoption and acceptance. Indeed, this could be a success or failure factor and it implies to consider the key role of education and training. Pay attention not to confuse these two practices: to train means to teach how to use the EHR software, but to educate means to explain why to use it! Education is one of the most

important success factors, to grant an effective impact of EHR adoption on the quality of care for patients. Another key factor slowing down the EHR adoption is represented by financial barriers (Sheen and Ginn 2012). However, as we will further explain, it depends not only on the lack of funds, but also on the inability to understand, measure and demonstrate the relation between cost and benefits, and on the difficult to compare investments with expected returns, or financial expenses with savings.

The cost saving is often considered the most assessed goal of the EHR adoption, and the unique easy to measure (Bardhan and Thouin 2012). Conversely, the cost-benefit relation is not easy to evaluate, especially because most benefits are intangible. However, savings could be easily accounted and an EHR ROI estimated, just to support investment decisions and development programs and projects (Menachemi and Brooks 2006). EHR is a saving weapon, impacting on several procedural aspects of health systems. By this point of view, EHRs are considered like administrative or organizational applications, able to improve the efficiency of activities and processes, but poor attention is paid to the quality of care delivered to patients. Nevertheless, to reduce the cost of administrative or procedural operations permits to drive more resources and efforts towards the medical aspects of care services (Black et al. 2011). EHR system could also be a way to control health expenditure, because it formalizes and standardizes some procedures and submits them to an automated and real-time control (Anderson et al. 2006). EHR can define better health processes such as reducing inappropriate pharmaceutical expenses or a better use of human resources in health care. To have a better view of the EHR impact on health care system performance, a larger investigation should be necessary, to study several linked aspects; for example, the relationship between wide scale usage, scale economy and cost reduction, or between network effects and benefit increasing (Mc Gowan et al. 2008) On the contrary, EHR value is generally underestimated; mainly, because benefits are ever underestimated, as most of them are intangible. But also because cost reduction is neglected too, owing to the lack of effective evaluation methods and of accountancy about cost reduction thanks to EHR implementation (Friedman et al. 2005).

The most important evaluation aspect regards the impact of EHR on the quality of health care. However, this is also the most difficult task. We already explained the different nature of cost – tangible, easy to measure, and benefits – intangible, difficult to evaluate and to measure by standard indicators. Goldschmidt (2005) examines several types of benefits deriving from EHR adoption, showing that an EHR system is able to foster patient focused care, to promote transparency and, finally, to enable citizens to drive the innovation of the health care system. But he says nothing about how to measure these benefits. Moreover, not ever benefits are perceived; not perceived benefits are sometimes the most important and they impact on care quality in the medium or long term. In several papers, researchers put in evidence the relationship between EHR value and barriers to adoption (Tang et al. 2006), such as patient participation. Indeed, the active role of patients is crucial for an effective use of EHR, and only a large adoption could improve clinical decision quality (Jones 2003). But patients participation is difficult to obtain, for example owing to digital divide and resistance to ICT use in health.

Papers in international literature showing a real evaluation method or framework for EHR are few, both regarding financial evaluation and qualitative impact. Miller et al. (2006) try to evaluate the returns and payback period of primary care EHR, and they conclude that incentive for physician are needed, to support a larger adoption rate. Shekelle et al. (2006) try to measure benefits by case study method. They examine 256 cases and apply some indicators to demonstrate the improved health care performance thanks to EHR implementation. However, they conclude that it is very difficult to estimate the whole benefits, as several of them are not quantifiable and costs are not ever accounted; the breakeven tie is difficult to predict in most of their case studies. It depends on the heterogeneity of benefit types and dimension, but also on several kinds of stakeholders. No paper studies the different impact of EHR on physicians, patients, health care entities, government, citizens and so on (Dameri and Cocchia 2012).

Several authors admit the need of a comprehensive framework (for example Ammenwerth 2003) but they also acknowledge the difficulties to define and implement it. Designing a comprehensive framework for EHR evaluation, should take into account both the different aspects of its impact (technological, procedural, qualitative, financial, …) and the different stakeholders of its adoption. The result should define and measure all the different cost and benefits often examined separately.

3. A COMPREHENSIVE FRAMEWORK FOR EHR EVALUATION

How to build a comprehensive framework to evaluate EHR systems? The answer is not easy. International literature shows to us that an EHR has multiple dimensions and stakeholders, that its role is complex and that the adoption rate and the evolution of this application are heterogeneous not only all over the world, but also in each country or region. A comprehensive framework shall consider and put together different aspects, trying to compose them in a homogeneous set of indicators able to support both the evaluation, and the awareness of the role and impact of EHR. Therefore, a quantitative evaluation framework is not enough, also a qualitative framework is needed, to support better public policies about EHR diffusion and a more effective EHR adoption for the health system quality (Blobel and Pharow 2009).

The most important requirements of a comprehensive evaluation framework could be summarized as follows (Sittig et al. 2010):

- to consider both the different evaluation aspects (technological, economic, social, qualitative, and so on) and the time evolution of EHR use in health care: indeed, all the aspects should be evaluated in a dynamic scenario, as technology, health care and patient expectations are continuously evolving;
- to consider that the technological aspects are only the necessary basis for an effective use of EHR, but the human factor is the most important;
- to orient evaluation towards sustainable adoption and increasing public value for citizens.

A general EHR evaluation framework could be designed as in Fig. 2.

Three different evaluation areas are defined: readiness, intensity and impact . Readiness means to measure if the context is ready for EHR adoption. It requires to prepare the technological and human resources to implement EHR applications: for example, infrastructures, platforms, networks, but also financial funding and investments in health ICT, training ad education of both physicians and patients. Intensity means to measure the adoption, diffusion and completeness of EHR applications, among physicians, patients, administrative employees, health institutions, government, countries, … Impact means to evaluate the effective role of EHR in supporting a less expensive, higher quality, more friendly health system for citizens, considering economic, individual and public value created by EHR.

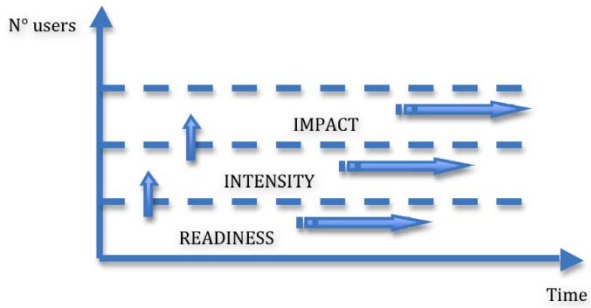

Figure 2. The conceptual definition of an EHR comprehensive evaluation framework

High readiness is needed to support intensity, and a good intensity is necessary to grant a satisfactory impact. All these evaluation areas evolve during time, but they should be enforced during time thanks to specific policies and incentives. Readiness, intensity and impact are not definitively reached, but they ever move towards higher expectations to be met. However, the impact dimension is the more important, as it regards the effective role of EHR for patients, physicians, finally: for people.

To evaluate EHR impact means to inquire if EHR really reaches its own goals (Simon et al. 2008). However, these goals are not simply to define and to identify, owing to the complexity and multidimensionality of EHR impact on the health care system. Before to evaluate, a clear definition of evaluation dimensions and value drivers is required, both to support the measurement and to choice the more important aspects to be measured. A graphical definition of these several evaluation aspects is showed in Figure 3.

The health system promotes or produces EHR applications. It aims at reducing health costs offering a high quality health care service. These applications are used by physicians, more or less stimulated by public/national health systems or health service market. They often resist to EHR use in their work, but they could improve the quality of their job and health care service if they would be more aware, trained and

educated in EHR use. Therefore, physician should spend some efforts to use EHR, but they could have interesting professional benefits.

Patients are the final target of EHR applications, used both by themselves and by physicians in delivering health care services to them. Therefore patients have both direct benefits (by their own use of EHR) and indirect ones (thanks to the better health services produced by physician using EHR). Governments are interested in reading data collected by EHR and regarding not individuals, but populations. They can gain awareness and better decisions by a deeper knowledge about patient problems, needs and used health services. Government uses these data to define better health policies regarding national health system improvement.

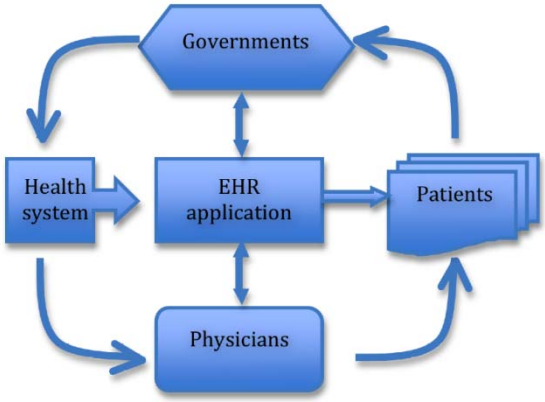

Figure 3. The graphical definition of EHR evaluation interests

All these actors are stakeholders respect to EHR implementation, but each of them expects different benefits from EHR use, and these benefits could be measured by different types of indicators.

- Health system especially aims at reducing cost of health services, maintaining their quality or improving it. Indicators should aim to measure efficiency and effectiveness of health processes to produce and delivery health care services. It is possible to apply a set of indicators not too different respect to similar ones applied to business process efficiency measurement, also including ICT implementation.
- Physicians expect a better quality of their job, thanks to better information about their patients or similar clinical cases, a better decision support in diagnosis, a more focus on patients needs thanks to the deeper information about personal medical health records. This aspect could be measured by a set of indicators, regarding the quality dimension of health services, for example the decreasing of clinical errors, the higher speed in responding to health needs, the higher confidence of physicians in EHR. This latter aspect should be measured by a panel investigation, with interviews to physicians involved in EHR use.
- Patients are interested in having better health services, in a shortest time, at lower cost, easily to reach for them or for their family members. These higher quality levels could be measured both by quantitative and by qualitative indicators. Time, cost, tangible aspects could be measured by quantitative indicators, also automated inside the EHR software. On the contrary, the patient satisfaction should be measured by interviews. A crucial aspect to be considered could be the difficulties for ageing patients in using ICT, but also the incapacity of citizens to understand or perceive the benefits deriving from the EHR use. For example, perhaps it is not easy for a patient to appreciate the better relationship with his own physician thanks to EHR, if he would prefer a personal contact, or the better information about his own health profile.
- Finally, EHR produces impact not only for individuals, but also for populations. Governments are certainly positively impacted by the data collected by EHR and useful to better understand how to support national health system improvement. In this case, macroeconomics and social indicators are needed, to better government health policies.

To summarize all these aspects and indicators in a unique, comprehensive evaluation framework, we could aggregate measurements in three streams: the ones regarding the EHR economic value, that could add together all the monetary cost and benefit indicators; the ones regarding individual value created by EHR,

joining quantitative and qualitative benefits representation in a grid or table; finally, the ones measuring the public value created by EHR, both adding the monetary indicators (for example, national savings) and representing in a formal grid or table qualitative improvements deriving from her adoption.

4. CONCLUSIONS

The EHR evaluation is a complex concept:

- it has different meaning: to measure, to assess, to understand, …;
- it involves different points of view: technical, economic, medical, social, …;
- it regards both tangible and intangible values, that are more or less difficult to measure and to put together in a unique framework;
- it involves different stakeholders: patients, physicians, politicians, public administrators, technicians, …;
- it should be placed in the spatial context, that is, specific goals should be defined for each specific EHR project;
- it should be placed in the time context, that is, the evolutionary aspect of EHR improvement should be evaluated in a dynamic manner.

At present, no comprehensive framework is available, to evaluate EHR taking into consideration all the different aspects, dimensions and measures defining EHR value. Several studies are available in the international literature, but each of them deeps only one or few aspects of the wider EHR evaluation topic. Different points of view are scarcely compared each others, and a time dimension lacks totally, to support an evolutionary EHR evaluation. This gap is especially severe, because EHR is a mature concept as it has been ten and more years researcher have been studying it and health institutions have been starting to use it. However, in ten years technology, people competences in ICT use and expectations from health systems have been deeply changing, so that old ideas are completely outdated.

Future steps in EHR evaluation research will regard the most crucial gaps to overcome, to define a comprehensive EHR evaluation framework. I consider particularly important these aspects:

- to verify if well-known and tested evaluation methods – such as Value for money, Balanced scorecard an so on – could be modified and adapted to be applied to EHR evaluation;
- to identify a set of indicators, able to measure different aspects of EHR value, both qualitative and quantitative;
- to define a modified maturity model, to evaluate the EHR evolution from the early stage of adoption to a complete maturity both in technological implementation and in users support.

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INFORMATION FLOW CONTROL FOR A MEDICAL WEB PORTAL

Thomas F. J.-M. Pasquier[*], Brian Shand[**] and Jean M. Bacon[*]
[*]*University of Cambridge*
[**]*Eastern Cancer Registry and Information Centre*

ABSTRACT

In this paper we present a web application prototype[1] developed for brain tumour patients to access their medical data. The prototype has been developed using existing technology for easy and cost effective deployment, yet supporting strong security requirements. With these constraints in mind we developed an architecture incorporating Information Flow Control for data isolation and audit.

KEYWORDS

Information Flow Control, Medical Data, eHealth, eRecord.

1. INTRODUCTION

It has been mandatory in England since 1971 for cancer records to be held by eight regional cancer registries. This data has traditionally been used to provide researchers and policy makers with statistics on the disease; anonymised data sets have been provided to researchers. There has recently been a move in the UK towards access by individuals to data held about them. For cancer data, a first step has been to provide this access for brain tumour patients; this paper describes a web application developed for this purpose.

This move creates a number of challenges that must be overcome. First, when data are released to medical practitioners, they work within a well defined and restricted network, where the use of standard *firewall* and *complex authentication* based techniques is possible (in the cancer registries' case, authentication is done using USB authentication tokens). Furthermore, the behaviour of the practitioners is strongly regulated. The first challenge is therefore to ensure that for personal access, the data is released to individuals securely within the system while making them aware of possible dangers when the data enters the user domain. The second challenge, is the need to use standard hardware and software to deploy the solution. This is to minimise the cost and make the service relatively user-friendly through familiarity of end users with standard software.

These challenges lead to a number of requirements for our application. The final solution should be accessible on a standard web-browser, it should not require installation of additional software, it should not require the use of an authentication token visible to the user and it should be deployable on Platform as a Service (*PaaS*) cloud solutions (such as Amazon EC2[2] or Rackspace[3]).

[1] Testing on a selected group of real patients is scheduled to start in 2013.
[2] http://aws.amazon.com/ec2/
[3] http://www.rackspace.com/

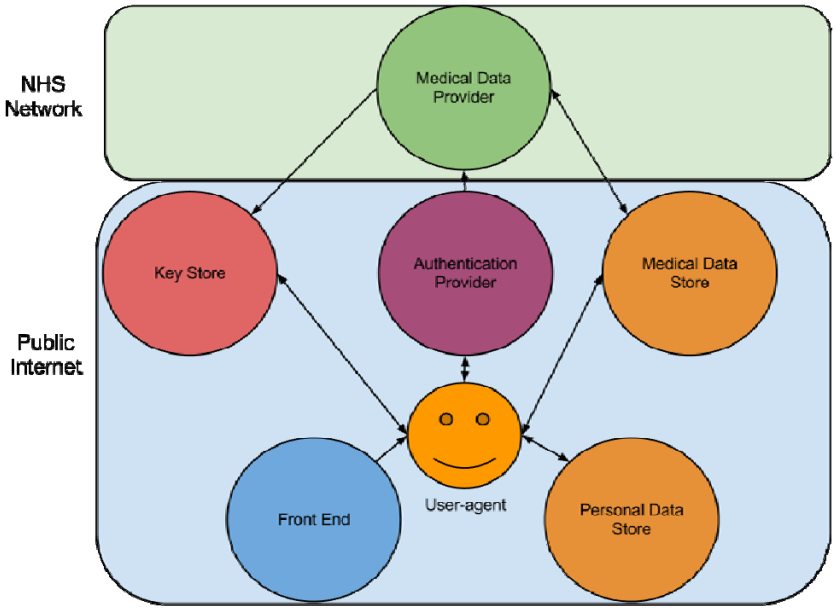

Figure 1. The system architecture

Furthermore, literature on the subject either assumes that the servers between the Medical Data Provider (MDP) and the end user can be trusted [Sunyaev et al. 2010a] or use complex encryption schemes [Alshehri et al. 2012, Benaloh et al. 2009, Li et al. 2010]. We argue that third parties should not be trusted and that if the purpose is to provide access and visualisation of medical records it is unnecessary and potentially risky to let third parties access the data. Also complex encryption schemes prevent large scale deployment because of the need to deploy specific software or even dedicated hardware.

In this context, we designed our system to protect patient privacy and reduce the risk of data leakage by considering the hosting platform to have a rather low level of trust. In order to enforce end-to-end privacy we rely on some well known principles and techniques: encryption, partitioning of data and Information Flow Control (IFC). It is important to note that protecting the data within the patient's computer is out of scope for this paper. Our focus was to provide end-to-end privacy from when the information leaves the MDP to when it reaches the patient's user agent (the web browser).

We now discuss what we mean by encryption, partitioning and IFC. Encryption has been used to ensure that the data can only be read by the patient and that no third party can gain access to it while it is stored on *PaaS* or in transit through the network. If the data happened to be disclosed, for example, by key compromise, a bug within the software and/or storage method, the medical and personal data are stored and accessed from two different separate virtual machines (VM) in the cloud. Medical data are de-identified medical records that minimize the risk of re-identification [Bertino et al. 2005]; personal data are patient-supplied information and/or information that allows the patient to be identified. In order to gain useful information about a patient an attacker would have to combine the two sets of information, which is made difficult by the fact they are stored on two different VMs. Finally, IFC techniques are used to ensure that data associated with a user are delivered only to the user presenting the corresponding credential. This is a software mechanism which ensures that, even in the case of buggy software, the server will refuse to serve data which does not belong to the currently authenticated user; more detail is given in section 3.

2. ARCHITECTURE

Our achitecture is centered around the user-agent. Indeed as we need to encrypt the data and partition them, while not fully trusting the infrastructure between the user-agent and the *MDP*, it must be the responsibility of the user-agent to combine and decrypt the different pieces of information concerning the patient.

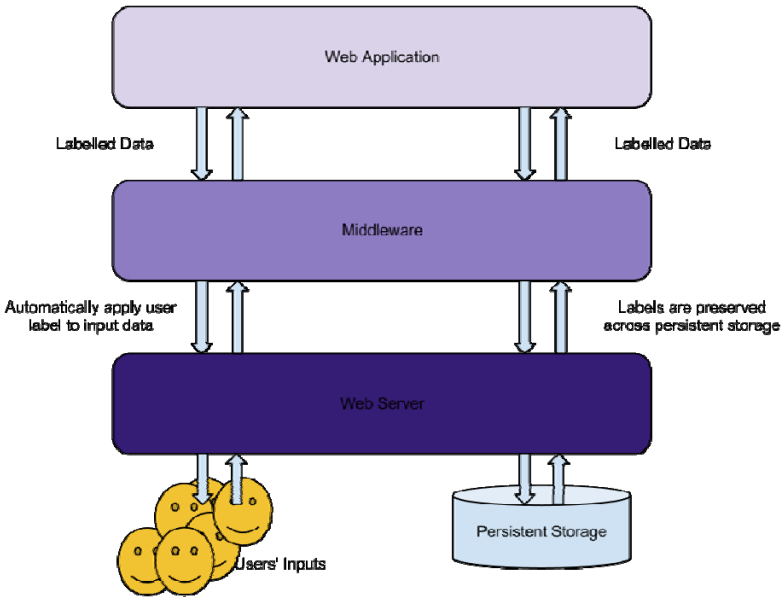

Figure 2. Data Store Architecture

As shown in figure 1, the system is divided into separate entities. A central component is the Authentication Provider which behaves as a single sign-on mechanism where the user authenticates in order to gain access to the different pieces of information stored in the separate servers. Two data stores are used, one for medical data (Medical Data Store), the other for personal information (Personal Data Store) and a Key Store is used to store the keys needed to decrypt information. Note that the persistent medical data is held in a private, secure database; the Medical Data Store holds data constructed in response to users' requests. Finally a Front End server provides the interface and web page environment to display the information to the user. For example, this might be incorporated into a cancer charity's web presence.

A typical access to a page with sensitive information from the Front End is done as follows (we assume the user is already authenticated):

- the user accesses a front-end web page containing references to sensitive information that should be displayed on this page;
- the User Agent retrieves those data from the appropriate server (medical and/or personal);
- the User Agent retrieves the corresponding encryption key(s) from the Key Store;
- the User Agent displays the data within the page layout as described by the Front End.

These operations, from the user's point of view, are carried transparently. Indeed the front-end through the use of a dedicated library automatically generates javascript code, which will perform the operations and cache data as needed, providing navigation experience close to a standard website.

In order to build the central authentication system we adopt a reverse OAuth 2.0[4] approach similar to the one described by Gonzalez et al. [Gonzalez et al. 2009]. When a user tries to access one of the data stores he is redirected to an authentication page on the Authentication Provider, accompanied by a randomly generated string to ensure the freshness of the request. Once the user is authenticated, the Authentication Provider redirects to the end-point specified by the data store concerned and includes a signed authentication token and an identifier (ID) representing this user uniquely. This unique ID which carries no real identification value is used by the data store to keep track of different users. The authenticity of the token is ensured by the random string freshness method and a standard private/public key mechanism. In addition to providing a delegated single sign-on mechanism, reverse OAuth 2.0 allows the user identity to be abstracted from the data stores.

In order to push medical data, the MDP needs to retrieve from the Authentication Provider the list of newly registered patients, their details and their pseudonymised ID used for access to the data stores and key store. Their registration details, once retrieved by the MDP, are deleted from the authentication portal as they

[4] http://oauth.net/2/

are no longer of use and could compromise patient privacy. Those details are used within the MDP infrastructure to identify patients within the MDP database. Once the patients have been identified, the data are transformed for publication by anonymisation, formatting and encryption. The key used for encryption is then pushed to the Key Store and associated with the correct patient; the same is done for the medical data. The medical data is given a label which is associated with the user. The labelling mechanism is further discussed in section 3.

All accesses to the system are logged in order to detect suspicious behaviour. Furthermore, those logs (or at least human friendly simplified versions) are made available to the patient to promote transparency and involve the patient with security related problems. If suspicious behaviour at a single patient level is detected there are several possible actions:

- the association between a patient and his labels can be deleted rendering the data inaccessible. If the case is cleared later, this association can be restored; if not, the data can safely be deleted;
- if there is serious doubt of compromise all data are deleted;

3. INFORMATION FLOW CONTROL (IFC)

Information Flow Control tracks how information propagates within a program during its execution to ensure that the information is handled in a proper fashion. In the case of a web application, we want to ensure strict isolation between different users' data [Bacon et al. 2010, Hosek et al. 2011]. Therefore, we ensure, through a taint tracking mechanism, that every piece of information is associated with a specific label and let only the patient associated with that label access those data. Other protection mechanisms such as access control, assume a well behaved and trusted process to handle the data, but cannot prevent this process leaking data. In the case of a web server handling confidential information, it would be extremely problematic if such a process leaked information from Alice to Bob through an unexpected bug.

In our solution the IFC label can be described as follows $L=\{name;o_n:r_i,...,r_j\}$ (there is a strong similarity with labels as described by Myers [Myers 1999]). The name is a user set name used to identify a specific label from others, o_n is the owner of the label, $r_i,...,r_j$ are the users allowed to access information associated with this label. The simplest label is $L=\{name;o_n\}$, meaning that only the owner o_n of the label is able to access the data associated with this label.

Consider a simple example: Alice wants to push into our data store some contact information. Alice sends to the server the following information: *{key:"contact",value:" [...]",label:"alice_label_1"}*. The server first transforms the label name using a hash function such that *stored_name=H(alice_id,label)*. We now have created the following label $L=\{stored_name,o_{alice}\}$. If Bob tries to access the data, the server will fail. If Alice wants to give Bob access to her information, she needs to send a request to the server to modify her label such that $L=\{stored_name,o_{alice}:r_{bob}\}$. Our model does not permit addition or deletion of ownership as we are dealing with medical records with a clear owner: the patient.

The IFC mechanisms are not enforced and managed within the web application, but in a middleware layer as described in figure 2. Therefore, even an application containing unexpected or buggy behaviour would not be able to grant access to one patient's information to another. The main application's access to the database is filtered through the middleware which verifies labels' associations and enforces them, generating a failure when inappropriate accesses (read or write) are requested. At this stage of the project the application is built on top of a standard SQLLite database. The middleware database interface for every read and write verify the labels associated with the retrieved data match with the labels associated with the current user.

Another layer, associates any data pushed by the server with the user specified labels (it is important at this point to know that the framework does not provide a facility to remove a label). With these two layers we ensure that the data going in and out of the application through the expected input/output of the application carry valid tags. Finally, a taint guard mechanism as described by Hosek et al. [Hosek et al. 2011], ensures that if the application tries to push data with inappropriate labels out of the application the server process will fail. We are able to guarantee that, given an appropriate authentication token, a user is unable to access data he did not create himself or which he has not been granted access to.

4. IMPLEMENTATION

4.1 Data Store

The data store is totally agnostic to the format of the data it stores. However, in practice to interact easily with the javascript generated by the front end (described in section 4.2), the data is stored under the json format. The interface used for our key-value store is intentionally simple. There are four functions:

- get(key)
- get_all
- set(key, value, label)
- delete(key)

```
{"data":[
  {
    ''full_name'':''John Doe",
    ''job'':''MD",
    ''address:''Somewhere",
    ''phone'':''991",
    ''email'':''john.doe@test.com"
  },
  [...],
  {
    ''full_name'':''Jane Doe",
    ''job'':''Nurse",
    ''address:''Somewhere else",
    ''phone'':''991",
    ''email'':''jane.doe@test.com"
  }
]
}
```

Figure 3. Stored Unencrypted Data

The provided interface is close to standard key-value store interfaces with the exception of the set function which takes an additional label attribute. The label attribute is used to mark the data and allow access by a third party to values bearing the indicated tag. The label is a string value and a stronger per-user unique label is built server side from the user's unique identifier and the string provided. In order to facilitate the communication with the javascript running within the user-agent, the data store communicates with it by *POST* with the json formatted value.

Additional functionality needs to be added in order to be able to share data. Each label has an owner, who can associate other users with this label or remove this association. Users associated with a label, but who do not own it, are not allowed to associate a further user with it. Therefore, only the original owner is able to decide which users should be able to see his data. This adds the two following functions to our interface:

- grant_access(user, label)
- revoke_access(user, label)

For further security the data store generate the javascript used to perform those API call and enforce *same domain-policy*[5]. The front-end web page communication with it through *HTML5 web-messaging*[6] and by including an html *iframe* pointing to the data store.

[5] http://www.w3.org/Security/wiki/Same_Origin_Policy
[6] http://www.w3.org/TR/webmessaging

4.2 Front-end

The front end has been realised in Ruby-on-Rails. This lightweight framework has been designed to hide from the developer the details of the interaction between the generated webpage and the data store. In consequence, the developer need only to specify the origin of the data and how they should be displayed. As discussed in section 4.1, the data are stored in the json format and we assume the programmer is aware of the structure of the data stored. Figure 3 presents how contact information would look like once decrypted.

```
<%= display_each_as(PERSONAL, :contact_info,
'<div class=''contact">
  <h3><!full_name!></h3>
  <ul>
    <li>Job Title: <!job!></li>
    <li>Address: <!address!></li>
    <li>Phone: <!phone!></li>
    <li>Email: <!email!></li>
  </ul>
</div>'
) %>
```

Figure 4. Rails Front-End Code to Display Contact Data

In order to display the data represented in figure 3, the programmer would simply write the code presented in figure 4. This code specifies that the value associated with the key *contact_info* should be retrieved from the *PERSONAL* store and that each of the elements of this value should be applied to a given html pattern. The javascript code retrieving the data from the data store, decrypting it and inserting the data following the pattern specified is then automatically generated.

In order to prevent cross-site scripting attacks modern browsers prevents web-pages from executing script from another domain of origin. This is known as the *same origin policy*. Therefore we include where needed *iframe* pointing to the relevant data store. Information are then exchanged with those iframe through *HTML5 messaging API* and the data store trusted code within those *iframe* perform the data store API call. Finally, in order to maintain good reactivity of the website and to provide the user with a seamless experience we use *HTML session storage*[7] as a local cache store.

```
<%= form_store_tag(MEDICAL, :label=>'quality_of_life_survey') do %>
  <%= label_tag(:tiredness, ''How tired do you feel from 0 to 5?") %>
  <%= select_tag(:tiredness, options_for_select(...)) %>
  <%= label_tag(:depression, ''How depressed do you feel from 0 to 5?") %>
  <%= select_tag(:depression, options_for_select(...)) %>
  [...]
<% end %>
<%= grant_access(MEDICAL, MEDICAL_PROVIDER, :label=>'quality_of_life_survey') %>
```

Figure 5. Rails Front-End Code for Quality Of Life Survey

Other functions are available to the front end developer such as automatic form generation to push data to the data store, pre-fetch data into the user-agent session storage to improve interface reactivity, reset of encryption key, deletion of data and others. Through those functions the programmer is able to develop a fully fledged website, offering similar functionality that one relying on more standard technology.

Consider a simple use case. The front-end provider, in our case a charity helping patients with brain tumours, provides them with access to their medical record. The MDP would like to perform a quality of life survey in order to generate statistics. The front-end code will generate a form which pushes data to the medical store and grants the MDP provider access to the data.

This example is illustrated in figure 5. For the reader familiar with ruby on rails syntax this code is quasi-identical to the one used to generate a standard form. The only method which differs is the *form_store_tag* method which replaces the *form_tag*, which takes one parameter. The second method *grant_access* will generate a button and the associated javascript for calling *grant_access* from the data store discussed in section 4.1.

[7] http://www.w3.org/TR/webstorage

5. RELATED WORK

Our work is mostly based on the SAFEWEB [Hosek et al. 2011] solution which provides a dynamic taint tracking mechanism for Ruby web applications, while not requiring modification to the language and only minor modification to the application code. There is a similar framework for python [Bello and Russo 2012, Conti and Russo 2012] or PhP [Papagiannis et al. 2011], however the latter does not support persistence. We decided to go one step further by separating front-end formatting from handling of sensitive data. We motivate this decision as we believe third parties do not require actual access to the data. Patient privacy is better protected by ensuring that no single third party involved is able to combine the whole set of patient data and should not see those data unencrypted under normal operation.

Separating and encrypting personal and medical data is not a new idea [Heurix and Neubauer 2011, Neubauer and Heurix 2011]. However, because we combine encryption and IFC techniques our encryption scheme can be much simpler. Access delegation in our case is not done through a complex encryption mechanism, but through a relatively simple IFC mechanism by simply providing access by a third party to a particular IFC label. Indeed, complex encryption mechanisms for delegation [Alshehri et al. 2012, Benaloh et al. 2009, Li et al. 2010], can be avoided using our method, while still providing as fine grained access control and encryption as necessary.

Microsoft Health Vault and Google Health [Sunyaev et al. 2010a;b] provide access to third parties to patient medical and personal data. Third parties behave like the front end of our application. They format or modify the information to present it to the end user. However, we argue that it is unnecessary to give those applications access to the data to perform such tasks and that it can potentially be harmful.

6. CONCLUSION

We have designed a system capable of protecting patient privacy between the Medical Data Provider and the User Agent. This is achieved by using the Information Flow Control mechanism to ensure that only the correct end user can access a given set of data. The de-identification, partitioning and encryption of data ensure that in order for an attacker to re-identify a useful number of patients, this attacker needs to compromise several servers.

However, our solution has a number of limitations. First, we did not address security within the user agent. To our knowledge, there is no standard web browser providing *application* sand-boxing. At the moment we trust the front-end to provide a script which does not transmit the data to third parties and we trust the user not to have software running that is capable of capturing the information displayed. With a sandbox ensuring that no data can be transmitted to unspecified i/o (in our case the display) and that no third party application can access the data displayed, we would be able to ensure end-to-end privacy (investigation on enforcement of Information Flow Control in Javascript exists [Austin and Flanagan 2012]). Information Flow Control is not enforced within the database, but at the application level; we believe this is also an area worthy of investigation.

The system proposed in this paper can be applied as it stands to any situation where data should be accessed only by the individual to whom the data relates. Furthermore, when the data is sensitive we believe it is of the utmost importance to store separately the sensitive data and necessary associated personal and/or identifying data. It is likely that a great deal of data will migrate to cloud services; private clouds when the data is sensitive. Here, data is likely to be held in encrypted form. Our approach of keeping the data encrypted and protected until it reaches the end user integrates well with this cloud scenario. As discussed above, we believe that current designs where third parties are allowed access to unencrypted data may eventually lead to unintentional or malicious leakage of patient information.

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INCORPORATING NEW MEDIA IN HUMAN TO HUMAN COMMUNICATION – THE CASE OF OCCASIONAL GREETINGS

Przemyslaw Polak
Warsaw School of Economics
Al. Niepodleglosci 162, Warsaw, Poland

ABSTRACT

The growing popularity of new media has changed human communication practices. The paper presents the results of a survey, conducted among the students from New Zealand, Poland and the Netherlands, on the use of different forms of communications in human to human relations. The study concerns one of the most popular messages sent between people – occasional greetings. The survey shows that the most popular form is an SMS, but traditional greeting cards still compete successfully with other electronic forms. Moreover, sending traditional cards is slightly more popular than using electronic greeting cards provided by social networking services or web portals.

KEYWORDS

Internet, e-society, new media, social networking services, electronic mail.

1. INTRODUCTION

From the time of ancient civilizations to the beginning of the nineteenth century the main forms of human to human communication over long distances did not change significantly. The development of technology in the nineteenth century led to the creation of the telegraph and telephone. In that century, modern, commonly available postal systems were also developed. The development of radio in the beginning of twentieth century did not caused major changes in human to human private communication. Radio and television were available for the majority of ordinary citizens in the form of broadcasted public programs. Whereas, the traditional postal service and telephones remained the main forms of human to human communication over long distances through the majority of the twentieth century (Briggs and Burke 2009).

The developments and convergence of communication and information technology, at the end of the twentieth century, led to the spread of new forms of communication. Particularly important role was played by the Internet and mobile telephony, including electronic mail and Short Message Service (SMS). The percentage of individuals aged 16 to 74 in the European Union (27 countries) using the Internet for sending and receiving e-mails increased from 38% in 2004 to 61% in 2010. Whereas, the number of subscriptions to public mobile telecommunication systems using cellular technology per 100 inhabitants in the UE increased from 20 in 1998 to 125 in 2009 (Eurostat 2012a). Simultaneously, the number of traditional letter post services in the EU fell from 46,487 millions in 2004 to 38,227 in 2010 (Eurostat 2012b). In recent years, can be observed remarkably rapid changes in human communication caused mainly by the growing usage of social networking services (Boyd and Ellison 2007) and the introduction of the new types of mobile devices e.g. smartphones and tablets.

Various statistical data sources show the increasing number of devices and users of new telecommunication services. However, such statistics do not show how particular human social actions and communication behaviors change due to the increasing usage of new technologies, and the replacement rates of old communication forms by new media in particular situations. There are several studies exploring different aspects of communication behaviors and patterns in various environments around the world (Dimmick et al. 2011, Flanagin and Metzger 2001, Petric et al. 2011, Ramirez et al. 2008). Such studies usually report on population, very often limited to students, in one country and cover general area of

communication, e.g. socializing, business relations etc. However, changes and developments of new forms of communication call for new studies showing current situation and trends.

2. RESEARCH METHOD

The purpose of the study was to examine the extent to which new media replace traditional media in human-to-human communication. According to Petric and others, such focus on the actual uses rather than on users' motives might be more relevant for analyzing the social consequences of the uses of interpersonal communication media (Petric et al. 2011).

The study required widely used, but also well-defined and clearly identifiable type of a message, sent using both traditional and new electronic channels. These requirements are met by occasional greetings. Sending this type of a message is a commonly accepted form of social behavior in many cultures, used by different generations and social groups.

Respondents were asked in a questionnaire, how often they use particular forms of communication, if they want to send occasional greetings. They have the choice of four types of messages:

- traditional postal greeting card,
- SMS,
- e-mail,
- dedicated service for sending electronic greeting cards provided by a social networking service or a web portal.

The study was conducted in 2011 and in the first quarter of 2012 at the universities in the Netherlands, New Zealand and Poland. All those countries are developed, free-market democracies and are members of the Organization for Economic Co-operation and Development (OECD). Poland and the Netherlands are also members the UE. Although New Zealand is located in the Antipodes, its culture and political system are strongly entrenched in European (mainly British) background.

The respondents of the questionnaire were students. It is a social group frequently using Internet and easily embracing new technologies (Eurostat 2012a). Therefore, any new trends in the use of new media can be early observed within that group. The study was conducted at three tertiary education institutions:

- Erasmus School of Economics and Rotterdam School of Management, Erasmus University Rotterdam (EUR),
- Warsaw School of Economics (WSE),
- Victoria Business School (Faculty of Commerce), Victoria University of Wellington (VUW).

All questioned students were from bachelor and master programs in various fields related to management, economics and business administration. Hence, all groups from different universities were comparable. Additionally, it was possible to analyze differences between the first and the second degree students.

The survey was conducted using group administered questionnaire, hence, the respond rate was nearly 100%. The high level of external validity was achieved as the result of distributing questionnaires during compulsory classes. Following the rejection of unreliably filled up forms, 660 questionnaires were qualified for an analysis. Furthermore, individual students were interviewed in order to learn in detail about their individual behaviors and preferences.

3. THE POPULARITY OF DIFFERENT FORMS OF COMMUNICATION

The results confirmed the relevance of the choice of the message type for the research. Only 12 respondents (1.8% of all participants) admitted that they never sent occasional greetings in any of the forms listed in the survey, and further 13 participants (2.0%) selected only options "never" or "rarely". Therefore, the survey confirmed the assumption that this type of message is sent regularly by almost all, because as many as 96.2% of respondents.

The results of the study clearly show that SMS messages are the most popular form of sending occasional greetings (see Figure 1). The majority of respondents (51.8%) indicated that they used SMS very often for that purpose, high above any other form (between 12% and 15% of answers). Moreover, this type of a message also received the lowest number of negative indicators. Only 4.5% of students never use that form,

compared to 46.4% never using social networking services and portals, 37.3% traditional greeting cards and 25.6% e-mails.

The dominance of SMS messages may be considered surprising, as occasional greetings, for example birthday or Christmas greetings are often associated with elegant, festive forms. Whereas, SMS messages have very short, concise forms, full of abbreviations and acronyms. The advantage of text messages is, however, high availability and convenience in use. With a mobile phone, SMS can be sent from almost anywhere at any time. Moreover, a recipient usually has an opportunity to read it almost immediately after sending. It is also fairly cheap form, but for example, sending a message via e-mail or using a social networking service usually does not involve any direct costs. Undoubtedly, however, the decisive factor is the overall popularity of SMS messages, especially among young people.

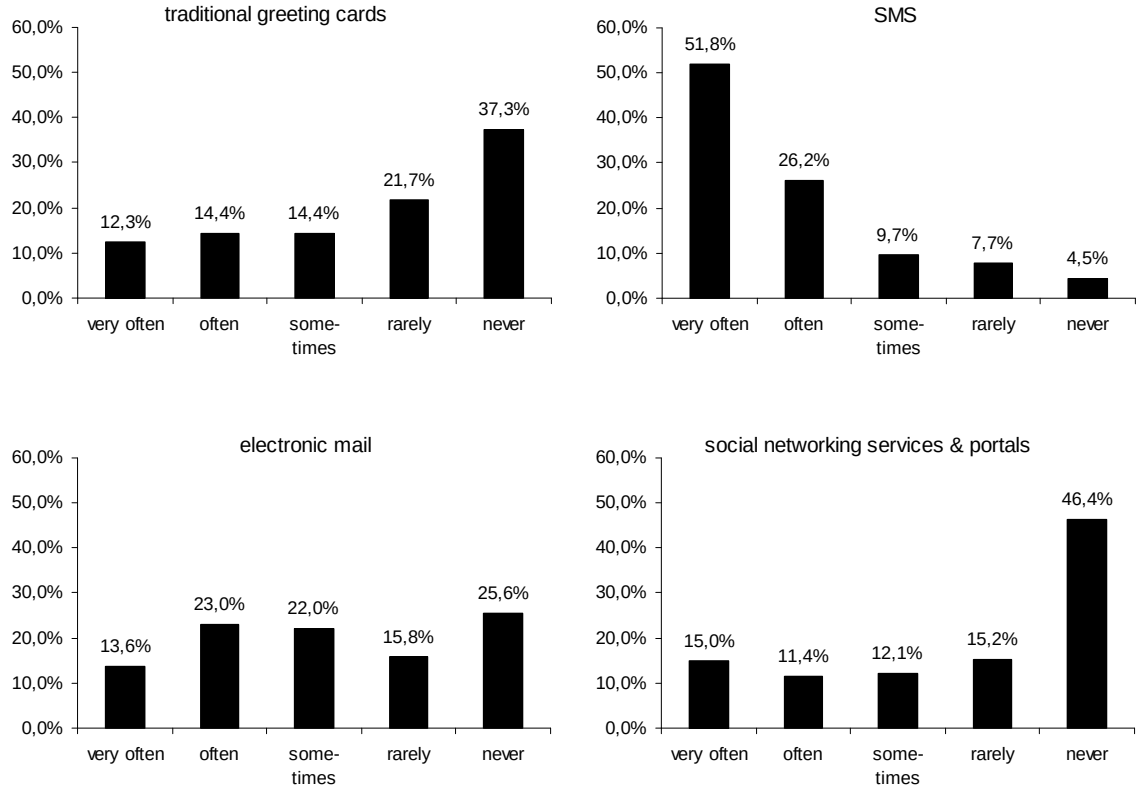

Figure 1. The usage of different media for sending occasional greetings

According to the survey, traditional postal greeting cards are still in use by some students, 26.7% of respondents send them often or very often. On the other hand, 37.3% of respondents do not use them at all and further 21.7% send them only rarely. Individual interviews showed that students use traditional greeting cards mainly in relations with older family members, for example parents and grandparents, which have no access to Internet and do not use mobile phones or smartphones. It can be expected that in time the frequency of the use of this form will become even more decreased, following the growth of population using new media. The only occasion when young respondents send more often paper greeting cards to their contemporaries is Saint Valentine's Day.

The most unexpected observation of the study is the lowest, among the alternatives options, usage of dedicated services for sending electronic greeting cards offered by social networking services or web portals. As many as 46.4% of questioned students do not use such services at all, what is the highest number of negative answers in the survey. Furthermore, only 26.4% of respondents declared to use that form often or very often. It is also surprisingly low result when compared to 78.0% using often or very often SMS messages, 36.6% e-mails and 26.7% traditional cards. Those outcomes are particularly interested and

surprising in the light of the statistics showing that in 2011 in the European Union (27 countries) 83% of students were using the Internet for participating in social networks, among them 86% in the Netherlands and 79% in Poland (Eurostat 2012a).

4. DIFFERENCES BETWEEN THE COUNTRIES

The study was conducted in three universities in different countries. Therefore, the research allows to compare the results of the survey from those universities. However, it should be remembered, that students from a single university are not a homogeneous group. It is a common practice in the modern world to study abroad. In European universities the large group of students comes from other EU countries. In New Zealand many students come from various countries from eastern and southern Asia. The Victoria University of Wellington (VUW) has over 20% of its students having been born outside New Zealand (Victoria University of Wellington 2012). In 2009, the Erasmus University Rotterdam (EUR) had the total number of 23,867 students including 4,547 international students, which is 19% of all students (Erasmus University Rotterdam 2012).

The most homogeneous group of students characterizes the Warsaw School of Economics (WSE). About 750 foreign students is currently studying in the WSE, which is approximately 8% of all students (Uczelnie.pl 2012). The largest groups of students come from former Soviet Union: from Belarus, Ukraine and Kazakhstan.

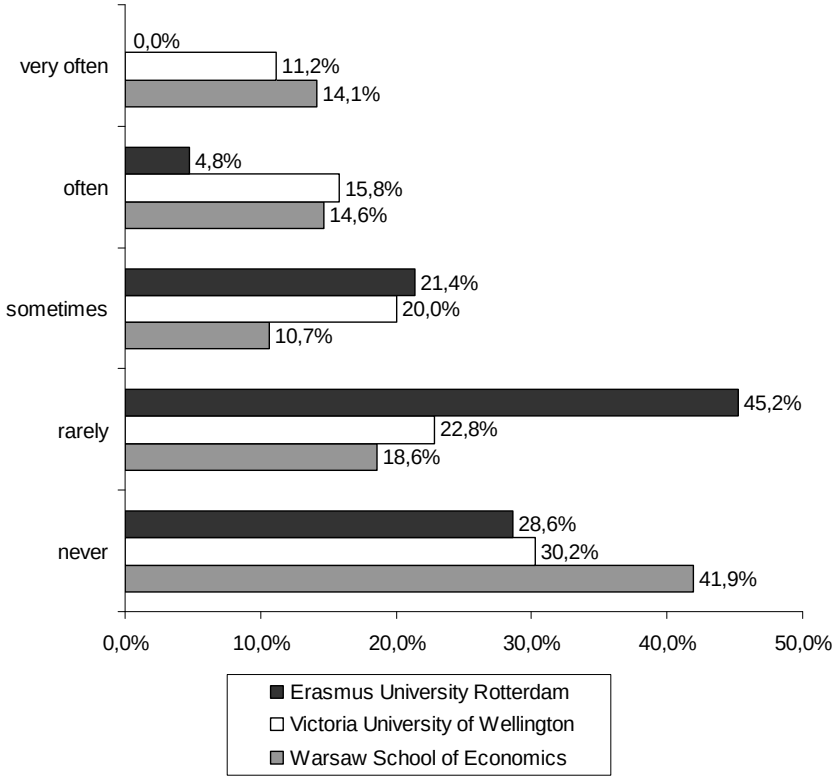

Figure 2. The usage of traditional postal greetings cards for sending occasional greetings

The survey shows that the students from Erasmus University send traditional postal greeting cards considerably less frequently (see Figure 2). None of them declare to use them very often, and only 4.8% often. Whereas, 27.0% of respondents from the VUW and 28.7% from WSE admitted to use them often or very often. On the other hand, exactly two thirds of the participants from EUR (66.6%) sends greeting cards occasionally (rarely or sometimes), noticeably more than in the other universities.

In the case of traditional cards, students from the Warsaw School of Economics took the most decisive position. 28.7% of them (the highest number of indications) send them often or very often, whereas 41.9%

admitted to never use them at all. The number of negative answers is in their case much higher than around 30% in the other two universities.

Significant differences in answers by respondents from different universities concern also the use of dedicated services for sending electronic greeting cards provided by social networking services or web portals (see Figure 3). This form of communication is the most popular among students from the Victoria University of Wellington. 27.0% of respondents from the VUW use it very often, 10% more than from the EUR and nearly 20% more than from the WSE. Furthermore, students form Wellington gave the lowest amount of negative answers considering the use of those services.

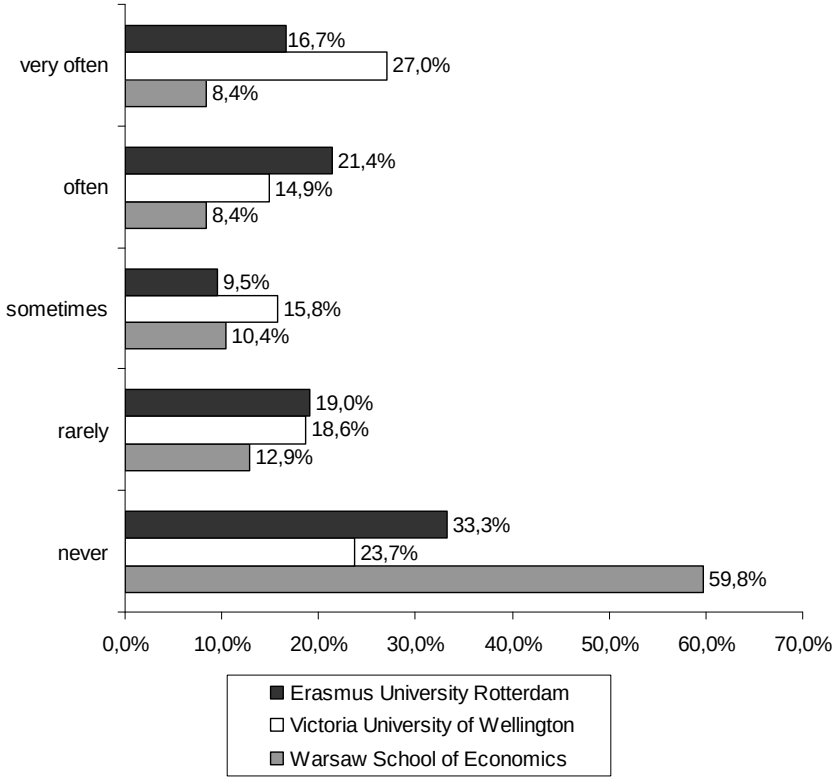

Figure 3. The usage of social networking services and web portals for sending occasional greetings

Completely different level of using social networking services or web portals for sending occasional greetings characterizes students from the Warsaw School of Economics (see Figure 3). As much as nearly 60% of them never send greetings that way, significantly more than in the other universities (33.3% and 13.7% respectively). Moreover, only 8.4% use them very often and also 8.4% use them often. Those outcomes are surprising because according to Eurostat 79% of students in Poland use the Internet for participating in social networks (Eurostat 2012a). The result of the survey may be caused by less intensive usage of social networking service by Polish students.

The answers considering the usage of SMS messages and electronic mail do not show significant differences between students of different universities.

An interesting observation provided the analysis of all answers given by respondents from individual universities. The amount of negative answers (indicating option ”never”) in the survey given by students from the WSE was considerably higher than in the case of other universities (see Figure 4). One participant from Poland gave on average 1.36 negative responses, whereas an average respondent from other universities gave less than one negative answer. It seems that Polish students are more decisive in their choices and opinions or simply less likely to send occasional greetings.

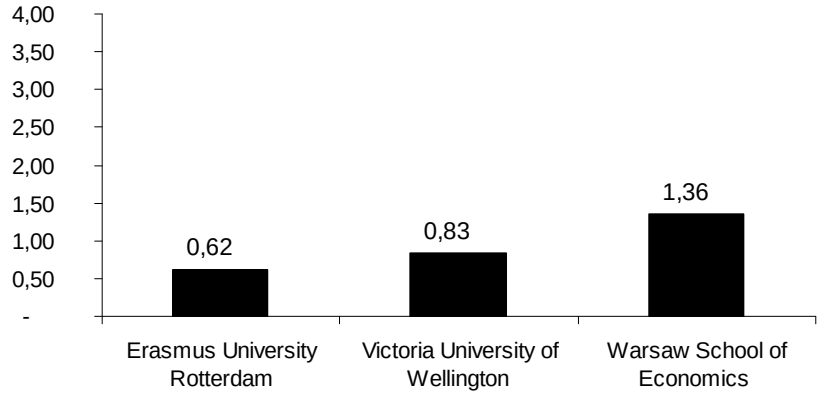

Figure 4. The number of negative answers given in the survey per one participant

5. DIFFERENCES BETWEEN UNDERGRADUATE AND GRADUATE STUDENTS

The first and the second degree students differ in age and experience. Average graduate student is at least 3 years older, but in some cases they are much older than undergraduates. Moreover, second degree students usually have much more work experience. Furthermore, the utilization of new information and communication technologies by younger generations is much quicker. Therefore, it is justified to search for differences between those students, treating them as two separate groups.

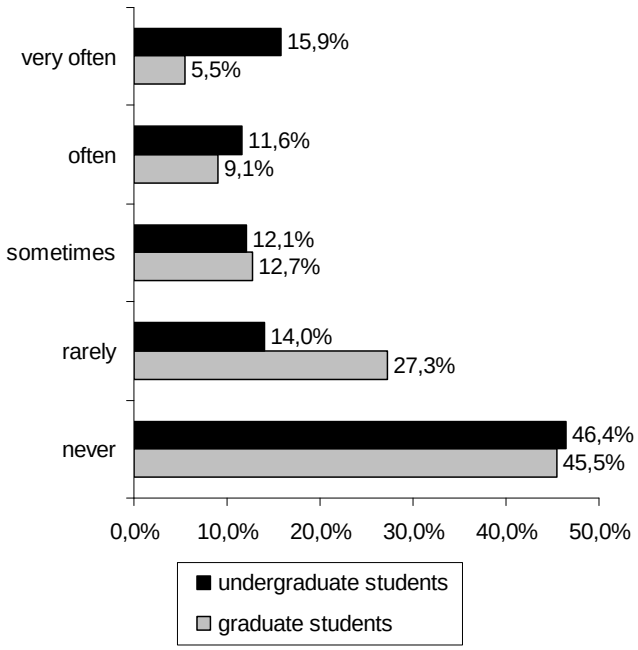

Figure 5. The usage of social networking services and web portals for sending occasional greetings

The study did not confirm an expectation that older respondents (graduate students) use traditional greeting cards more extensively than younger ones. For example, the largest amount of “very often” answers were given by the first degree students from Poland and the second degree students from New Zealand. Also,

no clear correlation was observed between the level of study and the frequency of sending greetings using SMS messages an e-mails.

The only significant difference between the first the and the second degree students considers the usage of dedicated services for sending electronic greeting cards provided by a social networking service or a web portal (see Figure 5). About 10% more undergraduates than graduate students send that type of messages very often. On the other hand, both groups gave nearly the same amount of negative answers about the usage of social networking services.

6. CONCLUSION

The study confirmed that sending occasional greetings remains a popular message transmitted among students. However, there has been a change in the form of messages resulting from the development of new telecommunication technologies in the past two decades. By far, the dominant way of sending wishes in an asynchronous communication mode has become SMS messages, despite their simple, modest form. However, contrary to some opinions, the traditional postal greeting cards remain in use by the majority of respondents to the survey and successfully compete with other modern forms: electronic mail and social networking service.

The most surprising observation from the survey is the lowest, among the alternatives options, usage of social networking services and web portals for sending electronic greeting cards. However, the popularity of sending greetings by social networking services may increase in nearest future as the participation in social networks grows and those services get a lot of attention in media. The author intends to continue the study of this phenomenon in future in order to observe any possible changes and new trends.

The survey showed only few areas of differences between questioned groups of students. Those differences concerns mostly social networking services, the newest and, therefore, the least established medium. The popularity of this form of communication was the highest among students in New Zealand and the lowest in Poland. Also, graduate students turned out to be less intensive users of social networking services then their younger colleagues.

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E-GOVERNMENT IMPACT IN DOING BUSINESS DIMENSIONS, CORRUPTION PERCEPTION, ENTREPRENEURIAL ATTITUDES AND ACTIVITIES

Deborah Moraes Zouain[1], Gustavo de Oliveira Almeida[1]
and Emilia Mathilde Moraes Zouain Sato[2]
[1]*The Brazilian School of Public and Business Administration - Getulio Vargas Foundation*
Praia de Botafogo, 190 - Botafogo, Rio de Janeiro - RJ, 22250-040
[2]*UNIBAN- Unidade Marte/São Paulo, Rua Guarará, 117/32, Jardim Paulista - SP, 01425-001*

ABSTRACT

This article seeks to understand the impact of e-government readiness on Ease of Doing Business, Corruption Perception and its relationships the on the attitude toward entrepreneurship and rate of new entrepreneurs. Data was collected from various databases, for the years 2008, 2010 and 2012 using a panel data study design. The study several reports: Doing Business Report from World Bank, E-Government Survey from the United Nations, Corruption Perception Index by Transparence International and GEM data from Global Entrepreneurship Monitor. Nonparametric correlation analysis and other statistical tests were performed. A model based on Azjen's Theory of Reasoned Action (with attitude, subjective norms and perceived control of behavior) was employed to predict entrepreneurial intention, and new business rate using the methodology of the partial least squares. The model was able to predict over 57% of the intention of starting a new business, which in turn predicted over 55 % of the rate of new business in the sample of countries and years considered (2008, 2010 and 2012). Future research to understand the real of impact of e-government is suggested.

KEYWORDS

E-Government; Entrepreneurship; Doing Business; Attitudes; New Business

1. INTRODUCTION

The e-government does not mean the mere use of information technology (IT) in the government, but the introduction of a new interface with governmental stakeholders. Even long before the Internet emerged in the late 1980s, governments around the world were already actively pursuing IT solutions to improve operational efficiency, cost saving and data management (Brown 1999; Norris & Kraemer 1996).

However, new forms of interaction have emerged more recently. Due to the high growth of social media sites, Web 2.0 and related technologies, the e-government became more participative following these Internet trends. In this new form of interaction the e-government is becoming more consultative, with a two-way relationship, using citizens' opinions and suggestions, and sporting a much higher participation of the citizens to support the definition of policies and priorities to the government, and providing a higher transparency of the government actions and spending (Halpern and Katz, 2012).

Business also can potentially benefit from a fast, responsive and complete e-government strategy. Those characteristics are known as enablers for enterprise creation and maintenance, as measured by The Doing Business Report (World Bank, 2011). The Doing Business Report provides a quantitative measure of regulations for starting a business, dealing with construction permits, employing workers, registering property, getting credit, protecting investors, paying taxes, trading across borders, enforcing contracts and closing business—as they apply to domestic small and medium-size enterprises (World Bank, 2011).

A better e-government strategy could, in theory, also diminish the corruption perception via added transparency and accountability of governmental transactions (Xenos & Moy, 2007) and provide easier access to services to start or operate a business, avoiding chances for corruption, since the procedures tend to

be fast, functional and well reported. This would make a country more competitive with lower corruption and easier to conduct business, potentially resulting in creation of new firms.

Gupta and Jana (2003) state that e-government is no longer just an option but a necessity for countries aiming for better governance. Similarly, Brunetti and Weder (2003) point out that free press has a strong association between level of press freedom and level of corruption across countries, even when using various instruments to measure freedom and corruption.

The United Nations (UN) has created an index known as e-government Readiness Index, as an initiative to measure the progress of the adoption of the electronic government solutions in different countries composed by three sub-indexes (four in 2012 e-government Readiness Index). They are: Online Service, human capital, telecommunication infrastructure and e-participation indexes(UN, 2011). The e-readiness concept was created to provide a unified framework to evaluate the breadth and depth of the digital divide between more and less developed countries (P. Hanafizadeh, M.R. Hanafizadeh, & Khodabakhshi, 2009).

The Web Measure Index 2008 is based upon a five-stage model (Andersen & Henriksen, 2006), while in the 2010 report it was renamed to Online Service Development (United Nations, 2011), both were built upon the previous levels of sophistication of an UN Member State's online presence. As a country goes upwards through the various stages, it is ranked higher in the Web Measure Index (United Nations, 2009).

The Connected Government Stage is the most developed level of sophistication of the e-government and implies a governmental transformation into a connected entity that responds to the needs of its citizens by the development of an integrated back office. It also means a greater connection with different levels of governmental agencies (i.e., local, federal, state), between citizens and government, and between the citizen, government, and all stakeholders (United Nations, 2009). In the last years, the most developed nations have made greater progress in the implementation of e-government solutions, especially the most developed European countries, U.S., South Korea and Japan, letting most of the world in a more modest state of adoption of more sophisticated e-government (Alomari, Woods & Sandhu, 2012; Khalil, 2011).

Dunleavy, Margetts, Bastow and Tinkle (2007) state that governments around the world spend every year billions of dollars in IT systems, in many countries it costs around 1.5 per cent of GDP yearly, for instance, the United Kingdom alone commits 14 billion £ a year to support public sector IT operations. Therefore, the level of e-government sophistication varies widely across the globe, since it requires substantial investment to enhance infrastructures as well as services to citizens (Ebrahim, & Irani, 2005).

In a study conducted by Zhao (2011), high correlations were found between GDP per capita and e-government development index (r=0.69) and the telecommunication infrastructure index (r=0.81), indicating that the level of economic development of a country is one of the major factors affecting the development of e-government and telecommunication infrastructures. Likewise, Khalil's (2011) study found that GDP explains 53% of the variance in e-government readiness.

Similarly, countries also spend substantial resources to encourage, support and stimulate citizens to start new business (WONGLIMPIYARAT, 2009). The idea that the growth of small companies contributes to the economic prosperity is universally accepted (MARTIN & PICAZO, 2009). Regardless, the entrepreneurial rates and conditions vary widely between countries (BAUMOL, 1990, p.898), indicating that the entrepreneurial process has innumerous variables and particularities. Shapero and Sokol (1982) indicate that the convergence of attitudes and situational factors that spur a person to the start a business. Robinson, Shaver and Wrightsman (1991) define attitude as a learned predisposition to behave in a consistently favorable or unfavorable manner with respect to a given object.

One of the most used models to explain relationship between attitudes and behavior is the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975). The authors affirm that attitudes and subjective norms should be combined to determine the intentions of behavior, which in turn would initiate the actual behavior or action. Ajzen (2011) also indicates that human action is influenced by three different factors: a positive or negative evaluation of a behavior (attitude), a social pressure to realize or not the behavior (subjective norms) and the perception of being able to execute the behavior (self-efficacy). In this paper, the impact of e-government readiness on corruption perception, the ease of doing business and entrepreneurial attitudes were used to predict the intention of starting a business, on a model based on TRA (Azen, 2011).

2. METHOD

The analyses were performed with the software: SPSS 20.0 (IBM) and SMARTPLS 2.0, used to compute non-parametric correlations, partial least square model specification, and data input, analysis and treatment. This study used a panel design, where a variable is measured more than once for the same subject, in this study design in different time periods. According to Hsiao (2003), panel data have been increasing popular mostly because the great availability of data in this format, being more able to answer substantial questions than a single set of indicators, that is used in cross sectional data. The figure 1 shows the study design:

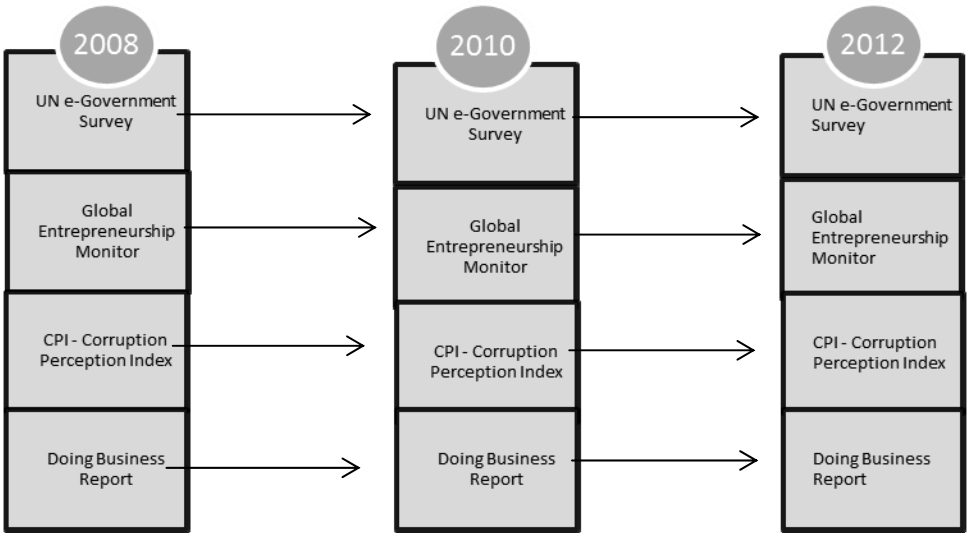

Figure 1. Scheme for the Data for the Study

The data were obtained for three years (2008, 2010 and 2012). The databases used were Doing Business Report in the years 2008, 2010 and 2012 edited by the World Bank (World Bank, 2009), UN e-government survey 2008, 2010 and 2012 (UN, 2012). The data were imported and treated in Microsoft Excel 2010. The following variables from the Global Entrepreneurship Monitor Data for 2008, 2010 and 2011 were used:

Table 1. Definitions of the variables used from the global Entrepreneurship Monitor

Variable	Definition (Percentage of 18-64 population)
Established Business Ownership Rate	% who are currently owner-manager of an established business, i.e., owning and managing a running business that has paid salaries, wages, or any other payments
New Business Ownership Rate	% who are currently an owner-manager of a new business, i.e., owning and managing a running business that has paid salaries, wages, or any other payments to the owners for more than three months, but not more than 42 months
Fear of Failure Rate	% with positive perceived opportunities who indicate that fear of failure would prevent them from setting up a business
Entrepreneurship as Desirable Career Choice	% who agree with the statement that in their country, most people consider starting a business as a desirable career choice
Perceived Opportunities	% who see good opportunities to start a firm in the area where they live
Entrepreneurial Intention	% (individuals involved in any stage of entrepreneurial activity excluded) who intend to start a business within three years
Perceived Capabilities	% who believe to have the required skills and knowledge to start a business
Media Attention for Entrepreneurship	% who agree with the statement that in their country, you will often see stories in the public media about successful new businesses
High Status Successful Entrepreneurship	% who agree with the statement that in their country, successful entrepreneurs receive high status

Source: Global Entrepreneurship Monitor (GEM) Key Indicators and Definitions (2011)

Finally, the last report utilized was the Corruption Perception Index (CPI), that measures the perceived level of public-sector corruption in 180 countries and territories around the world (Transparency

International, 2010), for 2008, 2010 and 2012. For GEM data, 2011 was the most updated year, and was used as a proxy for 2012 data. Some indicators were inverted to provide an easier interpretation of the correlation coefficients; and are represented with (INV).

3. ANALYSIS

To compute the relationship between the variables, the Spearman's correlation coefficient was used. According to Miles and Shevlin (2001) when the relationship between two variables is not normally bi-variate or when one is measured at a ordinal level, the Pearson coefficient may not be the best estimative. The Spearman coefficient measures the intensity of relationship using ranking position instead of the observed values (Miles & Shevlin, 2001). The results are presented in the table 2:

Table 2. Spearman correlations between E-government ranking and ease of doing business rankings

	E-Government ranking (INV)	**Corruption Perception Index**	**New Business Ownership**
E-Government Ranking (INV)	1,000	,742**	-,540**
Corruption Perception Index	,742**	1,000	-,514**
Doing Business - Closing a Business (INV)	,657**	,660**	1,000
Doing Business - Construction Permit (INV)	,365**	,491**	-,417**
Doing Business - Enforcing Contracts (INV)	,561**	,508**	-,252**
DB - Ease of doing business ranking (INV)	,777**	,785**	-,318**
Doing Business - Getting Credit (INV)	,639**	,541**	-,411**
Doing Business - Paying taxes (INV)	,363**	,530**	-,294**
Doing Business - Protecting investors (INV)	,457**	,431**	-,194**
Doing Business -Registering property (INV)	,481**	,438**	-,170*
Doing Business - Starting a business (INV)	,488**	,528**	-,112
DB - Trading (INV)	,668**	,733**	-,357**

**. Correlation is significant at the 0.01 level (2-tailed). (INV) –variables inverted to provide easier interpretation.
*. Correlation is significant at the 0.05 level (2-tailed).

For the data relations considered, a higher ranking in e-government readiness was associated with lower Corruption Perception. In addition, the dimensions of Ease of Doing Business were inversely associated with perception of corruption. The ranking scores were inverted to allow an easier interpretation of the results, since a high CPI indicates low perception of corruption. It means that the better a given country ranks in e-government readiness and ease of doing business, the less corrupt it appears. Nevertheless, countries with better ranking on doing business, and e-government readiness seem to sport a lower rate of population owning a new business than the countries that are more perceived as corrupt.

Table 3. Correlations between entrepreneurship attitudes and activities

	1	2	3	4	5	6	7	8	9
New Business Ownership Rate(1)	1,000	, 515**	,732**	-,291**	,704**	,494**	,449**	,342**	,554**
Perceived Opportunities(2)	,515**	1,000	,279**	-,256**	,494**	,349**	,333**	,351**	,577**
Estab. Business Ownership(3)	,732**	,279**	1,000	-,221**	,424**	,211**	,324**	,262**	,350**
Fear of Failure Rate (4)	-,291**	-,256**	-,221**	1,000	-,240**	-,240**	-,116	-,074	-,445**
Entrepreneurial Intention (5)	,704**	,494**	,424**	-,240**	1,000	,562**	,272**	,288**	,647**
Entrepreneur Desirable Career (6)	,494**	,349**	,211**	-,240**	,562**	1,000	,358**	,447**	,553**
Media Attention (7)	,449**	,333**	,324**	-,116	,272**	,358**	1,000	,380**	,241**
High Status Entrepreneurship (8)	,342**	,351**	,262**	-,074	,288**	,447**	,380**	1,000	,280**
Perceived Capabilities (9)	,554**	,577**	,350**	-,445**	,647**	,553**	,241**	,280**	1,000

**. Correlation is significant at the 0.01 level (2-tailed).

The correlation analysis indicate that the higher percentage of the population perceive opportunities to start a firm, and where entrepreneurship holds a higher status as an occupation, and a more favorable media coverage, people tend to have less fear of failure to start a business, and are more willing to start a new business in the next three years. These countries also have a present with a higher rate of new business.

After performing the correlational analysis, a Partial Least Squares (PLS) model was specified to regress the various predictors into the new business owner rate. Rigdon (1998) point out that structural equation modeling (SEM) has taken up a prominent role within the academic literature of many fields. The partial least squares approach to SEM (or PLS path modeling), was originally developed by Wold (1966), and is an alternative to the more prominent covariance-based method. In PLS the explained variance of the endogenous latent variables is maximized by estimating partial model relationships in an iterative sequence of ordinary least squares (OLS) regressions. Other advantage is that PLS path modeling is a soft-modeling technique that has less rigid distributional assumptions on the data (Hair, Ringle, & Sarstedt, 2011).

For this procedure were selected the variables that could be possible predictors of new business, according to the literature review, and then those variables were inserted in SmartPLS software version 2.0. To emulate Azjen's (2011) components of the Theory of Reasoned Action we used the Perceived Opportunities and Entrepreneurship as Desirable Career as the *Altitudinal* component, the variables High Status Entrepreneurship and Media Attention for Entrepreneurship as the *Subjective* component and perceived capabilities as the *Perceived Behavioral Control* component.

Furthermore the other variables were e-government ranking (INV), Doing Business Ranking (INV), Corruption Perception Index, and as the dependent variables, we have selected new business ownership rate and entrepreneurial intention. The model, with the associated statistics, is available in figure 2:

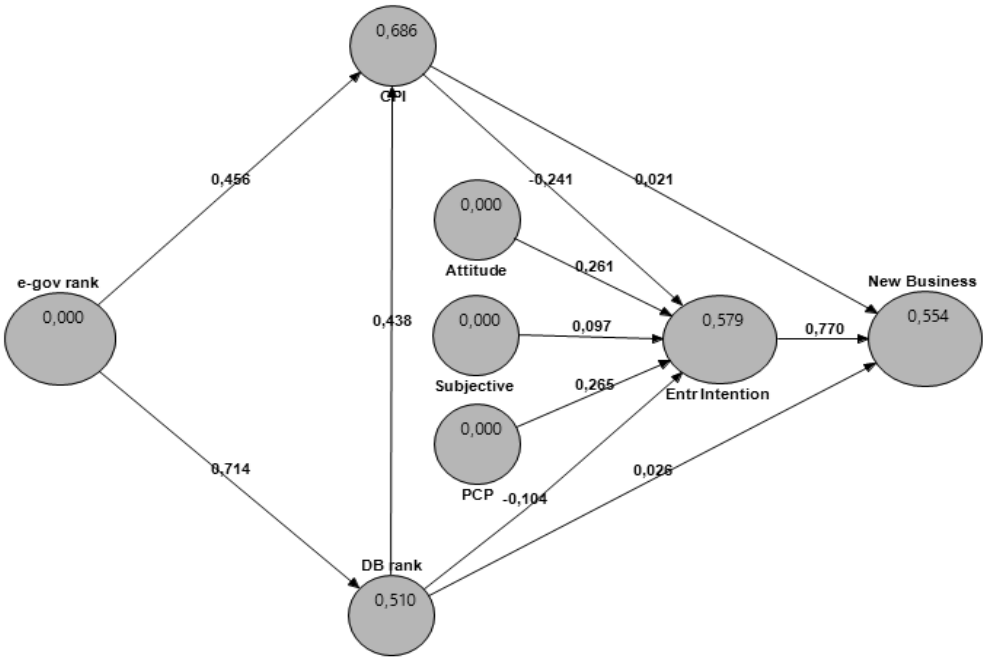

Figure 2. PLS Model Estimation of entrepreneurial intention and new business ownership rate

The model was able to explain almost 56% of the variance on the rate of new entrepreneurs (r2=0,554; p<0.000). In a similar way, the proposed three components of attitude toward entrepreneurship, subjective norms and perceived control of behavior, explained almost 58 % of the entrepreneurial intention. Although the e-government was positively correlated, and predicted very well doing business ranking position (r2=0.510; p<0.000) and lower perception of corruption (r2=0,686; p<0.000), it did not influence positively the entrepreneurial intention, and only had a marginal impact in the rate of new business. To access the statistical significance of the path coefficients a bootstrapping with 1000 resampling was performed. Boot strapping is a resampling method for conveying measures of accuracy to sample estimates (Efron & Tibshirani, 1993). Total effects and other statistics related statistics are displayed in table 4:

Table 4. Boot strapping - Total effects and related statistics

Effect **(Endogenous -> Exogenous)**	**Original Sample (O)**	**Sample Mean (M)**	**Standard Deviation (STDEV)**	**Standard Error**	**T Statistic**
Attitude -> Entrepreneurial Intention	0,2612	0,2648	0,0435	0,0435	6,0063
Attitude -> New Business Rate	0,2011	0,2039	0,0350	0,0350	5,7493
Corruption Perception -> Entrepreneurial Intention	-0,2411	-0,2413	0,0380	0,0380	6,3480
Corruption Perception -> New Business Rate	-0,1650	-0,1641	0,0469	0,0469	3,5173
Doing Business Ranking -> Corruption Perception	0,4383	0,4395	0,0306	0,0306	14,3041
Doing Business Ranking -> Entrepreneurial Intention	-0,2099	-0,2107	0,0391	0,0391	5,3663
Doing Business Ranking -> New Business Rate	-0,1260	-0,1275	0,0516	0,0516	2,4405
Entrepreneurial Intention -> New Business Rate	0,7701	0,7698	0,0333	0,0333	23,1451
Perceived C. of Behavior -> Entreprener. Intention	0,2651	0,2607	0,0372	0,0372	7,1161
Perceived C. of Behavior -> New Business Rate	0,2041	0,2010	0,0319	0,0319	6,3969
Subjective Norms -> Entrepreneurial Intention	0,0969	0,0977	0,0347	0,0347	2,7892
Subjective Norms -> New Business Rate	0,0746	0,0753	0,0272	0,0272	2,7475
E-government ranking -> Corruption Perception	0,7691	0,7688	0,0120	0,0120	64,0158
E-government ranking -> DB rank	0,7144	0,7135	0,0213	0,0213	33,4746
E-government ranking -> Entrepreneurial Intention	-0,2599	-0,2605	0,0295	0,0295	8,7961
E-government ranking -> New Business Rate	-0,1653	-0,1661	0,0303	0,0303	5,4501

Parameters: Missing Values - Case Wise replacement- 549 cases (all periods included) - 1000 resampling performed

The results of the boot strapping show that all total effects were statistically significant (t- statistic ranging from 2.774 to 64,015). The higher effect was from E-government to Corruption Perception with a path coefficient of 0.7691 ($p<0.001$), the lower was from the Subjective Norms Component, composed of high status and positive media depiction of entrepreneurship, to New Business Rate with a path coefficient of 0.0746 ($p=0.005$). Since the e-government readiness is composed by the three sub-indexes: human capital, infrastructure and online services, an additional correlation analysis was performed, and infra-structure was the most related index to new business rate, again in an inverse relationship, as seen in figure 3:

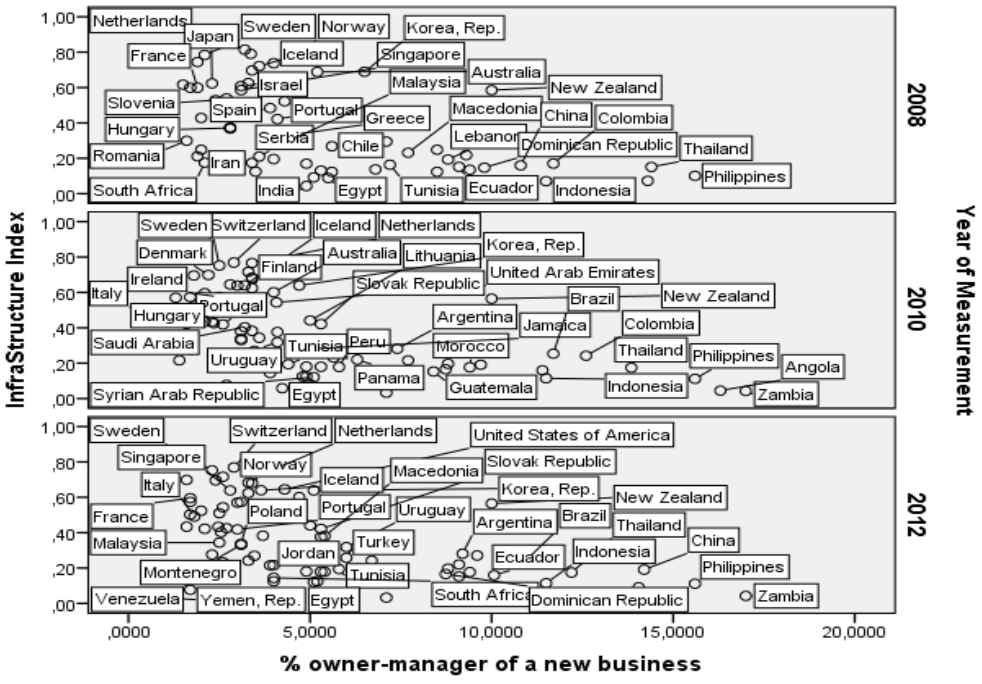

Figure 3. E-government readiness and infrastructure compared with new business rate

The figure 3 is very revealing because shows a clear pattern of less developed country (using infrastructure as a proxy) with significantly higher percentage of owner or manager of a new business. These countries seem to be economies that have been sporting a recent growth in recent years, and leading to a

spurious correlation, that in a first analysis would suggest that e-government and better business atmosphere (as measured by doing business indicators) would be in detrimental to new business creation.

4. CONCLUSION

The results were in the most part according to the expected relationships according to the literature review, indicating that the e-government readiness is highly related with the ease of doing business dimensions and with lower perception of corruption in the studied countries. In addition, in the model that was specified to test Azjen's Theory of Reasoned Action in context of entrepreneurship was also statistically significant, predicting over 57% of the intention of starting a new business, which in turn predicted over 55 % of the rate of new business in the sample of countries and years considered (2008, 2010 and 2012).

An important feature of PLS methodology that was used is to calculate the total effect, that is, direct and indirect effects, and its significance. These results show that all considered relationships were statistically significant, although the sign of the impact of e-government readiness ranking, doing business ranking and corruption perception index were all negative.

This result can be attributed to the lower growth of the more developed countries in the considered years, coupled with a lower intention to start a new business, probably due to economic crisis and governmental austerity measures, mainly in European countries. To test this hypothesis future research should run models with different groups, and considering GDP growth and other variables to corroborate those affirmations.

In the same way, it is always important to note that the composition formula for the e-government readiness index indicates that to furnish a successful web-presence is not the sole answer for a successful e-govern implementation (UN, 2009). The dimensions of formal education and infrastructure are determinant to the use of the electronic platforms by the recipients, the country citizens. The more prepared the population is to use the tools provided, the higher would be the effectiveness of a given e-govern initiative. Several studies point out that in the implementation of e-government projects the main problems usually are not technical, but instead were policy issues (EGOV, 2003).

Also, although e-government can help the establishment of entrepreneurship, many other factors are at play including economic and social variables that were not considered in this research, and in most cases are not within e-government possible range of interference. For the future research, we suggest that the way in which the e-government initiatives impacts developed and in development countries be investigated, using divided samples, and additional databases, and other research designs, including case studies.

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A CASE STUDY OF FEED-IN TARIFF PERSONAL CARBON ALLOWANCE

Takayoshi Kitamura, Asao Takamatsu, Hirotake Ishii and Hiroshi Shimoda
Graduate School of Energy Science, Kyoto University, Japan
Yoshidahonmachi Sakyo-ku Kyoto city, 606-8501, Japan

ABSTRACT

Since the Great East Japan Earthquake, Japanese energy and climate problems stand at a critical junction which requires an innovative energy and environmental policy. The idea of Personal Carbon Allowance (PCA) system which has been under discussion in United Kingdom is one of the innovative policies which have the potential to solve those issues. The authors have been proposed Feed-in Tariff PCA (FIT-PCA) as a suitable policy for Japan. The main purpose of this scheme is to encourage citizens to manage their CO_2 emissions from their daily lives, furthermore, it is expected to improve their attitudes to global environmental issues. In the psychological model to express their behavioral changes, it is assumed that the experience of FIT-PCA causes loss aversion, goal setting and eudaimonia, and they change their life styles to pro-environmental ones. In this study, a case study has been conducted for half a year in cooperation with 30 households to investigate the validity of the model and the change of their energy reduction behaviors and attitudes to global environmental issues. This case study is under progress and this paper reports the intermediate results.

KEYWORDS

Personal carbon allowance, Feed-in tariff, Case study, Climate policy, Energy policy, Pro-environmental behavior

1. INTRODUCTION

In Japan, reduction of CO_2 emission towards realization of a low-carbon society has been progressing in the industrial sector. On the other hand, in the household sector, it has not progressed enough. Under the Kyoto protocol, Japan has pledged to reduce 6 percent of CO_2 emissions of 1990 (Kyoto protocol base year) by 2012. In order to reduce CO_2 emissions, Japanese government has encouraged use of nuclear energy because more than 80% of greenhouse gases are CO_2 emissions from energy source in Japan (Ministry of Environment, 2012) and the nuclear energy does not emit CO_2 when generating electricity. However, the Great East Japan Earthquake and the following accident at Fukushima Dai-ichi Nuclear Power Plants significantly damaged public trust in the safety of nuclear power (Ministry of Economy, Trade and Industry, 2012). Therefore, nuclear energy can be no longer expected to be relied on. Other renewable energies such as solar, wind, geothermal and biomass are still under development and they cannot be replaced with the conventional thermal and nuclear energy because of their instability and inefficiency. In conclusion, it is necessary to change our energy policy dramatically, for example, introducing an innovative energy policy such as a carbon tax which imposes economic burden or constraint for the emission of CO_2 from our daily lives.

Personal carbon allowances (PCA) system is the policy in which the government distributes the right to emit CO_2 to citizens and manage them (Howell, 2012). The PCA system has been studied mainly in the UK and it is expected not only to reduce CO_2 emissions but also to improve our environmental attitudes as a non-economic effect (Capstick and Lewis, 2010). Japanese government however has no experience to introduce CO_2 emission management system when using energy. It is therefore difficult to adapt the research results in the UK directly to Japan.

The authors have proposed Feed in Tariff PCA (FIT-PCA) suitable for Japan, which has employed the idea of German feed-in tariff rule of electricity trading (Huenteler et al., 2012) where the government purchases and sells the remaining allowance at a fixed price. This idea can avoid the decrease of their motivations for CO_2 emission management caused by the price instability in the conventional PCA systems

and encourages the investment in housing equipment for reducing CO_2 emission because they can easily design their future energy management plan. In order to investigate the public acceptance and problems of the FIT-PCA, The authors conducted a questionnaire survey (Kitamura et al., 2012). As the result, the total support rate of FIT-PCA compared with assumed a down-stream Carbon Tax was 60.5%. It was also found that the presentation of the average CO_2 emissions of general public affects their attitudes of energy consumption. However, it is not revealed yet about what has the effect of promoting their pro-environmental attitudes and behaviors when actually introducing FIT-PCA. The purpose of this study is to conducts a case study of FIT-PCA and to examine the effects based on the psychological model which assumes that it promotes their pro-environmental behaviors caused by the effects of loss aversion, goal setting and eudaimonia.

2. FEED-IN TARIFF PERSONAL CARBON ALLOWANCE (FIT-PCA)

2.1 Proposal of FIT-PCA

Since the PCA systems studied in the UK and Nordic countries allow the citizens to trade their allowances between themselves or in the market, the management effect of CO_2 emission is greatly affected by the price of allowance deals. In addition, the lives of the people who have to consume much energy may be pressured when the price becomes high. On the contrary, when the price becomes low, the motivation to reduce energy consumption and CO_2 emission may be discouraged. This instability may spoil the effect improving their pro-environmental attitudes and behaviors by managing their own CO_2 emissions. In addition, such as a policy of downstream carbon tax which is the direct economic burden to the consumers has not existed in Japan. To solve these problems, FIT-PCA has been designed based on three principles which are “Simplicity”, “Effectiveness” and “Fairness”. The details of the principles will be described as follows;

2.1.1 Simplicity

FIT-PCA mechanisms must be comprehensive and the procedure must be simple. Because the ideas of imposing a constraint on CO_2 emissions is relatively new and current emission trading system is applied only to companies, it is unfamiliar to the public at present.

2.1.2 Effectiveness

FIT-PCA should be effective for the citizens to improve their pro-environmental attitudes and behaviors. This is the main purpose of this policy. It is also expected to give a good influence to solve other social issues because its affected fields can be broad.

2.1.3 Fairness

FIT-PCA should not cause the feeling of unfairness because it is applied to various kinds of people who live in various areas and situations such as ages, number of family members, climates of residential areas and house forms, and these varieties affect the amount of CO_2 emissions. FIT-PCA needs compensatory rules to reduce such unbalance caused by the varieties.

2.2 Rule Details

2.2.1 System Flow

Figure 2 shows the basic flow of FIT-PCA.

(i) Government distributes free personal carbon allowance (PCA) to the citizens periodically and equally. Here the PCA means how people have the right of CO_2 emission from their daily lives.
(ii) They have to redeem the PCA when they purchase / consume energy such as electricity, gas, gasoline, light oil and heating oil which originate in fossil fuels.
(iii) If they don’t have enough PCA when purchasing the energy, they have to also purchase the shortage of PCA for a fixed price.

(iv) They can sell the excessive PCA to the government for a fixed price if they don't need it. In this system, they have to manage their CO_2 emission by their energy consumption and it is expected not only that they reduce their energy consumption and CO_2 emission but also that their pro-environmental attitudes and behaviors are fostered..

2.2.2 Distribution Amount and Period of PCA

The PCA is transferred to all the individual PCA accounts equally without charge at the beginning of each month. The amount is one-twelfth of annual amount decided based on the annual average of CO_2 emission per person. The account is allowed to be kept for 12 months including the distribution month (banking system). The PCA which exceeds 12 months will be expired and disappears from the account. Due to this rule, the government would be able to prevent from weakening the effect of PCA management after the next fiscal year.

The PCAs which are distributed to children should be managed by their parents or protectors. And the transfer and integration of PCA inside the same household is allowed because the energy consumption of their daily lives can be managed only by their household units.

2.3 Prerequisite

2.3.1 Countermeasure for the Carbon Leakage

For the realization of the FIT-PCA, the problem of the carbon leakage must be solved. It occurs in the scene when the PCA is redeemed, because it is difficult in some cases to determine whether the CO_2 is from their daily lives or their business activities, especially in the self-employed business. Therefore, when government introduce the FIT-PCA, it will be required the downstream carbon tax for the CO_2 emissions from the business activities is also introduced at the same time. The rate of the downstream carbon tax should be equal to the cost when purchasing as the PCA. In this system for example, self-employed people can apply their own PCA to both their daily lives and their business activity, however, they have to pay the same amount of money when the CO_2 emission is exceeded their own PCA.

2.3.2 Infrastructure

In Japan, they have the data of residential basic book system (Ministry of Internal Affairs and Communications, 2012). By utilizing this data and advanced information system such as IC card system, it is relatively easy to realize the infrastructure of the FIT-PCA system.

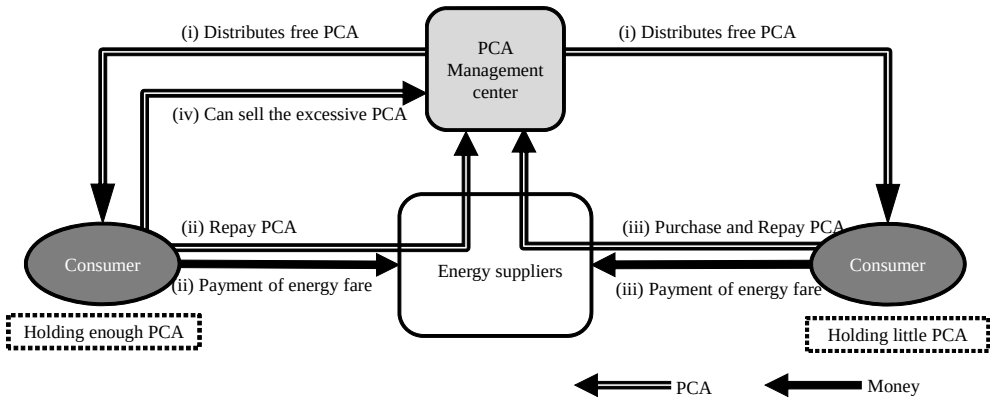

Figure 1. Flow of FIT-PCA.

2.4 Psychological Model of FIT-PCA

In order to examine whether FIT-PCA encourages eco-friendly behaviors and attitudes or not, this study have modeled its psychological effect as shown in Figure 2. This model is based on four theories: loss aversion, goal setting, eudaimonia and self-perception.

2.4.1 Loss Aversion

The "Loss aversion" is employed from the prospect theory (Kahneman, 1979). It refers to their strong tendency to avoid losses comparing with to make profit. This tendency is influenced by the price or a length of time. Although the price of PCA is not so expensive in the FIT-PCA, the authors expect that the loss aversion would play an important role to improve their CO_2 management.

2.4.2 Goal Setting

Locke claimed that the goal setting affects their motivation and performance (Locke, 1969). In the FIT-PCA, the amount of distributed PCA is set considering the average of CO_2 emission from their daily lives. Therefore, the following effects can be expected.

1. Rational target: The target performance is better if there is a difficulty. However, it requires the rational reason.
2. Clear goal: A clear and specific goal can foster high motivation.
3. Effect of feedback: When the feedback is combined with the target setting, it improves their motivation.

2.4.3 Eudaimonia

The "Eudaimonia" is a Greek word associated with Aristotle. This is the highest human good state of well-being and prosperous (Waterman, 1993). You will feel the eudaimonia when you are living well in our society. In the FIT-PCA, the authors expect the person who makes an effort to reduce CO_2 emission would feel the eudaimonia.

2.4.4 Self-perception

This is one of the theories on behavior mechanism. Bem claimed people develop their own attitudes, beliefs, and other internal states by observing their own behaviors (Bem, 1972). Therefore, in the FIT-PCA, participants may have developed their attitude by observing their own behaviors reducing CO_2 emissions. And they maybe perceive their own behaviors in connection with global environmental issues. This expectation can be also explained by cognitive dissonance theory.

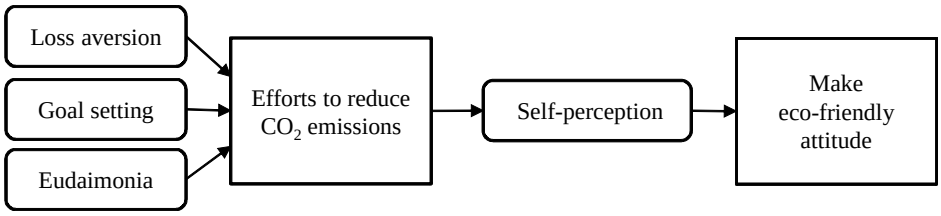

Figure 2. Psychological model of FIT-PCA.

3. A CASE STUDY OF FIT-PCA

3.1 The Purpose of the Case Study and Overview

The purpose of this study is to examine the effects which improve their attitudes and behaviors to reduce CO_2 emission when FIT-PCA is introduced in their lives. In this study, therefore, a case study has being conducted for a half year in cooperation with 30 households to investigate how they change their energy saving behaviors and attitudes on global environmental issues when FIT-PCA is imaginarily introduced. Figure 3 shows an overview of this case study. In the case study, a web system has been developed which realizes PCA accounts virtually. The participants can view the information about not only their balance of PCA but also bar graphs of CO_2 emissions with general average line in this web system. The overall procedure of the case study is shown below;

1. The participants input their energy consumption data which they used in the household to the web system when they pay for the energy.

2. They check their CO_2 emissions and the balance of PCA.
3. They answer the questionnaire once a month in order to examine the change of their attitudes and behaviors.
4. The above 1-3 is repeated for six months (From July to December 2012).

In this study, the reward to be paid to the participants is changed depending on how they trade their PCA in order to realize its economic effect. In addition, the participants have been divided into two PCA price groups, 1 or 10 JPY/kg CO_2 in order to examine the effect of loss aversion.

3.2 Methods of Case Study

3.2.1 The Design of FIT-PCA Account Inventory (FAI)

Case study participants can understand their balance of CO_2 emissions and PCA of the month by inputting the amount of their consumed energy to FIT-PCA account inventory (FAI). In this case study, the amount of PCA which distributed to the participants was set 150 kg- CO_2/month. It is because the average of CO_2 emissions by Japanese household per capita is 167 kg-CO_2/month approximately (Greenhouse Gas Inventory Office of Japan, 2012) and the distributed PCA should be a little lower than the average to promote their CO_2 emissions reduction. The following is a calculation of CO_2 emissions *G* in FAI.

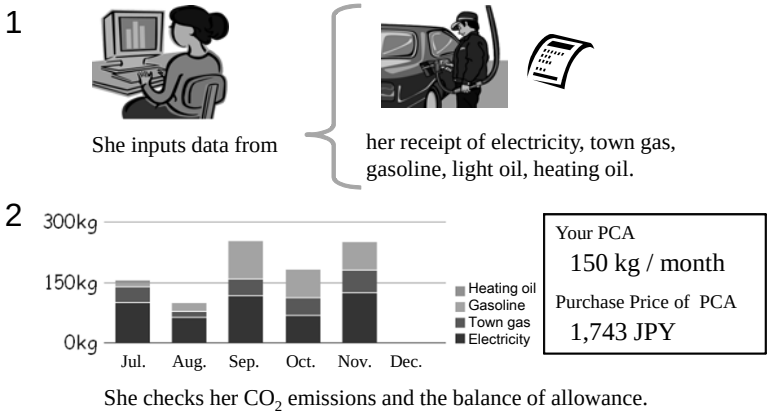

Figure 3. Overview of case study

$$G_i = \frac{p_i c_i E_i}{n} \cdots\cdots\cdots\cdots\cdots\cdots (1)$$

Where *p* is the proportion of energy use in their household against their business, *c* is the emission factor by energy source, *E* is the energy consumption, *n* is the number of people per household and *i* is the type of energy. Table 1 shows the CO_2 emission factors of energy (Ministry of Environment, 2006).

Table 1. CO_2 emission factors by energy types

Type of energy	CO_2 emission factor
Electricity [kWh]	0.559 [CO_2-kg/kWh]
Town gas [m^3]	2.23 [CO_2-kg/m^3]
Gasoline [l]	2.32 [CO_2-kg/l]
Light oil [l]	2.58 [CO_2-kg/l]
Heating oil [l]	2.49 [CO_2-kg/l]

3.2.2 Questionnaire

In this study, the questionnaire surveys have been conducted at beginning of each month. In the questionnaire, we have set the questions about the each element of FIT-PCA psychological model and the change of attitude to the global environmental issues. The respondents answer each question as a five grade likert-scale for later quantitative analysis. In addition, the sixth choice of "do not know" is set in some questions where there is a possibility that the respondents cannot understand the meaning of the questions. Furthermore, interviews to the participants will be carried out at the end of the case study period in order to confirm their detail psychological changes.

3.3 Results of the Case Study

This case study started from the middle of July 2012, so that the time of writing this paper is still under the experimental period. This section will report the current results.

3.3.1 Difference of the Loss Aversion by the PCA Price

In order to examine whether there is a difference of the loss aversion by the different price of PCA or not, the participants were divided into two groups of 1 JPY/CO_2-kg and 10 JPY/CO_2-kg as the price of PCA. Table 2 shows the result of independent t-test which shows the difference between the 1 JPY/CO_2-kg and 10 JPY/CO_2-kg groups' answers about loss aversion "I want to reduce the loss by purchasing PCA as much as possible". In the questionnaire of all case studies' period, there is no significant difference between these groups. Therefore, in this case study, it was found that loss aversion has not been affected by the difference of PCA price. And this result can increase the feasibility of FIT-PCA because it is easier to obtain public acceptance when introducing low price FIT-PCA.

3.3.2 Validation of the Psychological Model of FIT-PCA

In order to examine whether FIT-PCA has led to the participants' efforts to reduce CO_2 emissions by the loss aversion, the goal setting and the eudaimonia as shown in Figure 2, a multiple regression analysis was made. Figure 4 shows the path diagram based on the results. As shown in the figure, it was found that the efforts to reduce CO_2 emissions has significantly affected by the goal setting or the eudaimonia. Table 3 shows the number of the participants who perceived their own attitude to global environmental issues. This result shows the people who made efforts to reduce CO_2 emissions tended to perceive their own attitudes to be eco-friendly. Table 4 shows the changes of the attitudes to the environment which are their risk perception, effectiveness and responsibility attribution. This result shows their attitudes to global environmental issues have been improving compared with before the case study.

Table 2. Result of t-test which shows the difference of the loss aversion between 1 JPY/CO_2-kg and 10 JPY/CO_2-kg groups

Questionnaire period	Group	mean value	*SD*	*t* -statistic	*df*	Two-sided *P* value
Early August	1 JPY	2.00	1.15	0.35	25	0.73
	10 JPY	1.86	0.95			
Early September	1 JPY	1.79	0.80	0.94	26	0.35
	10 JPY	2.14	1.17			
Early October	1 JPY	2.00	1.18	0.61	26	0.55
	10 JPY	1.79	0.58			
Early November	1 JPY	1.71	1.07	0.39	26	0.70
	10 JPY	1.86	0.86			
Early December	1 JPY	2.00	1.08	0.59	25	0.56
	10 JPY	1.79	0.80			

Table 3. The number of the participants who perceived their own behaviors in connection with global environment

Questionnaire period	Make efforts to reduce CO_2 emissions [*n*]	Perceive their own attitude to global environment issues [*n*]
Early August	10	6
Early September	11	8
Early October	11	7
Early November	12	8
Early December	10	9

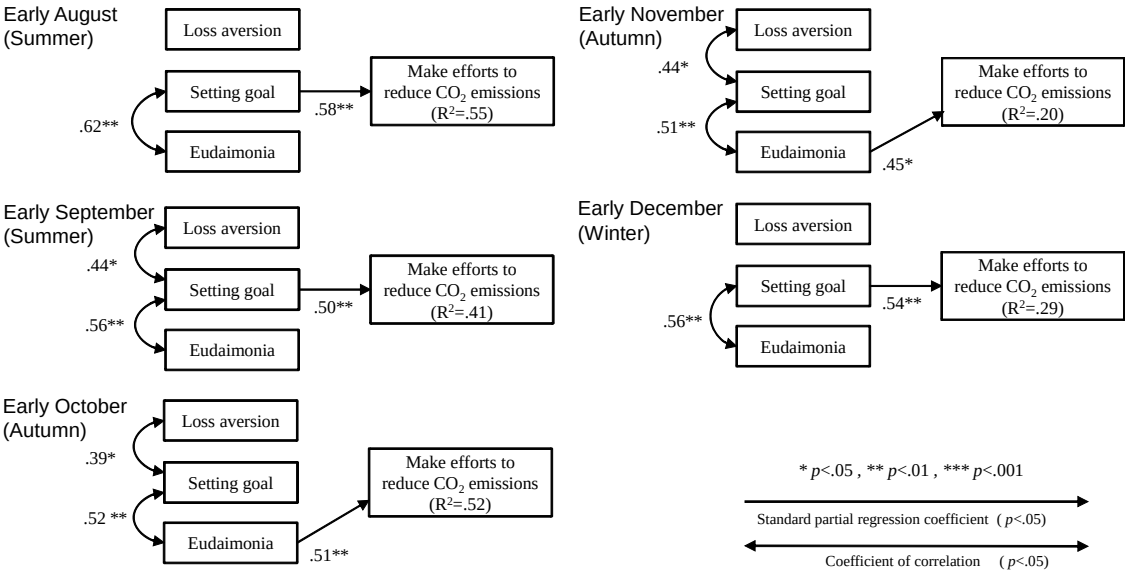

Figure 4. Path diagrams of FIT-PCA psychological model.

Table 4. Changes of the attitudes to the environment
(The people who have perceived their own attitude to global environmental issues in early December.)

Attitude to the environment	Questionnaire period	Mean value	*SD*	*t* -statistic	*df*	Two-sided *P* value
Risk Perception	Before experiment	3.22	1.09	2.26	8	0.025*
	Early December	4.22	0.833			
Effectiveness	Before experiment	1.22	0.441	2.00	8	0.040*
	Early December	1.89	0.928			
Responsibility attribution	Before experiment	3.00	1.07	1.69	7	0.067
	Early December	2.13	0.991			

3.4 Discussion

As shown in Figure 4, the results of multiple regression analysis show the goal setting or eudaimonia have improved the "make efforts to reduce CO_2 emissions". It is considered that the loss aversion have not affected it directly because the participants have not been able to imagine which activity saves a loss in daily lives from FAI. In summer and winter, they tended to be conscious of their goals because they have consumed more energy and PCA in these seasons and they have been forced to be aware of the rest of their PCAs. On the other hand in autumn, it is supposed that they could feel endaimonia because they have enough margins of their PCAs. This hypothesis will be confirmed by interviews after the case study period.

4. CONCLUSION

In this study, the authors have constructed a psychological model of FIT-PCA and have verified it through a case study. Since the case study is still under progress, some intermediate results were reported in this paper. For example, the loss aversion effect has not been different by the difference of PCA price. Setting goal and eudaimonia have led the participant to their efforts to reduce CO_2 emissions. Furthermore, there was a tendency to express that their CO_2 reduction behaviors were based on their global environmental attitudes. This is supposed to be caused by their self-perception. Since the potential of FIT-PCA is dependent on the individual needs for CO_2 emissions, the authors will clarify its effectiveness in this case study analysis.

ACKNOWLEDGEMENT

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BINDERS FULL OF VOTERS: HOW INFORMATION GATHERED THROUGH TRACKING WAS USED TO TARGET VOTERS IN THE 2012 PRESIDENTIAL ELECTION

Zijun (Jenny) Pang, Christina Pollalis and Alessandra Saluti
Wellesley College
106 Central Street, Wellesley, MA, 02481, USA

ABSTRACT

Modern technology and the accessibility of online databases have expanded the reach of information tracking, which played a strong role in the American presidential elections in 2012. Using technological strategies and databases, individual's online activity and offline behavior was tracked and translated into campaign strategies to better target voters. This allowed the campaigns to become more efficient and transmit a more effective message on both the individual and national level. However, the rapid increase of tracking raises questions about privacy, monetary cost and the effectiveness of these strategies, as well as the changes to the election system that they are facilitating.

KEYWORDS

Tracking, Micro-Targeting, Cookies, Elections, Analytics

1. INTRODUCTION

In the months leading up to the 2012 U.S. presidential elections, most voters received countless e-mails from campaigns, phone calls from volunteers, and literature that was specific to their geographic location, political leanings, and lifestyle. The strategies that political campaigns employed to produce such specifically targeted information are rooted in American political history. In early 960, the wide use of market segmentation for commercial goods influenced political marketing. John F. Kennedy and other presidential candidates used mass consumer data and pollsters to track voter behaviors, create voter categories, and hone campaign messages [11]. At that time, the focus of tracking was mostly limited to large groups like voting precincts. However, as the accessibility of technological tools increases and voter's online behavior can be monitored more easily, the focus of tracking has shifted from larger systems to smaller ones, like the habits and preferences of individuals. Modern technology has greatly facilitated this shift and led to an unprecedented expansion of tracking, which has served to increase the efficiency, speed, and precision of political campaigns. In this paper, we will define the technical aspects and outcomes of tracking, especially as it relates to micro-targeting. We will use cases from the 2012 presidential campaign to evaluate the effectiveness of tracking for campaigns and their consequences for future democratic elections.

2. DEFINITION OF TRACKING AND TARGETING

Modern tracking describes the monitoring of a person's online activity and the storage of his digital footprints in a database. The main goal of tracking voters' digital paths is for more precise targeting, or gathering information about individuals and groups to tailor campaigns more effectively. By tracking these online paths, campaigns are able to have access to our personal details, including home foreclosure status, ethnicity, vacation destinations, and beer preference [4]. In addition, as it has become such a common method to improve outreach, tracking user's internet activities has become an effective business model. Many

companies, including Strategic Telemetry, VAN (Voter Activation Network), and AdRoll offer services that are aimed at tracking internet activity and the storage of the gathered information [8].

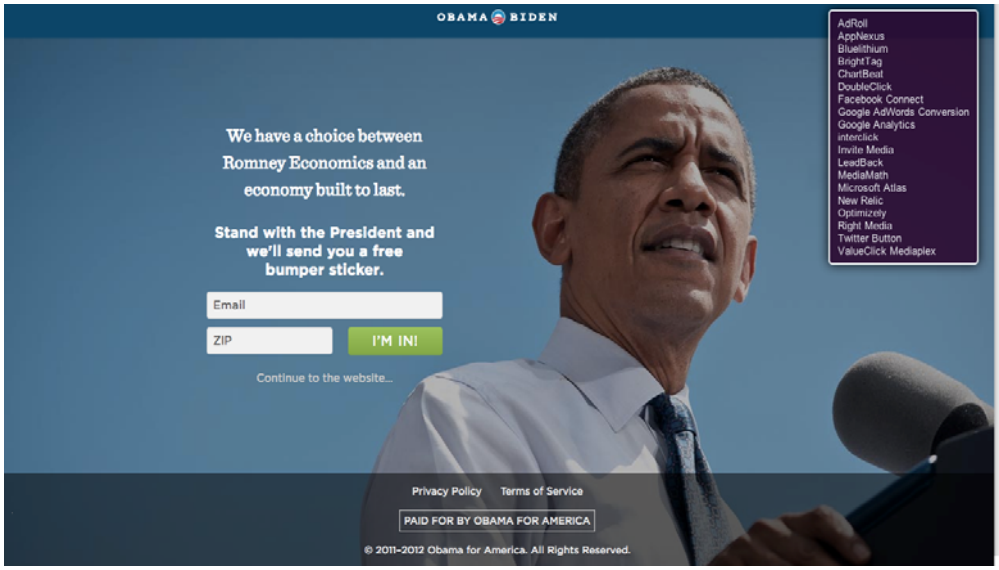

Figure 1. A list of third party websites that use cookies to track users who visited the official Obama website

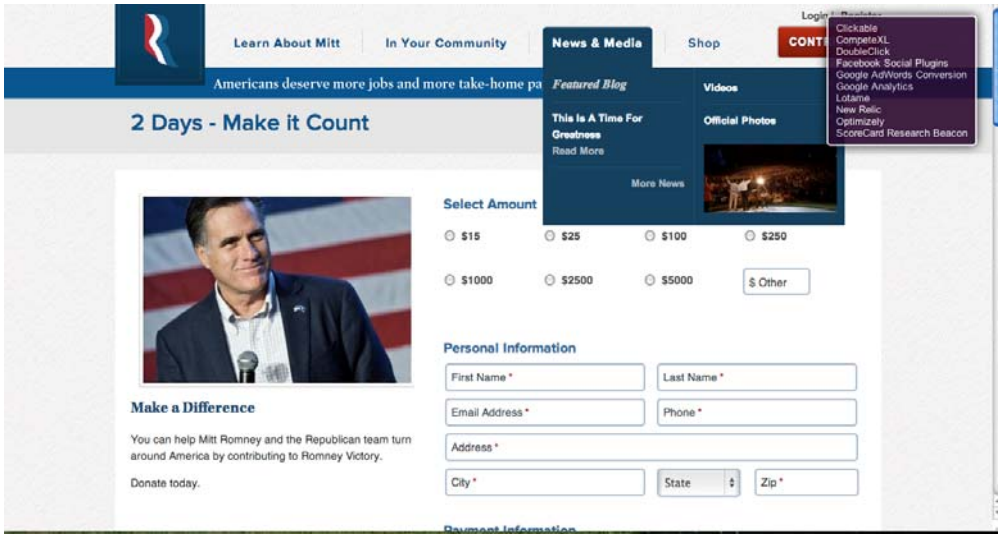

Figure 2. A list of third party websites that use cookies to track users who visited the official Romney website

3. TECHNOLOGY BEHIND TRACKING

This information about individual's internet activity is gathered through the placement of cookies, or digital markers which are placed after a user visits a Web site or makes a purchase. Cookies are small text files that a Web Server stores on a user's hard disk. They are used to store specific web server or client information on a user's machine, which they later on retrieve [2]. Essentially, cookies work as a convenient way to transfer information from one data exchange to another. Cookies enable a record of every site that a user accesses in order to build individual profiles. They also inform campaigns which advertisement, email link, or ad banner motivated people to visit campaign websites--an immediate feedback on which online marketing technique is

effective. These statistics inform campaigns on which keywords to include in email subject lines and which anchor texts to use in order to increase link popularity. This online profile is also matched with other accessible online data, such as Facebook profiles, as well as offline data, which campaigns can purchase from third-party companies and may include details like voting frequency and consumption patterns [12]. A market has been created from the handling of both offline and online tracking data, strengthening companies like Acxiom [5] and InfoUSA [7]. Together, data scientists, data miners, and political strategists assign a few summary numbers to each potential voter that predicts the likelihood that she will vote, how she will react to direct contact from campaigns, and political stance. These teams conduct analysis, through the use of algorithms, on this data to glean useful correlations between people's offline behavior and their political leanings.

4. TRACKING AS A TOOL FOR TARGETING

4.1 The Grassroots Level

However, the process of targeting voters does not rely exclusively on technology and databases. The middlemen that use the information gathered during tracking to microtarget voters are the volunteers and staff working for each campaign. For example, a union volunteer logged into the AFL-CIO election website with her Facebook account. Computers matched her list of friends with pre-existing voting data from the campaign which then pointed her to a company colleague that had never voted before. She was able to convince him to vote based on mutual trust, which he confessed was mainly due to their common backgrounds. This connection enabled the leveraging of a "trust network" in order to effectively target a voter [4]. Ultimately, tracking data is transformed into concrete targeting through these kind of personal and traditional means, including door-to-door canvassing and phone banking. The technological tools that these volunteers use, including VoteBuilder (shown in figure 3) and MiniVan (shown in figure 4) [8], are powerful because they allow users to have access to voter profile databases; the detailed information about each voter serves to inform volunteers about which issues to address when contacting voters. These databases are updated not only from tracking online, but also actual contact experiences. For example, if a voter did not answer the door or call and could not be contacted, campaign volunteers log that information, so that voter can eventually be reached.



Figure 3. The VoteBuilder website

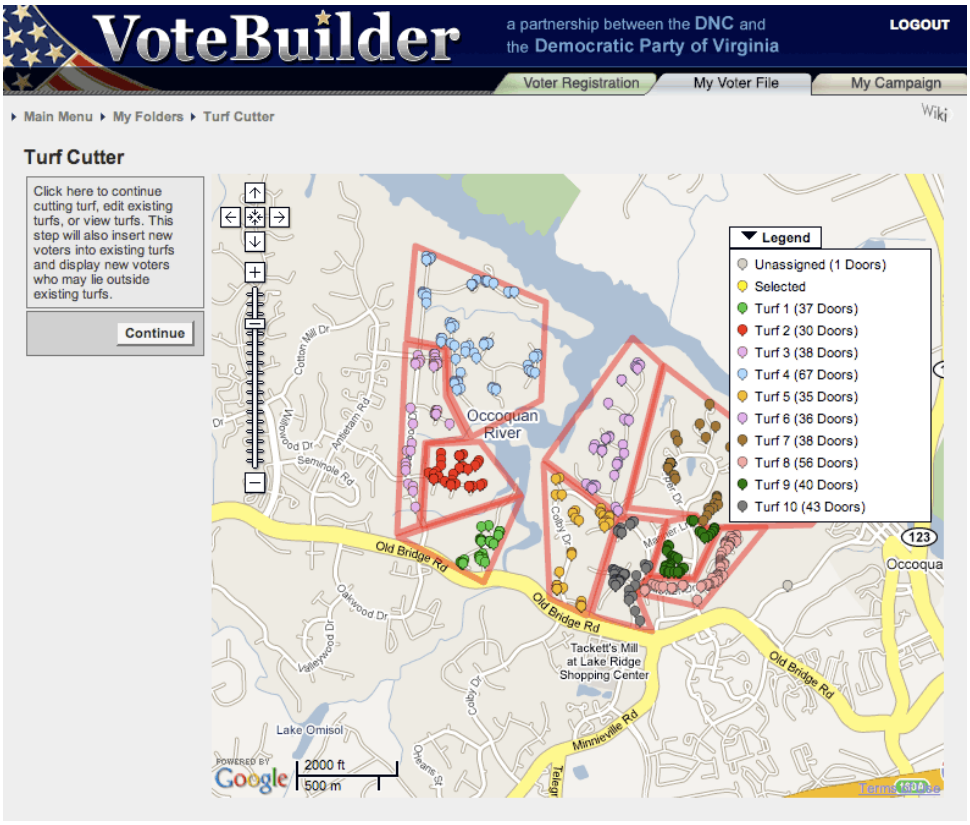

Figure 4. The VoteBuilder map



Credit: iTunes Store

Figure 5. MiniVan mobile application

4.2 The Campaign Level

Besides using tracked data to target voters on a personal level, campaigns also leverage enormous amounts of "big data" to guide the direction of the campaign from the regional to the national level. Everyone's political "scores," which represent their political alignment and voting preference, are later aggregated to form conclusions about geographic voting trends. These then determine the content of campaign speeches and the destinations of the campaign trail in order to better target "battleground" areas. For example, the swing state of Ohio was split into four geographic regions: the West emphasized defense spending, the North was dominated by the auto industry, the eastern coal miners were concerned about energy policies, and the central region emphasized the importance of financial regulation and education grants [10]. Information gathered through tracking allowed the candidates to speak to all four regions, but in the North, for example, Obama's speeches emphasized competitiveness of American manufacturing and in the East he trumpeted clean energy. The Obama campaign also directed million-dollar advertisements using iterative random controlled experiments and tracking to record outcomes. Other advanced forms of microtrageting include the various kinds of video advertisements are aimed at voters based on voter data. The Romney campaign, for example, had two main advertisements: the first was a strong-spoken video that emphasized the return of "American optimism" that was aimed at committed party members to encourage a large turnout; the second, which emphasized his role as a family man, was aimed at undecided voters that tend to vote more on character, according to their "scores" [12]. Armed with county and city-level voter data, the campaign tailored the airing of these ads to appeal specifically to the right audience and later used tracking data to reaffirm their broadcast decisions.

5. EVALUATION

The strategies and devices that campaigns are using to track and microtarget voters would clearly be impossible without the globalization of portable technology. In the relatively elite American political sphere, especially, these tools are essential to gathering and analysis mass amounts of data. However, it is that fact that these strategies affect such a large population that makes microtargeting so controversial. The criticisms directed at the collection of data and the implementation of information gleaned from this data can be separated into two spheres. The first argues that these strategies are counterproductive because the opportunity cost is too high. The implementation of these strategies is indeed very costly. In addition, the invasive nature of microtargeting raises the question if the benefits (voter outturn) outweigh the risk that the general population will feel that their privacy has been violated. That said, the second major criticism has to deal with the societal reaction to tracking and microtargeting.

5.1 Campaign's Perspective

Tracking and micro-targeting have been criticized for their high costs and seemingly aggressive nature. However, these mechanisms have been readily adopted by campaign and it is important to recognize their benefits as well as their downsides. Results of campaigns often hinge on independent, undecided, or unlikely voters. These are groups that are usually immune to traditional direct appeals and need more subtle and sophisticated arguments. Tracking enables campaigns to know exactly which issues are important to these voters. In turn, voters receive information on the issues they prioritize. This process increases efficiency in money and time for both sides. However, the two biggest critiques of tracking are aimed at its costs and privacy violations. Both parties have spent a combined $13 million on data acquisitions alone and maintained large in-house technology experts for data analysis of online and offline data to construct detailed profiles. Digital marketing was predicted to reach $160 million between the two campaigns, 10% of 1.6 billion combined campaign expenditures [3]. Though they vowed to not acquire intrusive data and restrict access to databases on a need-base use, both campaigns used third-party companies extensively [11].

These strategies, however, are sometimes counterproductive. The first national representative survey to explore Americans' opinions about political targeting showed that 86% of adult Americans are more likely to vote against a candidate that uses localized targeted ads, voicing their preference for more broad-based issues. Similarly, 85% adults would express anger if they knew campaigns tailor ads based on their Facebook

profiles [11]. This sense of unease toward tracking and microtargeting is shared by most Americans, who often feel as though their privacy has been violated. For example, a week before election day, voter Priscilla Trulen received a voicemail message from a presidential campaign, which reminded her that she had an absentee ballot that she had not mailed in yet [9]. In an interview, she expressed her discomfort that "Big Brother" had access to her confidential information [9]. This kind of mistargeting, the misjudging of voter's preferences or voters realizing they are being pandered to, can reverse the support that a candidate has gained [6]. Yet, in an interview with PBS Frontline, the CEO of Aristotle, nation's leading company on political tracking data, assured that, "...money spent on voter information is [...] effectively spent" [3]. Therefore, the risk of repelling voters through aggressive data collection and microtargeting is outweighed by the potential benefits of these strategies.

5.2 Society's Perspective

For campaigns, the big question may be whether tracking persuades voters and increases voter turn-outs, but for society, it is about how tracking is changing the election system. Tracking has made political campaigns look more like Target, Google, and retail banks: commercial entities that monitor personal data to tailor their services based on pinpointing a customer's needs. The question is whether tracking is, ironically, pinpointing and narrowing the amount of information voters are exposed to and confining the dissemination of information. This may jeopardize the holistic integrity of a candidate's campaign, encouraging proverbial "flip-flopping" and letting candidates amplify certain messages but remain silent about others depending on their audience. The tracking and selling of political data may also discourage citizens from discussing and expressing their political views online. Further, by categorizing voters, campaigns gradually ignore voters they deem unlikely to vote, which are usually the unregistered, uneducated, and impoverished [11]. The integration of tracking into modern political campaigns represents the difficult balance between the power and limitations of technology.

6. CONCLUSION

In this paper, we began by defining tracking and targeting and examining the technologies employed, such as cookies, scraping Facebook profiles, mobile applications, location-based ads, and big data analytics. Targeting politicizes tracking and data at both the grassroots and the larger campaign level. Different applications utilize tracking data to help strategize volunteers' door-knocks and mobilize identified voters to broaden the campaign's network. On the campaign, aggregate statistics decide location-based ads broadcasts, which online and offline sites and platforms to use. These, in turn, determine the content of political speeches, as well as the destinations of candidates' visits.

As tracking and political campaigns become inseparable, tracking's value to campaigns and to the greater society is evaluated. Though theoretically tracking should increase efficiency of time, money, and spread of information for both voters and campaigns, privacy violations and voters' mistrust of tailored information increasingly render tracking ineffective, especially if voters realize they are being targeted. The anecdotal evidence as presented suggests that tracking may entail broader consequences for the democratic elections: potentially, it can limit the type of information candidates give and voters receive, limit online political activity, and limit the types of voters that campaigns consider, undermining a sense the implied egalitarian nature of democratic elections. Though there are discussed methods to counter these concerns, like requesting individual permission for online tracking or full disclosure of tracked information by campaigns, it is inevitable that these issues will dominate the political media landscape for future US elections.

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SITUATIONALIZATION, THE NEW ROAD TO ADAPTIVE DIGITAL-OUT-OF-HOME ADVERTISING

Peter Lasinger and Christine Bauer
Institute for Management Information Systems, Vienna University of Economics & Business
Augasse 2-6, 1090 Vienna, Austria

ABSTRACT

'Digital out-of-home advertising' (DOOHA) leverages digital screens to reach out to consumers at any time and anywhere in public space. While personalization – tailoring advertisements to an individual – has proven successful for advertising, this concept has its limitations. Particularly challenging are privacy concerns and negative perceptions caused by personalized advertisements. We propose situationalization – adapting advertisements based on the current situation – as a promising (additional) option. The suggested PERSIT matrix (PERsonalizationSITuationalization) structures the available adaptation strategies. It helps advertisers and system designers to make educated strategy decisions for adaptive DOOHA system designs.

KEYWORDS

Digital Out-of-Home Advertising, marketing, situational advertising, personalization, situationalization, adaptation

1. INTRODUCTION

'Digital out-of-home advertising' (DOOHA) is a rapidly emerging marketing means that promises to leverage digital screens to reach out to consumers at any time and anywhere in physical space. It can be used to display advertisements to consumers who are in transit, waiting, or at commercial locations, such as a retail venue. Hardly any bus or train, airport, stadium or mall area is now without DOOHA. In contrast to other forms of advertising, DOOHA revenues are growing at an accelerating pace, having a projected growth of 19 percent for 2012 (BusinessWire, 2012).

Although advertisement spending has increased, advertising effectiveness has suffered dramatically in recent years. Consumers are overwhelmed by the quantity of advertising messages and it is getting more difficult to attract consumers' attention (Pieters et al., 2002). As a result, marketing researchers seek new ways to increase the effectiveness of advertisements. Personalization mechanisms are a promising approach to break through the information clutter in digital media. As digital media allows for the adaptation of content in real-time, advertising messages can be personalized (adapted and tailored to individuals) in real-time (Vesanen, 2007). On the Web, personalized advertising is widely used and praised for its effectiveness compared to traditional advertising (Adams, 2004, Kazienko and Adamski, 2007).

However, despite its benefits, personalization also has its limitations. For instance, consumers frequently feel that personalized advertising intrudes their privacy. As a consequence, they develop negative emotions towards the advertised product and/or company (Malheiros et al., 2012). Also, researchers postulate a trade-off between privacy and personalization (Lee and Ahn, 2011); thus an increase in required privacy (due to regulation or consumer pressure) will limit personalization options. When transferring personalization concepts to DOOHA, its limitations increase. For instance, the perceived privacy intrusion will likely rise, when personalized content is shown in public, where other people can watch it too.

We believe that the outlined pitfalls can only be avoided by taking a different perspective and propose *situationalization* as a viable way to avoid the challenges faced by personalization. We define situationalization as *delivering information that is relevant to an individual or a group of individuals in the present situation based on information about the current situation, which is retrieved, transformed, and/or deduced from information sources.* In contrast to personalization, situationalization eliminates the usage of personal data. Information about a situation is based entirely on physical context, that is non-personal aspects

such as location, time, atmospherics and social environment (cf. Bauer and Spiekermann, 2011). In terms of communication psychology, situationalization creates communication that is adequate to the situation (Schulz von Thun et al., 2003). Personalization, on the other hand, is an orthogonal concept, which creates communication that fits a person. Ideally both requirements are met in order to ensure effective communication (Schulz von Thun et al., 2003). Since personalization faces stronger limitations in DOOHA settings, we suggest situationalization as a particular interesting advertising concept for this fast growing advertising vehicle. Still, we stress that personalization has its value for DOOHA settings – though only within a limited application scope.

The remainder of the article proceeds as follows: The next section reviews the conceptual foundations of DOOHA and adaptive advertising. In the third section we suggest the PERSIT matrix as a model of adaptation strategies for DOOHA. The matrix has been systematically developed based on guidance for building a design science theory (Gregor and Jones, 2007, Hevner et al., 2004). Design science research involves the creation and evaluation of information technology (IT) artifacts, constructs, models, methods, and instantiations, which can address IT problems. Our proposed artifact represents a novel model of adaptation strategies for digital advertising, particularly suitable for DOOHA. The fourth section discusses the application of the matrix. The fifth section, finally, discusses our contribution and concludes this paper.

2. CONCEPTUAL FOUNDATIONS

This section presents work on digital out-of-home advertising (DOOHA) and adaptive advertising. The critical reflection of the existing literature motivates our proposed situationalization approach and acts as the foundation of the proposed PERSIT matrix.

2.1 Digital Out-of-Home Advertising (DOOHA)

A myriad of descriptors have been used to term networks of displays in public space. When such displays are primarily used for advertising, we speak of digital out-of-home advertising (DOOHA). We define DOOHA as *digital screens in public spaces that can be controlled independently via a centralized network and that are mainly used for advertising purposes*.

As mentioned before, DOOHA is perceived as an important and promising marketing vehicle, growing at a high rate and making a significant contribution to the global economy. Yet, research exploring the effects of DOOHA is limited. Only a few academic (e.g., Burke, 2006, 2009, Dennis et al., 2010a, Dennis et al., 2010b) and commercial (e.g., Page, 2007, NEC Display Solutions, 2006) studies investigate the effects that DOOHA has on consumer behaviour. From a scientific viewpoint, research on DOOHA is insufficient by now (Bauer et al., 2011). There are no experiments that compare DOOHA to traditional advertising concerning advertising effects. Many studies argue on a very global, imprecise level. For instance, retailers such as the British supermarket chain Tesco or Spar in Germany report that using DOOHA at the point of sale increased sales by 25-60 percent (NEC Display Solutions, 2006, Page, 2007) without indicating any reasons for the observed sales increase. Moreover, some studies indicate positive effects of DOOHA (e.g., Burke, 2006, 2009, Dennis et al., 2010a, Dennis et al., 2010b), while other scholars report challenges and severe drawbacks such as consumers ignoring screens (Müller et al., 2009b) or getting annoyed by attention grabbing displays (Müller et al., 2009a).

2.2 Adaptive Advertising

Advertising on digital media promises improved advertising effectiveness compared to advertising on non-digital media. The anticipated increase in advertising effectiveness should originate from the ability to *adapt* advertising messages, thus being able to deliver more relevant and suitable advertisements (Adams, 2004). Adaptation is conceived as *dynamically changing advertising messages on digital media based on information that is sourced from the targeted consumer or the situation shared by the advertising system and the consumer*. Hence, adaptation of advertisements on digital media promises to break through the information clutter, which is created by an overwhelming quantity of advertisements (Ha and McCann 2008) and challenges to attract consumer's attention (Pieters et al., 2002).

Existing adaptation techniques, which deal with placing the 'right' advertisements, can be best described as person-centric adaptation (better known as 'personalization'), because they target an individual and rely on personal data. Many scholars refer to personalization as the tailoring of products, services or content to consumer needs, goals, knowledge, interests or other characteristics (Zimmermann et al., 2005).

On the Web, personalization methods are already very advanced, making use of a wide range of approaches (e.g., Riemer and Brüggemann, 2007, Adomavicius and Tuzhilin, 2005). Personalization is typically based on user information (Adomavicius and Tuzhilin, 2005) such as identity, demographics, lifestyle, specified preferences, past purchases, or historical visit patterns (cf. Kim, 2002). It has proven effective in increasing the level of attention (Malheiros et al., 2012) and perceived usefulness of information (Tam and Ho, 2006).

Besides personalization, research in psychology and marketing has long acknowledged the influence that the *current situation* has on the human processing of information (cf. Mehrabian and Russell, 1974). Studies have shown for TV (De Pelsmacker et al., 2002), print (Dahlén, 2005, Moorman et al., 2002), sponsorship (Fleck and Quester, 2007), and product placement (Balasubramanian et al., 2006) that 'editorial context' (content that surrounds an advertisement) highly impacts how advertising affects its audience. All these approaches have in common that they anticipate a specific advertising-situation and select the advertisement way before consumers are exposed to it.

Digital media enable the real-time adaptation of ads, supported or automated by information systems. Indeed, information systems that are aware of their context can adapt to it have already been described (Dey and Abowd, 1999). Yet, little research exists on information systems that dynamically adapt advertisements to the situation on DOOHA (e.g.,Kazienko and Adamski, 2007, Di Ferdinando et al., 2009, Rosi et al., 2010). This is surprising since several researchers emphasize the importance of situational context in this setting. For instance, Silberer (2010) indicates that the advertising effects largely depend on the display's environment. Also Telschow and Loose (2008) state that advertisements that are directly related to the current purchasing situation are better remembered. However, if there is adaptation to the situation, it is generally not considered an independent form of adaptation, but is merely considered as a complement of personalization (Zimmermann et al., 2005).

3. THE PERSIT MATRIX AND ITS CONSTRUCTS

In this section, we introduce the PERSIT matrix. PERSIT abbreviates the two dimension of adaptation: 'PERsonalization and SITuationalization'.

The design of an artefact, such as the PERSIT matrix, is an inherently iterative search process that follows a continuous cycle of generating design alternatives and testing their utility (Hevner et al., 2004). Our approach to generating and testing the PERSIT matrix combines the informed argument method and group reflection phases. Both were performed iteratively throughout the design process. To ensure continuity, we based the PERSIT matrix on the existing conceptualizations of adaptive advertising. We critically analyzed concepts and ideas in analytical group reflection sessions. We then used input from these sessions to generate an improved model. For instance, the importance of distinguishing between 1:1 personalization and 1:n personalization came up in a group reflection with DOOHA experts. Further group reflection after each generate/test cycle helped to converge design alternatives into a coherent design. Each cycle contributed considerably to the advancement of the artifact, leading to the final model as presented in this section.

The PERSIT matrix provides a systematic overview of available adaptation strategies for DOOHA. It proposes a structured approach to apply adaptation strategies to achieve coherence in communication. Communication theory states that communication has two important anchors of reference, the person and the situation (Schulz von Thun et al., 2003). Effective communication strives to be coherent with both.

The PERSIT matrix (Table 1) presents personalization on the vertical axis and situationalization on the horizontal axis. Combining these two constructs leads to six possible adaptation strategies. All of these strategies inherit the advantages and challenges associated with personalization and/or situationalization. Because every strategy implies the use of different information sources, different hard- and software will be required thus leading to DOOHA systems of different technical complexity and cost structure.

Table 1. PERSIT Matrix with Adaptation Strategies

		Situationalization	
		no	**yes**
Personalization	**no**	(I) no adaptation	(IV) adaptation to a specific situation
	1:1	(II) adaptation to a specific individual	(V) adaptation to a specific individual and to a specific situation
	1:n	(III) adaptation to a group of individuals	(VI) adaptation to a group of individuals and to a specific situation

3.1 Personalization

"*Personalization is the use of technology and consumer information to tailor electronic commerce interactions between a business and each individual consumer. Using information either previously obtained or provided in real-time about the consumer, the exchange between the parties is altered to fit that consumer's stated needs as well as needs perceived by the business based on the available consumer information.*" (Vesanen, 2007).

Personalization literature only implicitly differentiates between adaptation for a specific individual (1:1 personalization) and a group of individuals (1:n personalization). However, we emphasize that for the design of adaptive DOOHA this distinction is crucial. It makes a difference if communication is tailored to an individual, or if this communication has to address several people at once. When a system personalizes for an individual, it must consider only characteristics of that individual. Whereas, when a system personalizes for a group, it must categorize individuals according to characteristics that the individuals share (Kim, 2002). In a nutshell, both options require different kinds of identification and approaches to analyse characteristics.

The main advantages of personalization are increased advertising effectiveness (e.g. improved memory or improved attitude towards the brand) (Adolphs and Winkelmann, 2010), increased perceived usefulness of information (Tam and Ho, 2006), and increased attention towards the ad (Malheiros et al., 2012). Personalization is also well suited for any situation where just one consumer views an advertisement (1:1). Furthermore, personalization techniques are based on established technologies and have been studied and optimized for years (Adams, 2004, Kazienko and Adamski, 2007).

However, recent research pinpoints the limitations of personalization: Firstly, person-centric adaptation is not possible in all situations, and secondly, its benefits are limited by a phenomenon referred to as 'personalization reactance'. The first implication is based on the concept of a personalization-privacy tradeoff (Lee and Ahn, 2011). An increase in required privacy (or decrease in available personal data) reduces personalization options. The second implication – personalization reactance – describes a phenomenon, where consumers feel that personalized advertising intrudes their privacy and start to develop negative emotions towards the advertised product and/or company (Malheiros et al., 2012, Tucker, 2012). We expect that personalization reactance will be particularly high when personalized advertisements are shown on public displays, because sensitive information is potentially disclosed to nearby people.

Additionally, the *advertising situation* of DOOHA differs from the one on the Web. On the Web a single user typically browses a website on his or her PC or mobile phone. In contrast, DOOHA is encountered in public space, where several people can see an advertisement concurrently. Therefore, personalization needs to be able to consider several people at once, for example by personalizing for the closest consumer or by using characteristics that is shared between these people.

3.2 Situationalization

Instead of basing adaptation efforts on personal data, situationalization draws on information from the environment that is not related to an individual. It provides a way to harness the various effects described by psychological and marketing research, referring to the relation between an advertisement and its 'editorial context' (Moorman et al., 2002) or the environment (Mehrabian and Russell, 1974).

We define situationalization as *delivering information that is relevant to an individual or a group of individuals in the present situation based on information about the current situation, which is retrieved, transformed, and/or deduced from information sources*. An example application of situationalization is advertising ear protection in loud environments. The relevance of the advertisement is enhanced through the situation, regardless of the characteristics (e.g., age, gender, preferences) of the beholders. According to communication psychology, this situationalized advertisement better corresponds with the definition of a communication that is adequate in a particular situation (Schulz von Thun et al., 2003).

The main benefit of situationalization is that it resolves the main challenges encountered by personalization. As no adaption to a person appears, personalization reactance is avoided. Also no personal data is required, counteracting a privacy trade-off (Lee and Ahn, 2011). Situationalization is well suited for a DOOHA environment, as the number and type of beholders do not matter. Research revealed that perceived thematic closeness between advertisements and the TV program enhances recall (De Pelsmacker et al., 2002) and the perception of relevance between an ad and its medium leads to more positive attitudes (Dahlén, 2005).

However, there are conceptual and technical challenges when applying this concept to DOOHA. For instance it is not clear yet how situations (context) can be best conceptualized and which parameters to choose for adapting advertisements (Bauer and Spiekermann, 2011). Existing research mainly focuses on rather 'obvious' parameters such as time, place or weather. Consequently the empirical implications of situationalized advertisements are not clear. Technical challenges include the deployment of required sensor infrastructures, as well as the lack of algorithms being capable to match advertisement content to situations.

3.3 Distinguishing Personalization from Situationalization

As mentioned above, the constructs of personalization and situationalization are orthogonal. According to communication psychology, effective communication fits to the involved person and is adequate for the respective situation (Schulz von Thun et al., 2003). Likewise personalization aims to fit an ad to the person, while situationalization aims to make an ad adequate to the situation. Ideally both dimensions are regarded, however, in case that one option is not available (e.g. privacy concerns) the other option can still be used to optimize communication.

The major differences between personalization and situationalization are the target entity and data used for the adaptation. Personalization targets a defined person (or group of people). In contrast, situationalization does not target an individual but aims to make a message adequate to the entire population in a given situation. Hence personalization relies on person-related data (data that preservers meaning only if being related to a person or group of people), but situationalization relies on situation-related data (data that preserves meaning if being related to a situation, but does not need to be related to a person). These differences are orthogonal, which means that it is possible to optimize ads for a defined person as well as the general population and to use data sources that are related to a situation as well as to an individual.

For instance, imagine advertisements on an online search engine. Traditionally ads are selected based on the keywords entered. This is personalization because the ads are only relevant for the person who is searching (targeted to this individual) and also the search terms are only relevant and meaningful to this person. If these ads would be shown to any other person, they would very likely not being relevant. However, in case the search interface presents searchers with an ad based on the time and location of the searcher (e.g. using the most likely language and greeting form that can be expected for these parameters), this ad would likely be meaningful to any other person being at the same place and time. In this case, we speak of situationalization. Of course both concepts can be combined. For example searching for 'bank' could mean a financial institution or an object to sit down on. Ads could be selected based on personal information (e.g. previous searches, the job, preferences) and/or situational information (e.g. more likely to look for a place to sit during day, at sunshine and when walking in a park).

4. APPLICATION OF THE PERSIT MATRIX

In the following, we demonstrate how the PERSIT matrix benefits practitioners in the development of a DOOHA system. A manufacturer for ear protection decides to advertise its products by using DOOHA. The

company wants to use innovative technology and advertising concepts. A task force is created to work out a DOOHA strategy and implementation roadmap. By consulting the PERSIT matrix, the team learns about the six possible adaptation strategies and decides to use the matrix to structure their decision process. It runs through the matrix and develops usage scenarios for each matrix area (see Table 2).

So far the team has only been aware of personalization, which they already use on the company's web store. RFID tags, which are embedded in all of the company's products, could be used to identify past customers. However, the team knows that such practices have been met with serious opposition in the past and are legally at the edge. Furthermore, the team has learned from marketing research that people are more willing to buy ear protection when they are exposed to loud noise (e.g., in clubs or at construction sites). As a result, the team comes up with the idea to customize their ear protection advertisements based on the level of noise that surrounds the screen; different noise levels will trigger the display of ads for different ear protection products. Consequently, an ad could be triggered when the noise level exceeds a certain threshold-level or increases at a certain rate. The resulting PERSIT matrix, including extracts of the usage scenarios, is depicted in Table 2.

A technical feasibility study confirms that all options could be implemented. Technology is available to identify individuals based on the RFID chips embedded in the products; microphones, which are deployed with the screens, can capture noise levels. However, the 1:n personalization strategies (III, VI) must be excluded because of regulatory restrictions in many European countries. Likewise, the legal due diligence leads to the exclusion of the 1:1 personalization strategies (II, V) due to privacy constraints and company policies concerning the usage of customer data. As a result, the team decides to adopt a situationalization-only strategy (IV), as it is more targeted than no adaptation (I).

Table. 2 Applied PERSIT Matrix with Application Scenarios

		Situationalization	
		no	**yes**
Personalization	**no**	**(I) no adaptation** e.g. just displaying the ads, without any adaptation. Cheapest and least complex approach, however not targeted enough.	**(IV) adaptation to a specific situation** e.g. using noise level – display the ad when a certain noise level is exceeded
	1:1	**(II) adaptation to a specific individual** e.g. using data from web store combined with mobile phones or RFID tags embedded in products. Identification of past customers (promote new products, cross selling) or presentation of target group specific products (teen, adult, retiree)	**(V) adaptation to a specific individual in a specific situation** e.g. ID of customer and display of product ad depending on the noise level (very low – very high)
	1:n	**(III) adaptation to a group of individuals** e.g. determination of average age and gender of viewers via video camera – display of suitable product category	**(VI) adaptation to a group of individuals in a specific situation** e.g. determination of average age and gender and display of advertisement depending on this information and the noise level

Summing up, the PERSIT matrix helped the team to (1) consider all possible adaptation strategies, (2) generate new ideas to increase advertisement relevance (based on noise levels), (3) structure their decision process (feasibility and due diligence) and (4) enhance communication between technical and marketing experts.

5. CONCLUSION AND DISCUSSION

Real-time adaptation of DOOHA systems is a promising way to enhance the relevance and impact of advertisements. We propose situationalization as a viable alternative and orthogonal concept to personalization. The PERSIT matrix structures the available adaptation strategies for DOOHA alongside the dimensions of situationalization and personalization. This allows considering the various adaptation

opportunities systematically to select a feasible adaptation strategy (regarding regulatory, time and cost constraints). As shown in our application example, the PERSIT matrix helps marketing decision makers and system designers to envision, design and articulate implementable and adaptable DOOHA systems, especially making use of the possibilities offered by situationalization. The matrix allows its users to consider personalization and situationalization options at an early stage of the requirement definition process. The matrix also supports the systematic evaluation of approaches, which can result in the exclusion of certain strategies based on economic, social, or regulatory (e.g., privacy) constraints.

A limitation of our work is a missing large-scale evaluation of the PERSIT matrix. Field experiments should be performed, demonstrating which of the six adaptation strategies outperform the others in given advertising settings. In addition, we encourage researchers to apply the PERSIT matrix also to other settings than DOOHA and evaluate whether it may be applicable in those settings as well. Due to missing empirical work on advertising effects on DOOHA, currently the PERSIT matrix cannot provide detailed recommendations on advertising effects or system designs.

However, as the PERSIT matrix provides a level of abstraction that both business people and system designers can understand, it facilitates the communication between these groups. Advertisers can relate to the strategic options that the matrix offers them to create coherent advertising messages. The PERSIT matrix also facilitates their creativity and allows considering other, non-personal, adaptation variables that suit the advertised product or service. Correspondingly, system designers can use the matrix to present technological opportunities, without the need to explain technical details. When combining the identified strategy with the desired adaptation variables such as location, noise or weather (as specified by the advertisers), system designers can translate this information into specific technical designs and requirements.

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HOW COUPLES MAKE DECISIONS ABOUT AN ONLINE PURCHASE: BUYING EVENT TICKETS

Abdelouahab Mekki Berrada
Université de Sherbrooke
2500 boul. de l'Université, Sherbrooke, J1K 2R1, Québec, Canada

ABSTRACT

With the Internet playing a growing role within households, couples are finding themselves making more purchases online, and engaging in all the related navigation, together. The phenomenon is likely to grow in scope with the arrival of new technologies such as interactive television and tablets. This descriptive study investigates relative influence within couples making a decision to buy event tickets online. A sample of 336 couples were invited to answer a questionnaire. The relative influence of each member of the couple during the online purchase of event tickets was analyzed throughout the different stages of the purchasing process and its sub-decisions. The results showed that, in accordance with earlier studies of online purchasing, women have as much or more influence than men during online decision-making.

KEYWORDS

Online purchase, shopping with a partner, couples' decision-making, relative influence, decision-making in a partnership, online consumer behavior.

1. INTRODUCTION

Since researchers started investigating consumers' purchasing and navigation behaviors on the Web and the resulting decision-making processes, the unit of analysis has always been the individual Internet user, who has control of the mouse and keyboard, and is viewed as a single individual interacting with a website in order to make a final decision. However, as the Internet plays an ever-increasing role in households, other situations should be considered, and in particular the possibility that another person might be physically present who might actively participate in the online decision-making process and share the screen of the computer or tablet (Kennedy and Wellman, 2007; Canadian Internet Project, 2008). This is particularly true given that technological progress means that Internet use will not remain tied to the use of a computer screen. On the contrary, it will spread to other supports, such as interactive television. In that specific case, it would be quite plausible for two people to use the Internet sitting on a sofa facing the television.

That being so, one of the aspects of decision-making as a couple that has been most widely examined in the literature is the role played by each member of the couple in deciding to purchase a product or service and the relative influence of each one (Commuri and Gentry, 2000). Is this decision influenced by the husband, the wife, or both together? This interest is largely explained by the fact that corporations wished, and still wish, to know at what point in the decision-making process the decision is actually made and which member of the couple makes it so they can better target that person.

To date, all studies have considered the nature of relative influence during offline decision-making and no study has yet investigated decision-making related to an online purchase. However, we think that it is important to integrate online consumption, with all of its specific features, into the overall picture of couples' consumption.

2. RELATIVE INFLUENCE IN OFFLINE DECISION-MAKING

Davis and Rigaux (1974) showed that the members of a couple played different roles in decision-making and that their degrees of relative influence varied based on the type of product and the stages of the purchase

decision process. Several researchers have also shown that relative influence can vary not only based on these two factors but also throughout the sub-decisions that are an integral part of the final decision (Davis, 1970; Filiatrault and Ritchie, 1980).

Recent studies of relative influence have investigated the changes that have occurred in family structure and that in turn result in changes in the decision-making process, suggesting that there is a focus on more common, mutual decision-making (Belch and Willis, 2002). As these authors point out, the prevalence of dual incomes within households has increased women's influence in decision-making and changed how roles are assigned. Today, all those changes indicate that couples' relationships are increasingly egalitarian, leading to more joint decisions at all stages of the decision process and most sub-decisions related to purchasing decisions. The studies by Wilkes and Laverie (2007) and Razzouk et al. (2007) confirm this trend.

The two main theories proposed to explain the relative influence of each member of a couple in purchase decisions are resource theory and social power theory (Belch and Willis, 2002). Resource theory claims that the source of a person's influence in family decision-making stems from the socio-economic resources that person possesses, such as income, education level, and social status. Social power theory suggests that social power is a resource that an individual can use to influence another person.

In a Web context, Belch el al. (2005) showed that the arrival of the Internet had an impact on family decision-making. Although their study concerns adolescents' influence on family decision-making, they, like earlier studies, showed that family members' relative Internet expertise increased their level of influence during a family decision-making process.

In analyzing the Internet landscape, we see that its use in households continues to be influenced by income, education and age. According to CEFRIO (2012), 88% of adults who had used the Internet in the previous year belonged to households with an income of $60,000 or more, and 71% of them had university degrees. In Kennedy and Wellman's (2007) study of individuals who spent between one and a half and three hours per week on shared Internet use as a couple, 70% had jobs and 38% had some level of post-secondary education.

Moreover, daily use of the Internet gives today's couples skills and expertise that were hard to access before and greatly reduces skill gaps between family members.

In light of these numbers, we think it is possible that the profile of couples who purchase on the Internet would be very favorable to mutual decisions. This is especially true given that families' time constraints mean that it is more likely that spouses will be at home at the same time to make an online decision than that they will be at a store together for an offline decision.

3. HYPOTHESES

Further to the literature review, the first two hypotheses have the goal of testing the results of Davis and Rigaux (1974) and of Belch el al. (1985) regarding relative influence in the context of a decision to purchase event tickets online. The aim of the third hypothesis is to test whether decisions made online are more syncratic than those made offline.

H_1: The relative influence of the members of a couple varies as a function of the stage of the process of deciding to buy event tickets online.

H_2: The relative influence of the members of a couple varies as a function of the sub-decisions of specific decisions in the purchase of event tickets online.

H_3: Decisions to buy event tickets online are more syncratic than decisions to buy event tickets offline.

4. METHODOLOGY

An online questionnaire was administered to a large convenience sample of 550 French-speaking couples. Respondents were invited by e-mail to participate in the study and to encourage their partners to do so as well, according to the instructions they were sent. A study participation code was assigned to each participant. This same code had to be used by the second member of the couple in order to validate the couple's participation.

It should be mentioned that this online data collection sequence, which remains unique in studies of

family decision-making, could introduce bias: the responses of one member of a couple could be affected by the intervention of the other member or by his or her mere presence at the time the responses were entered online.

Although our online data collection process from the two partners separately had never been used before, it still conforms in this regard with all past studies (Davis, 1970; Davis and Rigaux, 1974; Filiatrault and Ritchie, 1980; Corfman, 1991; Sidin et al., 2004; Razzouk et al., 2007; Wilkes and Laverie, 2007), the majority of which used mailed questionnaires in which the partners were asked to answer the questionnaires without consulting each other and to return them separately by mail. Thus, to reduce the time that a couple might spend consulting and discussing the questionnaire, we accepted only responses from both members that were entered online within a 48-hour period and without the presence of any other family member. After analyzing all the entries and removing incomplete responses, we retained the responses of 336 couples.

Our sample comprised couples made up of a man and a woman living together under the same roof for at least a year who had made purchases together. Of this sample, 82% had purchased event tickets online as a couple, while 18% had made only offline purchases of event tickets as a couple. This distinction was made so we could test hypothesis H_3. In our sample, 42.4% of participants were aged from 25 to 44 years old, and 36.3% between 45 and 64 years old. Most participants, 74.9%, had at least a college education, 60.8% were employed full-time, 55.7% had gross personal income of more than $40,000, and 53.5% had family income of more than $80,000.

As for couples' Web use habits, more than 54% used the Internet as a couple for more than one hour per week to find information or make purchases from online retailers' sites (42.45%), tourism/travel sites (36.6%), classified ad sites (30.6%) and arts and entertainment sites (29.6%).

4.1 Purchasing Event Tickets Online

Event tickets were chosen in this study because these are considered to be among the products most often purchased on the Internet (CEFRIO, 2012; eMarketer, 2012). In addition, all past studies of relative influence have examined products and services that had a medium to high involvement level (Davis and Rigaux, 1974; Belch et al., 1985; Belch and Willis, 2002). We therefore measured involvement in the purchase of event tickets using two items on a scale ranging from 1 to 7. The mean obtained, $M_{Event} = 4.51$, indicates greater than average involvement, which is in accordance with the literature.

4.2 Specific Sub-Decisions in Purchasing Event Tickets

Regarding the specific sub-decisions in the purchase of event tickets, we adapted Davis's (1976) categorization to the context of online decisions. The following variables related to the sub-decisions in the purchase of event tickets online were established without any preliminary judgment concerning their order: which website to visit, the type of event, the date of the event, how much to pay, and when to pay.

4.3 Relative Influence

The measure of each partner's relative influence is based on the perception of the degree of influence that each member of the couple has at each of the four stages of the online decision-making process in buying a event ticket (initiation, information search, evaluation, and final decision).

Considering the most recent event tickets purchased online as a couple, each partner was asked to specify which member of the couple had had the greatest influence, using a 7-point scale (1 = No influence at all, 7 = Very great influence). They were also asked to do the same thing for each sub-decision. This method of measuring members' perceptions of "who does what" in a couple has been widely used in past studies of families (Davis and Rigaux, 1974; Qualls, 1987; Belch and Willis, 2002; Wilkes and Laverie, 2007; Razzouk et al., 2007).

To deal with possible bias related to the memorization of facts, we insisted that participants restrict themselves to the most recent purchases made online as a couple.

5. RESULTS

To test the first hypothesis, H_1, an ANOVA was computed to verify the interaction effect of two factors – stage of the decision-making process and sex (4 x 2) – on relative influence. The results show that the two-way interaction is significant (F = 2.960, p. value = 0.031), indicating that the relative influence within couples is not the same at all stages of the process of deciding to buy event tickets online. Thus, they support H_1.

Table 1. Mean influence at each stage of the decision to buy event tickets online

	Initiation	**Search**	**Evaluation**	**Final decision**
Man	**4.27**[a] (1.81)	4.46 (1.90)	4.50 (1.72)	4.69 (1.51)
Woman	**4.61**[a] (1.75)	4.63 (1.86)	4.44 (1.75)	4.60 (1.51)

Each score represents the mean relative influence of the man and the woman in making a final decision in the choice of online purchase (1= no influence at all, 7 = very great influence). The number between parentheses represents the standard deviation. a: p. value < 0.05; N = 336

To test the second hypothesis, H_2, suggesting that the relative influence of each member of the couple would vary based on the sub-decisions of the specific decisions for each class of products selected online, we calculated the mean score for the perceived influence of men and women at each sub-decision. Then a matched pairs Student t-test was done to detect any significant differences.

The mean comparison test on the relative influence of men and women shows that the partners' influence varies significantly as a function of sub-decisions in the decision process, thereby supporting H_2. As table 2 shows, women have marginally more influence on the choice of date when making the final choice of online event tickets ($\overline{X}_{\text{Woman}} = 4.76$; $\overline{X}_{\text{Man}} = 4.51$; p.value < 0.10; N = 336 couples). The other sub-decisions appear to be made jointly, as there are no statistically significant differences between the influence of men and women.

Table 2. Mean influence by sub-decision in the decision to buy event tickets online

	Man	**Woman**
Which website to visit	4.25 (2.06)	4.31 (2.01)
Type of event	4.81 (1.61)	4.88 (1.62)
Date of event	**4.51 (1.73)**[a]	**4.76 (1.71)**[a]
How much to pay	4.69 (1.63)	4.73 (1.69)
When to buy	4.35 (1.77)	4.50 (1.83)

Each score represents the mean relative influence of the man and the woman in making a final decision in the choice of online purchase (1= no influence at all, 7 = very great influence). The number between parentheses represents the standard deviation. a: Matched pairs Student t-test man-woman, p.value (paired t-test) < 0.1

Regarding the analysis of differences between online and offline decisions to choose a product (test of H_3), the mean scores for the two groups in the sample were compared, namely the group of people who had previously made online purchases and the group that had only made offline purchases of the event tickets. As table 3 shows, the results indicate no significant difference between groups.

Table 3. Mean influence in online and offline decision-making for a purchase of event tickets

	Man $\overline{X}_{12}$	**Woman** $\overline{X}_{11}$	**Man** $\overline{X}_{22}$	**Woman** $\overline{X}_{21}$
	Online (n = 275 couples)		**Offline (n = 61 couples)**	
Initiation	**4.27**[a] (1.81)	**4.61**[a] (1.75)	4.15 (1.71)	4.54 (1.60)
Search	4.46 (1.90)	4.63 (1.86)	4.05 (1.61)	4.51 (1.61)
Evaluation	4.50 (1.72)	4.44 (1.75)	**3.98 (1.38)**[b]	**4.54 (1.43)**[b]
Final decision	4.69 (1.51)	4.60 (1.51)	4.26 (1.29)	4.59 (1.35)
Which website to visit	4.25 (2.06)	4.31 (2.01)	-	-
Type of event	4.81 (1.61)	4.88 (1.62)	4.64 (1.56)	4.97 (1.53)
Date of event	**4.51 (1.73)**[b]	**4.76 (1.71)**[b]	4.16 (1.60)	4.48 (1.53)
How much to pay	4.69 (1.63)	4.73 (1.69)	4.34 (1.62)	4.41 (1.62)
When to buy	4.35 (1.77)	4.50 (1.83)	3.80 (1.56)	4.39 (1.66)

Each score represents the mean relative influence of the man and the woman in making a final decision in the choice of product (1= no influence at all, 7 = very great influence). The number between parentheses represents the standard deviation.
a: Matched pairs Student t-test (man-woman), p.value (paired t-test) < 0.05
b: Matched pairs Student t-test (man-woman), p.value (paired t-test) < 0.1
All non-significant differences have a value of p.value > = 0.1

6. DISCUSSION AND IMPLICATIONS

To sum up, the empirical results of this study reveal that the relative influence of members of a couple varies as a function of the stages of the decision-making process. As table 1 shows, an interesting result of this study is that women have more influence than men on initiating the process of buying event tickets online ($\overline{X}_{\text{Woman}} = 4.61$; $\overline{X}_{\text{Man}} = 4.27$), whereas women and men have equal influence in the other stages of online decision-making.

Regarding the final choice of event tickets purchased online, women also have slightly more influence than men in choosing the date of the event ($\overline{X}_{\text{Woman}} = 4.76$; $\overline{X}_{\text{Man}} = 4.51$). Women visibly have more influence than men in sub-decisions related to time (dates), which may be explained by their ability to multitask, which gives them more responsibility for organizational matters within the couple.

In general, these results support the tendency shown in earlier studies (Belch and Willis, 2002). They confirm that women play an important role in making online purchasing decisions; in fact, this study was the first to empirically investigate the topic in the context of online purchasing. These results are interesting because they contradict the line of thought that women are less interested in science and technology than men (Turkle, 1988).

Like past studies of offline purchasing, we found that women had as much influence as men, or more influence, in making decisions online. In accordance with the work of Belch and Willis (2002), and with resource theory, this increase in influence, whether online or offline, may be explained by the fact that, for some years now, women have possessed resources that place them on an equal footing with men. Access to the labor market and to the upper levels of society is among the causes.

However, this influence on online decisions may also be explained by the fact that technology, and particularly the use of computers and the Internet, has become very accessible in everyday life for both men and women today; consequently, women have acquired skills and expert power that enable them to be more involved in making decisions online. In Canada, according to eMarketer (2009), half of all Web users are now women, and they spend an average of 15 hours a week using the Internet, in all age groups. This trend is also at play in the U.S.A., where women spend an average of 17.7 hours a week online (Fleishman-Hillard and Harrison Group, 2010).

This research did not reveal any significant differences between decisions made online and offline. Although our results concern only a single product, we think that the proximity and presence of both members of a couple in the online purchase process may contribute greatly to more mutual decision-making in which influence is shared in the final stage of the decision and both members are active and involved

together. As Belch and Willis (2002) pointed out, joint decisions are associated with significant expert power for both members of the couple, which is more likely to be found in couples with greater-than-average education and income levels; our sample confirmed this trend.

6.1 Implications and Research Avenues

Although research on family decision-making has undergone a number of developments over the last 30 years, this study makes a non-negligible contribution to models of joint decision-making. It proved possible to present a picture of the relative influence of each member of a couple in the decision to make an online purchase of event tickets, at all stages of the decision process and in all the sub-decisions inherent in that process. In addition, it was possible to compare influence during online and offline decisions.

With regard to the implications for management, the latest report by the Canadian Internet Project (2008) revealed that 73% of Canadians who use the Internet share screen pages or undertake an online activity in the company of someone else. This finding, combined with the ever-greater penetration of the Internet in households and the constant growth of online purchasing, means that marketing and website managers need to take a new reality into consideration. Thus, a better understanding of relative influence within couples who are deciding to purchase something online would help managers to better target their online communications by mans of the content of their advertising messages and to adapt their websites to people using the Internet together.

Indeed, given that women have more influence during the initiation stage of online purchasing, it is important for websites selling event tickets to communicate more effectively with female customers on the basis of their strategies to acquire such products. Organic search engine optimization of websites using specific keywords that target women more would be prudent for these companies. The same thing applies to the partnership or affiliation strategies that these websites might develop. For example, it would be valuable to communicate on portals that target women in order to support products that are intended for couples.

Moreover, this study opens the door to a number of research avenues related to couples' online purchases, such as studying other products and understanding the effects of certain internal or external factors on two-person decisions of this type. For instance, analyzing the conflict resolution strategies applied during online purchase decisions and examining factors related to computer use and their impact on decision-making would be two very interesting research avenues.

7. LIMITATIONS

First of all, the size of the convenience sample and the fact that it was limited to French-speaking people in Quebec mean that the results cannot be widely generalized. It would be interesting to validate the results in other regions of Canada and the world and with an English-speaking population.

It should also be noted that in this study several variables that could affect the results were not taken into consideration such as the cultural backgrounds, the duration of the couple's relationship and the presence of children and their involvement in online decision-making for certain products. These variables can have a direct impact on relative influence in product purchases (Commuri and Gentry, 2000; Kim and Lee, 1996).

The choice of a single product also limits the results of this research and means that they cannot be generalized to other products and services. Even though purchasing event tickets online is popular nowadays, it would have been valuable to examine other products with a high involvement level for the couple and a longer useful life, and ones where it is easier to evaluate the product before the purchase, such as home furnishings, for example.

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CULTURAL FACTORS IN THE DESIGN OF GLOBAL E-COMMERCE WEB SITES

Malcolm Mactavish and Magdalena Jaworska
University of Abertay Dundee
Bell Street, Dundee, UK

ABSTRACT

Organisations who wish to maximise their income must also maximise engagement with potential customers. This study investigated the degree to which cultural factors impacted on the design of eCommerce applications offered by four global corporations. The corporations comprised a variety of industry sectors and product types. 25 factors were analysed to determine the degree to which the applications conform to two principal heuristics – Hofstede's cultural dimensions model and Hall's context of communication framework. A matrix of expected results was produced by analysing each corporation and their respective target audiences within the context of these heuristics. The actual characteristics were compared to expectations and the outcomes quantified. The results of the study demonstrate that none of the applications entirely fulfils expectations. However, the areas that are problematic differ between samples. It concludes that global corporations can gain commercial benefits by paying more cognisance to the cultural dimensions of web design and communications.

KEYWORDS

e-commerce, culture, web design, communications

1. INTRODUCTION

There is no clear definition (or even a universally accepted spelling) of the term “eCommerce/e-commerce”. Attempts have been made by, among others, Duffy & Dale (2002) and Chaffey (2007). The Organisation for Economic Co-operation and Development (OECD) suggests an objective definition - “An e-commerce transaction is the sale or purchase of goods or services, conducted over computer networks by methods specifically designed for the purpose of receiving or placing of orders. The goods or services are ordered by those methods, but the payment and the ultimate delivery of the goods or services do not have to be conducted online. An e-commerce transaction can be between enterprises, households, individuals, governments, and other public or private organisations” (OECD Guide to Measuring the Information Society, 2011). eCommerce can be conducted on a machine / machine basis, between the computer systems of business partners (e.g. in supply chain systems). However, most eCommerce systems that are intended for use by humans will be presented within a web site. With this in mind, it is important to differentiate between true eCommerce web applications and simple web sites that provide information and services without possessing a commercial imperative. The most significant difference between eCommerce applications and non-commercial web sites is the transfer of goods or services for a monetary consideration. If culture is one determinant of the success of a commercial web, it is likely to be equally important in simple, non-commercial, webs. Although this paper focuses on eCommerce, it uses the term “web site” to describe both.

The web has been largely driven by countries that are Anglo-Saxon, but by 2011 almost 40% of Internet users were of Asian extraction (www.internetworldstats.com, 2011). Thus it can be seen that the importance of cultural differences should not be underestimated and, to maximise return on investment, sites should conform to local customs and cultures. Liebmann (1999) said, “Changes in culture and values are subtler than changes in technology – yet they have a much more profound impact on people and businesses”.

Gong (2009) presents an example of the implications of failing to understand the role of culture across populations. When the Dell Computer Corp. globalised their web site, they did little more than translate text.

The visual design, incorporating a black border around the main content, was unchanged. In western societies, black is associated with quality, but in Japan it infers negativity. Thus Japanese consumers acquired a poor perception of Dell. Although a single example, it is reinforced by Chen and Hicks (2000) who concluded that webs should take account of culture and customs. For example, navigation may differ between English and Chinese webs because the top-down style of Chinese writing causes a preference for vertical menus. Religious, historical and visual representations of culture are also important (Marcus, 2002).

Two important and widely used tools for analysing culture are Hofstede's cultural dimensions and Hall's communication context theory. Hofstede (1980) proposed a framework that classifies cultures according to four dimensions - power distance, individualism/collectivism, uncertainty avoidance and masculinity/ femininity. It represents cultural dimensions and describes national cultures (Liao, Proctor and Salvendy, 2008). "Power distance" describes human (in)equality in a society. Web sites in cultures with high power distance will be highly structured, symmetrical and will emphasise national and social order. The visual design will reflect the political and social regime (Marcus, 2002). Structures will be imposing and organised. Webs in low power distance cultures will be less structured, more asymmetric, have fewer access restrictions and will not overtly promote authority or leadership. Their design will be simple (Callahan, 2005).

"Individualism/collectivism" describes the attitude towards each member of society. In individualistic societies, people tend to care only about themselves and their families. Collectivistic cultures tend to depend on the organisation to look after them. (Lim et al, 2004). Web sites of individualistic cultures concentrate on success, provide personal information as well as promote progress and change. They highlight tradition, history and socio-political points of view, using images of aged and experienced groups (Callahan, 2005).

Cultures demonstrating high "uncertainty avoidance" have limited trust and are more resistant to change. Organisations seeking to trade on line must appear trustworthy and dependable. Webs should have simple designs and limit choice, with content focusing on daily life. Low uncertainty avoidance cultures' sites are more complex, with many options. Pages will be longer, require scrolling and may include abstract images.

"Masculinity cultures" are characterised by a strong need for success, achievement and power. Web sites possessing these characteristics will use interactive elements, and navigation will focus on full control. Design will be process-orientated and use a softer colour palette (Marcus, 2002). Authority and tradition are emphasised, choices will be limited and orientated to goals (Callahan, 2005). Femininity cultures are service-orientated and are characterised by a desire to care for others. They also emphasise the quality of life (Liao, Proctor and Salvendy, 2008), focus on visual aesthetics and promote the exchange of information as well as visual representation of feminine theme such as photos of families, females etc. They promote a relaxed style by using pictures of happy people interacting together and use a more vivid colour palette (Callahan, 2005).

Hall (2000) proposed a framework which distinguishes high/low cultural differences. He suggested that cultures differ in the way people communicate with one another. The meaning of words depends upon the context in which they are used; just as "body language" can skew the received meaning of words, the cultural "wrapper" within which words are presented can skew interpretation. For full understanding, it is necessary to combine words with context. "High context" cultures (e.g. China, Japan and Korea) are characterised by non-verbal methods such as behaviour, situation and body language. People within such cultures use indirect verbal communication and expect listeners to guess their point by analysing the context. However, most western nations are "low context" cultures, using mainly text and speech to communicate.

Studies carried out by Rajkumar (2003), Callahan (2005), Ahmed, Mouratidis and Preston (2008) and Eristi (2009) are valuable in their own right, but are limited in scope; either by restricting the business sector, range of geographic regions or some such. The current study undertook an analysis of the eCommerce web sites of a range of global corporations. It included a range of industry sectors, geographic and cultural regions, and subjected a sample of web sites to formal analysis. The outcome would be a matrix that shows the degree to which the candidate web sites adapt to different cultures. It would provide global operators with a series of objective benchmarks against which they could assess or plan their own offering.

2. BODY OF PAPER

2.1 Objectives and Methodology

The main objective is to assess cultural differences across of a number of global corporations' websites against Hofstede's and Hall's frameworks. A sample of four corporations was chosen. Each operates in a different business sector and has a different country of origin (Table 1). All are leaders in their industry.

The selected companies represent not only different business sectors, but also are culturally diverse and each plays a major role in global markets. All are successful and have internationalised web sites.

Table 1. Website specifications

NAME	COUNTRY OF ORIGIN	SECTOR
HSBC	United Kingdom	Banking
Samsung	South Korea	Electronic
McDonald's	United States	Food
Nokia	Finland	Telecommunication

2.1.2 Approach

Each web site was examined to assess the degree to which it had been adapted to accommodate cultural differences across the regions of the United Kingdom, USA, South Korea and Finland. These four regions possess significant differences in terms of Hofstede's dimensions and Hall's context scale. Chinese editions were added in order to increase cultural diversity. Although the UK and USA share many characteristics that are relevant to this study, sufficient cultural differences exist to justify inclusion of both.

Hofstede's cultural dimensions were expected to impact on web site designs. Hence the subject web sites were characterised in terms of power distance, individualism/collectivism, masculinity/femininity and uncertainty avoidance factors. A sample of the expected results (for "Power Distance") is shown as Fig.1.

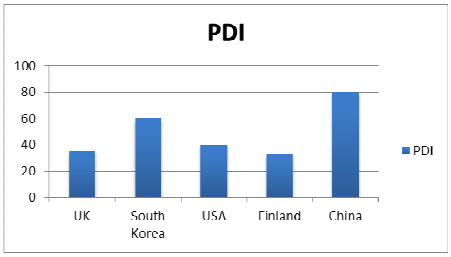

Figure 2. Hofstede's "Power Distance" cultural dimension
Source: www.geert-hofstede.com

2.2 Expected Results

2.2.1 UK and USA

According to Hofstede's cultural dimension, these countries would have low power distance, high individualism, high masculinity and low uncertainty avoidance. Classified as rather low context cultures in Hall's framework, their web sites should have simple, asymmetric and process-orientated designs that promote access to detailed and personal information. Pictures contain individuals of both genders, public spaces, buildings and daily activities and will also promote progress and change. Sites would present private opinions and emphasise recent news and events. They would be full of interactive elements, have limited choices, soft colour palettes and navigation systems that give users full control.

2.2.2 China

China has high power distance, low individualism, high masculinity and low uncertainty avoidance scores and is classified as a culture of high context. Websites should be highly structured and organised, with symmetrical design and a top-orientated, text-based navigation model. They would be expected to promote national and social order using official logos, photos of leaders, company representatives, aged and experienced groups, monuments and buildings. They would highlight tradition and history, be orientated towards groups and offer links to clubs, chat rooms and newsletters. Visual designs would use soft colours, include many active elements and limit choice within a process-orientated design.

2.2.3 South Korea

South Korea has high power distance, low individualism, low masculinity and high uncertainty avoidance scores. Hall would classify it as a culture of high context. These websites should be highly structured and organised, with symmetrical design and a top-orientated and text-based navigation model. These sites will promote national and social order using official logos, photos of leaders, company representatives, aged and experienced groups, monuments and buildings. They will highlight tradition and history, and be 'we' orientated. Limited navigation links reflects restricted choice, in similar manner to Chinese websites. Their "femininity" places focus on visual aesthetics and the exchange of information. Site designs were expected to include families, females, and "happy people interacting with each other". Colour palettes would be vivid and visual designs would use animation, while products would be promoted by images of people using them.

2.2.4 Finland

Finland would be characterised by low power distance, high individualism, low masculinity and high uncertainty avoidance scores. Under Hall's framework, it is a low context culture. Sites will be asymmetrical, loosely structured and simple in design with a limited range of choices provided by a restricted number of links. These sites should not restrict access to information and the exchange of private opinions. Photos will include individuals of both genders, families, relaxed people, placing them in public spaces and enjoying daily activities. They will concentrate on success, events and news and promote change and progress. They will be 'you' orientated where private opinions will be shared. Visual design will include vivid colour palettes and large amount of text. Product values would be communicated by the use of imagery centred on individuals' lifestyles rather than by displaying images of the products themselves.

2.2.5 Choice of Assessment Criteria

The purpose of the study was to assess the degree to which previous studies of limited but varied scope provide an insight can be generalised. An objective set of assessment criteria was determined by drawing a set of 25 assumptions based on those earlier studies. The selected web sites were examined to determine the degree to which they conformed to the expected characteristics. Assimilation of these results across the sample space would provide a gauge of generalisability.

Table 2. Assumptions tested

1. American & British web sites have simple and asymmetrical designs.	6. American & British web sites display large amount of text.	11. Chinese web sites display pictures of products and people using those products.	16. South Korean web sites display photos of families, females, laughing people and daily activities.	21. Finnish web sites have simple and asymmetrical designs.

2. American & British web sites present pictures of both genders, buildings and daily activities.	7. Chinese web sites have structured and symmetrical designs.	12. Chinese web sites use soft colour palettes.	17. South Korean web sites have active elements.	22. Finnish web sites present pictures of individuals of both genders, families, public spaces and daily activities.
3. American & British web sites have active elements.	8. Chinese web sites have top-orientated and text-based navigation models.	13. South Korean web sites have structured and symmetrical designs.	18. South Korean web sites display pictures of products and people using those products.	23. Finnish web sites do not display images of products.
4. American & British web sites do not display pictures of products.	9. Chinese web sites present pictures of leaders, company representatives, aged & experienced groups, monuments, etc.	14. South Korean web sites have top-orientated and text-based navigation models.	19. South Korean web sites highlight tradition and history.	24. Finnish web sites display large amounts of text.
5. American & British web sites use soft colour palettes.	10. Chinese web sites have large amount of active elements.	15. South Korean web sites present pictures of leaders, aged & experienced groups, monuments, etc.	20. South Korean web sites use vivid colour palettes.	25. Finnish web sites use vivid colour palettes.

2.3 Results

The web sites of each corporation and for each cultural region were assessed within the context of Hofstede's and Hall's frameworks. The outcomes were then compared to those that had been anticipated from the results of previous studies, with the results contained in tables 3-5. Each assumption was allocated a correlation factor that could be used to confirm full or partial compliance with the expected result (Table 7). Overall, seventeen assumptions have been confirmed, the characteristics of six fully complying with expectations. Eight assumptions were shown to be false.

2.3.1 HSBC

Table 3. Evaluation of HSBC web sites

HSBC	UK	USA	China	Korea	Finland
Structure	Simple Asymmetrical	Simple Asymmetrical	Highly structured Symmetrical	Simple Asymmetrical	N/A
Navigation	Top +right Text based	Top + right Text based	Top + right Text based	Top + right + left Text based	N/A
Layout	Top-right-bottom	Top-right-bottom	Top-right-bottom	Top-left-right-bottor	N/A
Images	Some. Mainly people, both genders, different age, daily activities, culturally diverse.	Not many Mainly people.	Many. Mainly men. Women at the background. Smart dressed.	Some. Mostly objects. Images of the product.	N/A
Colour palette	Soft Red, black, white, grey	Soft Red, black, white, grey, blue	Vivid Red, grey, white	Vivid Red, grey, blue, green	N/A
Active elements	Not many	None	Many	None	N/A

2.3.2 McDonald's

Table 4. Evaluation of McDonald's web sites

McDonald's	UK	USA	China	Korea	Finland
Structure	Simple Asymmetrical	Simple Asymmetrical	Simple Asymmetrical	Unique Asymmetrical	Simple Asymmetrical
Navigation	Top Text-based	Left Text-based	Top Text-based	Bottom Text-based	Top Text-based
Layout	Header-footer	Top-left-bottom	Header-footer	Floating-window	Header-footer
Images	Many Product People all ages, genders and nationalities Families Public figures Open spaces	Many Product People all ages, genders and nationalities Families Daily activities	Many Product People young, company's representatives, Both genders	Many High quality and large Mostly product People of both genders (only home page)	Large Product People young, all genders, families
Colour palette	Vivid Grey, red, white	Soft Red, white, grey	Vivid Red, yellow, black	Vivid Red, white	Vivid Black, orange, yellow
Active elements	Not many	Not many	Many	Many	Not many

2.3.3 Samsung

Table 5. Evaluation of Samsung web sites

Samsung	UK	USA	China	Korea	Finland
Structure	Simple Asymmetrical	Simple Asymmetrical	Simple Asymmetrical	Simple Asymmetrical	Simple Asymmetrical
Navigation	Top Text/icon based	Top Text based	Top Text/icon based	Top Text/icon based	Top Text/icon based
Layout	Top-bottom	Top-bottom	Top-bottom	Top-bottom	Top-bottom
Images	Many Product People all ages, genders and cultural background	Many Product People, women, families, company representatives	Many Only products	Many Product People young, successful, kids Home environment	Many Only products
Colour palette	Soft White, blue	Soft White, blue, black	Soft White, blue, grey	Vivid Blue, white	Vivid Blue, white
Active elements	Not many	Not many	Not many	Many	Many

2.3.4 Nokia

Table 6. Evaluation of Nokia web sites

Nokia	UK	USA	China	Korea	Finland
Structure	Simple Asymmetrical	Simple Asymmetrical	Simple Asymmetrical	Simple Asymmetrical	Simple Asymmetrical
Navigation	Top Text based	Top Text based	Top Text based	Top Text based	Top Text based
Layout	Top-bottom	Top-bottom	Top-bottom	Top-bottom	Top-bottom
Images	Many Product People's fingers	Many Product People young,	Many Product People young,	Many Product People both	Many Product People young, both

		both genders, Daily activities	both genders, company representatives	genders, experienced, Daily activities	genders Animals Public spaces Daily activities
Colour palette	Soft Green, white White space	Soft Green, white, blue	Vivid Green, white, blue, grey	Soft Green, white and blue White space	Vivid Bright colours Green, blue White space
Active elements	Not many	Not many	Many	Not many	Many

2.3.5 Summary

Table 7. Assimilated Results

Assumptions	HSBC	McDonald's	Samsung	Nokia	Total
1. American and British websites have simple and asymmetrical designs.	1	1	1	1	1
2. American and British websites present pictures of both genders, buildings and daily activities.	1	1	1	1	1
3. American and British websites have active elements.	0	1	1	1	0.75
4. American and British websites do not display pictures of the product.	1	0	0	0	0.25
5. American and British websites use soft color palettes.	1	0	1	1	0.75
6. American and British webs use large amounts of text.	1	0	0	0	0.25
7. Chinese websites use structured and symmetrical design.	1	0	0	0	0.25
8. Chinese websites have top-orientated and text-based navigation model.	1	1	1	1	1
9. Chinese websites present pictures of leaders, company's representatives, aged and experienced groups, monuments and buildings.	1	1	0	1	0.75
10. Chinese websites have large amounts of active elements.	1	1	0	1	0.75
11. Chinese websites display the picture of products and people using those products.	0	1	1	1	0.75
12. Chinese websites use soft color palette.	0	0	1	0	0.25
13. South Korean websites have structured and symmetrical design.	0	0	0	0	0
14. South Korean websites have top-orientated and text-based navigation model.	1	0	1	1	0.75
15. South Korean websites present pictures of leaders, company's representatives, aged and experienced groups, monuments and buildings.	0	0	0	1	0.25
16. South Korean websites display photos of families, females, laughing people and daily activities.	0	1	1	1	0.75
17. South Korean websites have active elements.	0	1	1	1	0.75
18. South Korean websites display the picture of products and people using those products.	1	1	1	1	1
19. South Korean websites highlight tradition and history.	0	0	0	0	0
20. South Korean websites use vivid color palette.	1	1	1	0	0.75
21. Finnish websites have simple and asymmetrical design.	N/A	1	1	1	1
22. Finnish websites present pictures of individuals of both genders, families, public spaces and daily activities.	N/A	1	0	1	0.66
23. Finnish websites do not display images of the products.	N/A	0	0	0	0
24. Finnish websites display large amount of text.	N/A	0	1	1	0.66
25. Finnish websites use vivid color palette.	N/A	1	1	1	1

3. CONCLUSION

This study set out to analyse the impact of culture on the design of global eCommerce websites. The results verified that knowledge from previous studies has been recognised and implemented. Webs aimed at cultures of low power distance score (e.g. Finland, Great Britain and USA) are simple and asymmetrical in design. Pictures present people of both genders, performing daily activities, families, public spaces and buildings. However, although it was expected that high power distance cultures (China and South Korea) would present pictures of leaders, company representatives, aged and experienced groups and monuments, this was confirmed only for Chinese websites. Callahan (2005) said that feminine cultures (South Korea and Finland) would display such images on their websites. This has been confirmed.

Cultures of high power distance were expected to use top-orientated, text-based navigation models. This was confirmed in 17 of 19 cases. Masculine cultures (e.g. UK, USA and China) were expected to use soft colour palettes. British and American web sites did so but Chinese sites used more vivid colours. However, although the Chinese associate the colour red with prosperity and good luck, the samples did not use red excessively. The results confirm that collectivistic cultures of high level of masculinity and high level of communication context (e.g. China) have large amounts of active elements such as slide shows, video players etc.

In conclusion, this paper has identified a number of principal factors that should be taken into consideration when planning regional editions of global web sites. It also demonstrates that, in general, multi-national corporations have some awareness of the need to "glocalise", but that they have yet to appreciate and implement the complete range of design features that provide fully culturally aware web sites.

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EXTEND THE UTAUT TO MEASURE THE ADOPTION OF ON-LINE SHOPPING IN SAUDI ENVIRONMENT

Faisal Fahhad Alsharif[1], François Siewe[1], Chris Fidler[2] and Giampaolo Bella[1]
[1]*STRL , DMU*
[2]*CSSR, DMU*

ABSTRACT

Due to the growing importance of electronic commerce and on-line shopping economically and socially in people's lives, the researchers took interest in conducting several studies in order to identify the factors that urges people to adopt this type of electronic activity. This study among these studies aimed at to the same purpose. Particularly, this study aimed to investigate the constructs that are related to the adoption of online shopping, and also explore the relative importance of factors that encourage or discourage Saudi use on-line shopping. The Unified Theory of Acceptance and Use Technology (UTAUT) for (Venkatesh et al. 2003) were adopted by this study. In this study, a set of hypotheses based at the original model in addition to the factors added to extend the model were used. The results of this study confirmed the validity of the added factors as influential constructs in the process of adopting on-line shopping in Saudi Arabia, also showed the relative importance of each element.

KEYWORDS

E-Commerce, on-line shopping, The Unified Theory of Acceptance and Use Technology

1. INTRODUCTION

1.1 E-Commerce and On-line-Shopping in Saudi Arabia

The activity of electronic commerce in Saudi Arabia is witnessing remarkable real growth in the last five years in particular. Many of the indicators and statistical reports indicate that. A new major survey of the internet users in Saudi Arabia was concluded by the Arab Advisors Group in January 2011.

The survey revealed that around 39% of adult internet users in Saudi Arabia buy products and pay for services online. The Arab Advisors Group conservatively estimates the number of these users to be around 3.1 million which is around 12% of the total population in Saudi Arabia. These e-commerce users have spent an estimated $3bn on buying products and paying for services through e-commerce transactions in 2010.

1.2 The Components of Extended UTAUT

Venkatesh et al. (2003) reviewed and compared the eight dominant models that have been used to explain technology acceptance behaviour. These models included TRA, TPB, TAM, combined TAM - TPB, DOI, SCT, MM, and MPCU (some discussed in literature review). Venkatesh et al. (2003) define each of the determinants, specify the role of key moderators (gender, age, voluntariness, and experience), and provide the theoretical justification for the hypotheses as follows:

Performance Expectancy (PE) is the degree to which an individual believes that using the system will help him/her to attain gains in job performance. Effort Expectancy (EE) is the degree of ease associated with the use of system. Social Influence (SI) is the degree to which an individual perceives that important others believe he/she should use the new system. Facilitating Conditions (FC) is the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system. Self-efficacy (SE) is the belief that one has the capability to perform a specific task. Perceived credibility (PC) can be

defined as the degree to which an individual believes online shopping is trustworthy and secure. This construct is divided to three factors, security, trust, privacy and risk factors.

Perceived Risk with Products/Services (PRP) Lee et al. (2000) define perceived risk as the overall amount of uncertainty or anxiety supposed by a consumer towards a particular product/service when the consumer purchases online. Perceived Risk in the Context of Online Transactions (PRT) Lee et al. (2000) define perceived risk in the context of online transactions (PRT) as a possible transaction risk that consumers can face when exposed to e-commerce.

Cultural background (CB) According to Hofstede (1991), the term is defined as "The collective mental programming of the mind which distinguishes the members of one group or category of people from another.

Prevention Factors (PF) This construct is developed by this study. It contains a set of factors that could impede the adoption of new technology and it is related to the Saudi society as developing country. This construct is divided to three factors, Legislation Availability, The Quality of Internet Services and postal Address and Delivery System.

2. RESEARCH METHODOLOGY

This research follows a quantitative methodology. Quantitative data according to Oates (2006) means numerical data or evidence. The questionnaire was more appropriate to use to collect data from 472 shareholders. Questionnaires are an efficient method used to collect data when the researcher knows exactly what to ask and how to measure the variables of interest in order to achieve relevance and accuracy (Sekaran 2000; Zikmund 1997).

These data were subjected to statistical analysis by simple and multi linear regression in addition to univariate. In statistics, regression analysis includes many techniques for modeling and analyzing several variables, when the focus is on the relationship between a dependent variable and one or more independent variables. Regression analysis is widely used for prediction and forecasting, where its use has substantial overlap with the field of machine learning. Regression analysis is also used to understand which among the independent variables are related to the dependent variable, and to explore the forms of these relationships.

2.1 Research Hypotheses

H1: *There is a statistically significant relationship between* ***Performance Expectancy*** *of on-line shopping and Behavioural Intention in Saudi Arabia.*
H2: *There is a statistically significant relationship between* ***Effort Expectancy*** *of on-line shopping and Behavioural Intention in Saudi Arabia.*
H3: *There is a statistically significant relationship between* ***Social Influences*** *of on-line shopping and Behavioural Intention in Saudi Arabia.*
H4: *There is no statistically significant relationship between* ***Facilitating Conditions*** *of on-line shopping and Behavioural Intention in Saudi Arabia.*
H5: *There is a statistically significant relationship between* ***Perceived Credibility*** *of on-line shopping and Behavioural Intention in Saudi Arabian.*
H6: *There is a statistically significant relationship between* ***Cultural Background*** *of on-line shopping and Behavioural Intention in Saudi Arabian consumers.*
H7: Computer self-efficacy *of on-line shopping adoption in Saudi Arabia has no significant influence on Behavioural Intention.*
H8: Computer anxiety *of on-line shopping adoption in Saudi Arabia has no significant influence on Behavioural Intention*
H9: Attitudes toward using technology *of on-line shopping adoption in Saudi Arabia have no significant influence on Behavioural Intention*
H10: Behavioural Intention *of on-line shopping adoption in Saudi Arabia has a significant, positive effect on usage.*
H11: *There is no statistically significant relationship between* ***Prevention factors*** *(Legislation Availability, Delivery System, Postal Address and Quality of Internet Services) of on-line shopping and Behavioural Intention in Saudi Arabia.*

3. DATA ANALYSIS

3.1 Sample Description

A total of 472 respondents were answer the questionnaire with 212 (45%) being female and 260 (55%) male. There was gender imbalance in those who participated in the study and this difference was statistically significant, p-value = 0.002. The age distribution for the respondents were 52.1%, 34.3%, 11.9%, and 1.7% in the age groups less than or equal to 25 years, 26 – 35 years, 36 – 45 years, and greater than 46 years respectively as shown in figure 1.

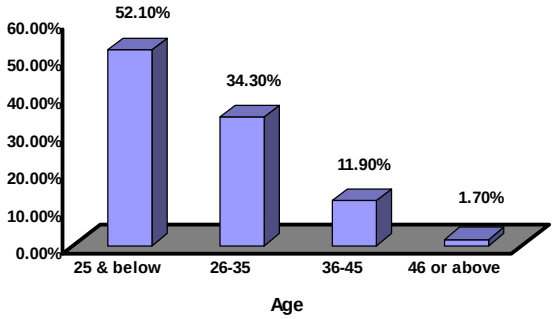

Figure 1. Age Distribution of Participants

Of the total, 13.1% of respondents were educated to high school level or below compared to 5.9% with Diplomas, 56.8% graduates (Bachelor's degree), and 20.8% postgraduates (higher education) and 3.4% with other educational qualifications as shown in figure 2.

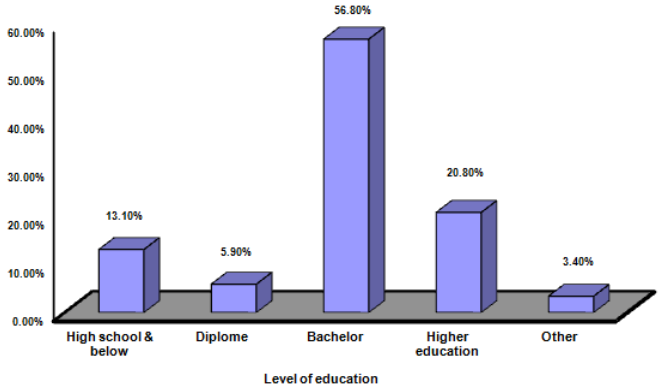

Figure 2. Educational Groups for Participants

Of the total, 408 respondents were less than 35 years (86.4%). Majority of the respondents were not in employment since they were students, 57.6% compared to 30.3% who were employed in the public sector, 10% in private sector and 2.1% are freelancers. 47.5% of the respondents were earning less than 3000 S.R, 12.3% between 3001 and 5999 S.R, 17% between 6000 and 9000 S.R and 23.3% earning more than 9000 S.R. Respondents were asked to rate themselves on a Likert scale of 1 – 5 about their computer and internet skills with 1 being the lowest score and 5 the highest. The scale was defined as 1 "Very Poor" 2 "Poor" 3 "Moderate" 4 "Good" and 5 "Very Good". In terms of general computer knowledge based on self-rating; 82.8% and 85% rated themselves as having both good or very good computer and internet skills respectively. Only 4.7% of respondents had used the internet for less than a year with 2.3% using having used it for 1-2 years. Majority of the respondents, 92.6% reported to have been using the internet for more than 2 years with 79% using the internet for at least 3 hours per day (table 1). There was no association between age category and general computer knowledge, p-value = 0.283 and internet skills rating, p-value = 0.622. Users' perception toward online shopping was assessed by a 5 point Likert scale constructed as strongly disagree =

1, disagree = 2, neutral = 3, agree = 4, and strongly agree = 5. The highest score denotes the most positive outcome. The results are presented in table 2 below.

3.2 Hypothesis Test

The following table contains the hypotheses test results:

Table 1. Hypotheses Analysis Summary

Hypo. No	Variable	Hypotheses	Decision
H1	*Performance Expectancy*	*PE of on-line shopping adoption in Saudi Arabia will influence BI*	Supported
H2	*Effort Expectancy*	*EE of on-line shopping adoption in Saudi Arabia will influence BI*	Supported
H3	*Social Influences*	*SI of on-line shopping adoption in Saudi Arabia will influence BI.*	Supported
H4	*Facilitating Conditions*	*FC of on-line shopping adoption in Saudi Arabia will not influence BI*	Not Supported
H5	*Perceived Credibility*	*PC of on-line shopping adoption in Saudi Arabia will influence BI*	Supported
H6	*Cultural Background*	*CB of on-line shopping adoption in Saudi Arabia will have influence BI*	Supported
H7	*Computer Self-Efficacy*	*SE of on-line shopping adoption in Saudi Arabia will not have significant influence on BI*	Not Supported
H8	*Anxiety*	*Computer anxiety of on-line shopping adoption in Saudi Arabia will not have significant influence on BI*	Not Supported
H9	*Attitude toward using technology*	*AT of on-line shopping adoption in Saudi Arabia will not have significant influence on BI.*	Not Supported
H10	*Behavioural Intention*	*BI of on-line shopping adoption in Saudi Arabia will have a significant positive effect on AU*	Supported
H11	*Prevention factors*	*PF of on-line shopping adoption in Saudi Arabia will not have influence BI*	Supported

4. DISCUSSION AND CONCLUSION

4.1 Performance Expectancy

According to the result in this study, performance expectancy has positive effect on behavioural intentions. This outcome is consistence with the (Venkatesh et al., 2003). This finding is also supported by some empirical studies such as (Al-Gahtani, 2003) and (Al-Awadhi, 2008). However, On the other hand the results show a lack of an influential role for age and gender in the relationship between the two variables.

4.2 Effort Expectancy

According to the result, there is a statistically significant relation between EE and BI in the case of using the online shopping technology. This result is consistent with the UTAUT model and (Al-Gahtani, 2003). However, the findings in this study showed that gender, age and experience do not play any effecting moderator on the relation between EE and BI, but rather age has direct influence on BI. This is consistent with a study (Al-Gahtani, 2003).

4.3 Social Influence

The result from the current study showed that this construct also has significant influence on behaviour intention, which is consistent with the original UTAUT model. However, the result does not support the role of age, gender, education and experience as moderators.

4.4 Facilitating Conditions

In opposition to the original theory the test of the amended UTAUT model found that facilitating conditions have a significant influence in predicting behaviour intention. This may be due to the absence of support, considering that on-line shopping activity is considered as personal activity done by the person from home or office. The results however, proved the existence of a strong relationship between the facilitating conditions and actual use. This is consistent with the original theory of UTAUT as well as Al-Gahtani (2003)'s theory.

4.5 Computer Self-Efficacy and Anxiety

The SE and AX in UTAUT model were non-significant as a determinant of intention due to the effect being captured by effort expectancy. However, the results in the current study indicate that both factors SE and AX have significant influence on BI. This result is consistent with Social Cognitive Theory (SCT) (Venkatesh, 2000; Sundaravej, 2006) and (El-Gayar, 2010). This can be explained by the lack of experience for some respondents that lead to increasing effect of anxiety on behaviour intention.

4.6 Attitude toward using Technology

The extension model in this study found that attitude has significant influence to predict BI. Indeed, attitude was found as the most important factor in the process of predicting the intention to use on-line shopping to the Saudis, (Beta= .578). The high impact strength of the attitude toward using on-line shopping found in this study may be due to the fact that most of the users are well educated and they have sufficient experience using computer, since computer self-efficacy was found to be associated with attitudes toward computer technologies (Zhang and Espinoza, 1998).

4.7 Behavioural Intention

The finding of this study proved this relationship between BI and AU. This result is consistent with the underlying theory for all of the intention models, (Venkatesh et al., 2003).

4.8 Perceived Credibility

The result showed that the four factors have a significant influence to predict the behavioural intention. Privacy was found as the second important factor in the process of predicting the intention to use on-line shopping to the Saudis compared to all constructs and the first factor among the PC factors, (Beta= 0.543). Trust was the second (Beta= 0.471) followed by Security (Beta= 0.433). (See table 7.1). This result is certainly consistent with many studies in this regard. The high sensitivity of credibility factors found in this study was expected since the Saudi society is still growing with the use of new technology. Therefore, these factors are still the most influential factors on the adoption of electronic shopping.

4.9 Cultural Background

The results showed that the cultural background represented by language and religion does not have any effect on the intention to actual use of on-line shopping. For religion, these results are unexpected considering that the Saudis are religiously committed people. There are people who believe that the credit card concept is incompatible with the principles of religion. Use of interest is forbidden in Islam. These

findings are consistent with studies confirming that language and religion are not considered anymore an obstacle to consumers' adoption of e-commerce (Aleid, 2009; Al-Ghaith, 2010).

4.10 Prevention Factors

This construct is divided into three factors: the absence of legislation, the quality of Internet services, mailing addresses, and delivery services. The prevention factors are similar to the facilitating conditions construct in terms of the relationship between these conditions and the behaviour intention and the actual use. It is suggested that the prevention factors has no effect on the behaviour intention in light of the availability of performance expectancy, effort expectancy constructs. The results indicated that there was a significant influence of both mailing addresses and delivery services on AU, while there was no effect of absence of legislation and the quality of the Internet on AU. These results are unexpected especially the absence of legislation. The non-significance of the absence of legislation may be due to the absorbing aspect of this question for some of the respondents.

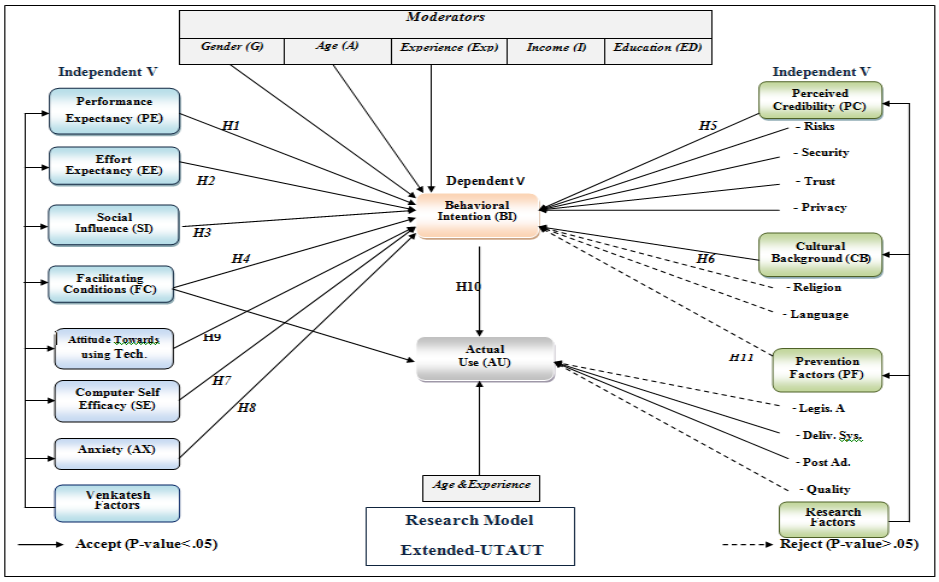

Figure 3. The Proposal Extended UTAUT

The figure above shows the extended research model based on the UTAUT after conducting the hypotheses test.

4.10.1 The Most Important Factors predicting BI and AU

The results shown in the next table were attained using regression and univariate analysis.

Table 2. The Important factors affect BI and AU

The important Variables affecting BI			
Rank	**Variables**	***Beta Value***	R^2
1	*AT*	0.578	.334
2	*Privacy*	0.543	.294
3	*PE*	0.507	.257
4	*Trust*	0.471	.222
5	*PC*	0.453	.205
6	*Security*	0.433	.187
7	*EE*	0.415	.172
8	*SE*	0.380	.145

9	*FC*	0.307	.094
10	*SI*	0.300	.090
	AX	-0.268	.072
11	*Risk*	-0.186	.035
12	*CB*	0.168	.28
13	*PF*	0.104	.011
The important variables affecting AU			
1	*FC*	0.475	.225
2	*BI*	0.378	.143
3	*LA2*	0.196	.030
4	*Postal Address*	0.156	.024
5	*Exp.*	0.165	
6	*Delivery Services*	0.109	.012

The *Beta* coefficients are the standardized regression coefficients. Their relative absolute magnitudes reflect their relative importance in predicting respondent's behaviour intention (BI). But *Betas* are only compared within a model, not between models. $\boldsymbol{R}^2$ is the percent of the dependent explained by the independents. In this case, the independent variable *AT* explains about 33% of the variability in BI (table 2).

Attitude is shown to be much more important than the other independent variables. This means that the Saudis are willing to use on-line shopping in the future. This may reflects their awareness of the importance and benefits of on-line shopping. In addition, the fact that respondents are well educated with good experience may motivate their attitude to use on-line shopping. Privacy (ranked second) is an important factor of the Saudis on-line shopping experience. This result is not surprising. Issues like privacy (ranked second), trust (ranked fourth), and security (ranked sixth) are still a big concern for everyone around the world when shopping online, even for the western peoples.

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A VISUAL T-COMMERCE INTERFACE USING PARALLEL COORDINATES

Diovanni Moraes de Araújo[1], Nikolas Jorge Santiago Carneiro[2], Anderson Gregório Marques Soares[3], Aruanda Simões Gonçalves Meiguins[4] and Bianchi Serique Meiguins[1]
[1]*Programa de Pós-Graduação em Ciência da Computação – Universidade Federal do Pará (UFPA)*
[2]*Bacharelado em Ciência da Computação – Universidade Federal do Pará (UFPA)*
[3]*Faculdades Integradas Ipiranga*
[4]*Área de Ciências e Tecnologia – Centro Universitário do Pará (CESUPA)*

ABSTRACT

This paper presents work and research in the Digital TV area, with a focus on t-commerce - Digital television commerce - [Ghisi, 2010]. This paper presents a information visualization prototype to improve the user experience when searching for products that best match their needs. The visualization technique implemented is a modified version of parallel coordinates, adapted to the reality of digital TV applications. The prototype was built over the middleware Ginga® using NCL and Lua. Ginga® is the Brazilian middleware of the Digital TV System (ISDB-T_B), developed based in the Japanese middleware, but adapted for the Brazilian context.

KEYWORDS

t-commerce, iDTV, Ginga, interactive, visualization, parallel coordinates.

1. INTRODUCTION

With the increasing popularity of devices that support the Brazilian Interactive Digital TV (iDTV) platform, the middleware GINGA [SBTVD, 2010], and the increase of internet access by the Brazilians, boosted by digital inclusion initiatives and future discontinuation of analog TV broadcasts, make natural to consider the Interactive Digital TV as an environment for popularization of electronic services and as a entry point for new users.

The definition of a Brazilian middleware for digital interactivity, besides allowing the country to determine the course of its technology, allows a popular device, the TV [IBGE 2003], to be used to access the internet and the services it provides. It is believed that on the TV, services such as sales (t-commerce), education (t-learning), governance (t-government), banking (t-banking) and others, will be adopted by viewers as those for the web environment [Roher, 1997].

But for users to be attracted to a new environment, it is necessary that this provides a pleasant usage experience, intuitive and easy interactions, safety and agility. As an example, [Baladhandayuthan, 2010] highlights the strong adoption of e-commerce and other related services in the web environment, such as security, inventory tracking, etc. Some services however, show aspects intrinsically dependent upon the platform in which it will be used, for interactive TV, an aspect that needs to be addressed with greater attention is interactivity.

With the popularization of computers, the interaction through pointing devices (like the mouse) has become a common way to use electronic services. However, the Ginga does not establish the use of any pointing device, defining only a delimited set of remote control buttons for interactivity. This lack of a more sophisticated interaction device causes the applications to tend to two approaches, very simple applications with low level of interactivity and more complex applications, which are more difficult to use and, sometimes, end up making user not to feel motivated in using it. This difficulty interaction is even more noticeable when bringing to iDTV an application that involves a lot of interaction, such as information visualization tools.

To use visualization concepts in iDTV, it is still needed to find a balance between ease of use and the availability of more complex interactions. The navigation on the visualization is one of the most affected characteristics by the lack of a better interaction device. It is necessary to define not only a simple mechanism of interaction, but also one that it is easily related to the interface presented.

User tests using the treemap technique for T-commerce [Carneiro, 2012], point out some problems caused by excess of settings and interactions on a t-commerce application. These tests indicate that establishing a kind of navigation strongly attached to the visualization technique may confuse the viewer, in part for not taking into account the viewer lack of contact with info graphics.

Considering the Morris' [2005] classification and the test observations made by Carneiro [2012], we define the following characteristics to be used in this paper:

- Association with content: as seen on Marques [2011], the data used and the application itself are related to the content presented by the TV channel, and it may not be properly functional at other time. Thus, both data and application are sent by the service provider each time the application is started.
- Use of filters and groupings: considering that a very large amount of data might hinder the process of comparing products on TV, and that the viewers have responded well to the use of groups [Carneiro, 2012], it was decided to allow filters based in categorical attributes, so that the viewer can limit the display to groups that share a common characteristic.
- Assistance to the viewer: a tool where there is no prior usage training needs to provide instructions and captions to guide the viewer. However, the poor location of this aid can make its use not effective. It is proposed that the textual aid should be close to the content to which it refers, with a font size that is readable in most sizes of screens and made by words that are not associated with specific niches and are easy to understand for viewers in general.
- Navigation: the use of applications on TV not only should try to minimize viewer effort, in number of interactions, this should also be easy to understand and related to navigable space that the viewer sees, not to confuse or disorient the user.

Considering these aspects, this works presents a prototype of t-commerce application that tries to refine the aspects seen in the literature so far, in order to provide not only an application, but also, a more suitable experience for a new computational environment.

This paper has three subsequent sections. Section 2 presents works that are directly related or served as base for some aspect of this work. Section 3 describes the design and functionality of the prototype developed during the course of this work**.** Section 4 demonstrates a scenario of the prototype. Finally, Section 5 makes some concluding remarks about this work and it next steps.

2. RELATED WORKS

Although the middleware GINGA is a relatively new and has not yet been popularized among the Brazilian households, we selected a series of works that were important during the development of this one, as related below:

- In Development of a System Providing a Personalized Yellow Page Service Based on an Interactive Video Application Service, one of the earliest references to the use of the t-commerce environment with a return channel, [Hur , 2009] presents a yellow pages service for TV.
- From Conceptual Model for T-Commerce in Brazil, we used the definition of Ghisi [Ghisi, 2010] to define a scope for this work. Ghisi's model shows a t-commerce based on presentation, associative content and form of payment. The concept of associative content was present during all the development of this work.
- In A Visualization Interface Applied in the Brazilian T-Commerce Scenario, Marques [Marques, 2011], using the Treemap technique [Shneiderman, 1992], propose the use of information visualization concepts (such as navigation, selection, details on demand, etc.) in the process of t-commerce, this also presents a navigation model adapted the visualization technique, application controls and limitations on interaction device.
- In Design Decisions for a Brazilian T-Commerce Application, Carneiro [Carneiro, 2012], based on Marques' [2011] work, discuss the decisions taken in the process of developing a t-commerce

application with IV. It is also presents the results of user testing and impressions about these decisions made in the development process.

This work can be seen as a sequel to the one proposed by Marques [2010] in order to use info graphics and visualization concepts as a way to support t-commerce, and to surpass the issues, observations and results presented by Carneiro [2012] in order to provide a better experience to the viewer, when using interactive visualizations on the TV.

3. IMPLEMENTATION PROTOTYPE

The prototype is a general-purpose information visualization interface for the iDTV environment. It allows a comparative visual analysis in the choice of products, through the use of the *Parallel Coordinate System* with the following characteristics:

- Allow that the viewer to select products, to gain more details about them;
- Allow the viewer get instructions about how to interact with the prototype;
- Dynamic configuration of the visualization by filters;
- Dynamic configuration of the color of the items;

The parallel coordinates technique was chosen as visual metaphor due to its characteristic to represent multidimensional information. However, a database in the context of Digital TV platform should not present too much data, due to the limited resources present a set-top box (STB) (Marques, 2011).

As each different attribute value is represented by a position in an axis, the lines connecting two items that posses the same values for attributes represented next one to the other will be occluded. To minimize this issue, and considering the limited number of items displayed concomitantly, we chose to render a colored square in a position relative to the value in an axis, the square has the same color as the line it represents and multiple same valued squares are stacked in horizontally. Even some line segments remain occluded, it is possible to identify the presence of the item by the squares, as show in Figure 1.

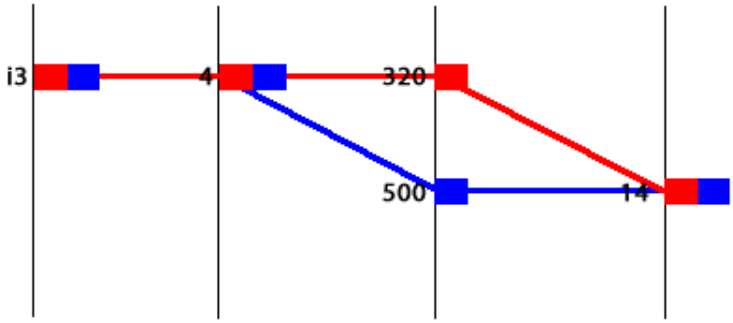

Figure 1. Sketch Adapted Parallel Coordinates

Data labels were used on the axis of the parallel coordinates to assist the user in the analysis. The labels were created on a layer on top of the data visualization, facilitating the reading of the labels.

As well as at work of Marques [Marques, 2011], we chose Ginga-NCL, instead of Ginga-J, to develop the prototype, due to the maturity of this option compared to the other one [Costa, 2010].

The NCL is only used as a presentation layer, to define the positioning of the graphical user interface and to make available the user controls of the application. The NCL layer also catches the Ginga events and passes it to the Lua layer. The visualization is generated and plotted by the Lua layer, following the configurations made. The Lua layer is also responsible for loading and organizing the dataset, control filters and the application chart.

The architecture of the prototype (Figure 2) was defined to it act as a prior step in the buying process, more specifically, in the choice of products. It is expected that the graphical representation plus the capability of filter of data, favors the viewer in having insights about the data relation, holding and facilitating the choice of products according to user need.

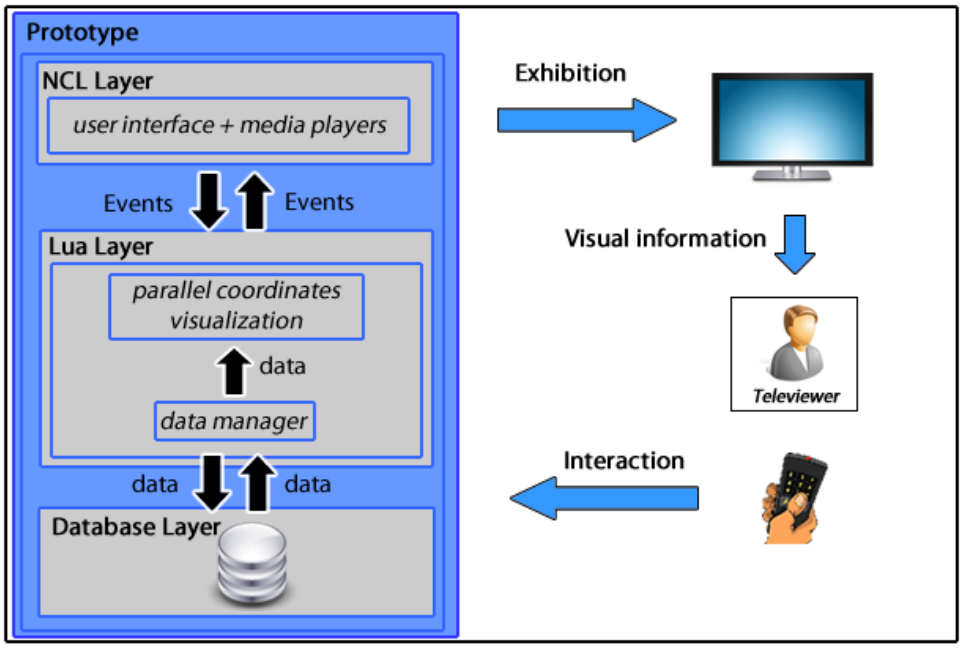

Figure 2. Architecture Prototype.

Besides the adaptability required, in both dataset handling and user interface generation, for the prototype to be a general purpose visualization application, another strongly considered point was the navigation cost for the user.

Based on Marques [Marques, 2011], we decided to design the user interaction with the prototype adopting an hierarchical-based method of navigation, but different from Marques, in this prototype the user never loses the sight of the configurations made, making the usage less dependent of user's memory efforts. Less and always visible configurations can gain also benefit from the lack of previous training, since the viewer can view the controls and its effects over the visualization at the same time.

The application life cycle begins when the user receives the notification of interactivity on its TV. Once started, it will end only in two ways: the users can exit the application without selecting products to buy, using the button "Exit" or the red button, or select the products they wish and send this information to the application that will finalize the purchase, using the green button.

It is important to say that the scope of this work is self-contained to the analysis, through the visualization, and the selection items to buy, it does not include the application of purchase nor the treatment by the remote server for sending and receiving data.

3.1 Main Features

This section describes the main features and functionality of the prototype. When the user starts the interactivity with the application, the prototype pops up a mosaic for the user to choose which kind of product will be analyzed (Figure 3). After this step, the user is directed to the next screen, which will display the products of the chosen category.



Figure 3. Mosaic with Product Category.

The main screen of the application (Figure 4) shows a selection menu with two categories (Brand and Price Range) horizontally positioned. These categories are used as filters for reducing the dataset analysis. The choice of categories in the top horizontal menu (Figure 4-A) changes the menu containing the list of items for analysis (Figure 4b). If the user doesn't want to filter, the menu is filled with all products in the dataset. When navigating to the product menu, the user can select the desired item by pressing the OK / ENTER button on the remote control. When selecting the product, the application assigns a color to the item by highlighting it in relation to the non-selected items. The user can select up to four items. When an item is selected, its respective poly-line is drawn in the display area (Figure 4-C), so that you can compare the values of the selected items in each attribute mapped in the parallel coordinates. Below the visualization, there is the area dedicated to the instructions for interaction (Figure 4-D), which shows the user the commands that he can perform in the application using the remote control.

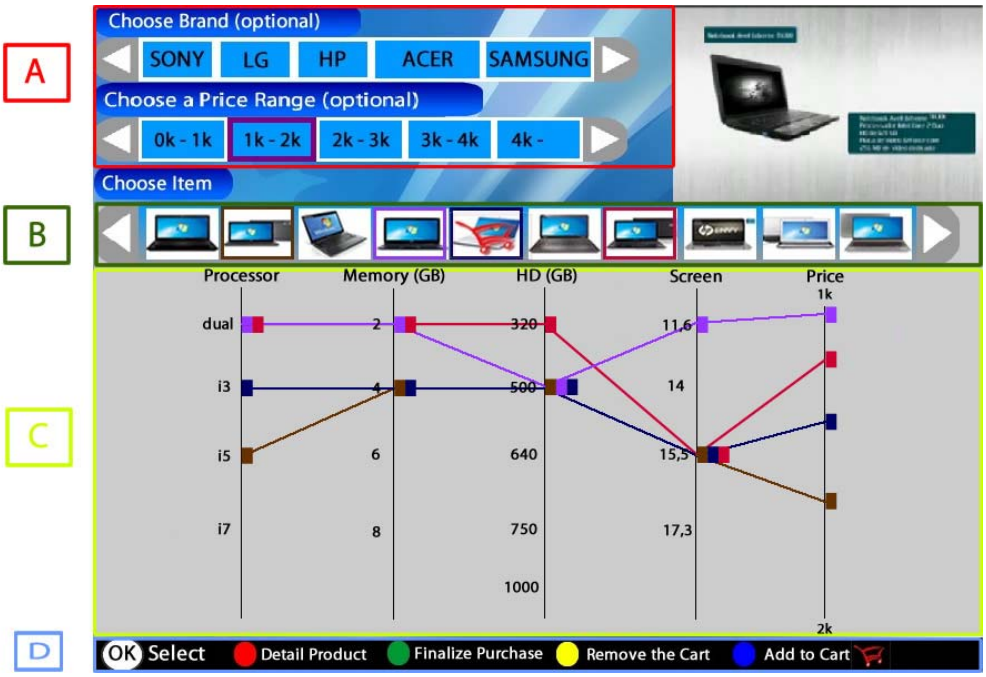

Figure 4. A - Filters menu; B - Items menu (Products); C - Visualization, D - Legend

Another feature of the prototype is the details on demand function. This function allows the user to see other characteristics of the selected item that is not visible in the visualization. This feature is enabled when the user press the red button over an item. Figure 5 shows the details on demand screen of a selected item, it is show in a navigable pop-up window, highlighted in the figure (Figure 5a), where the above and below arrows in the remote control function are used as a vertical scroll, and the left and right arrows are used to navigate between details of other selected items. To close this window, the user must press the red button.

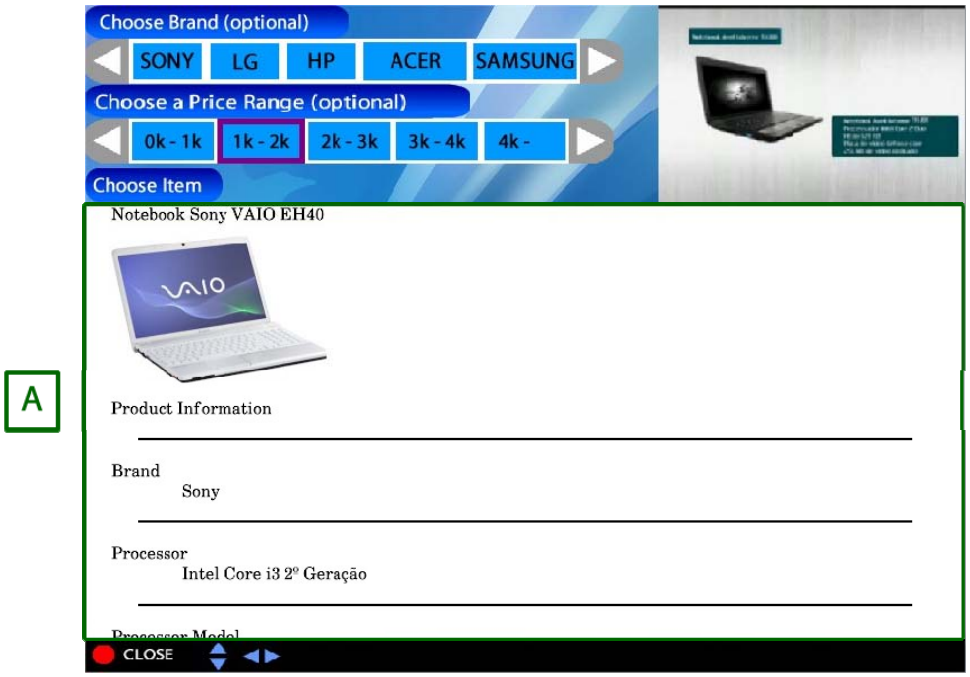

Figure 5. A - Pop-up navigable with product details.

Other features are necessary in a t-commerce (e-commerce in digital TV platform) application, such as add and remove items from the shopping cart. The legend at the bottom of Figure 4 informs to the user that the yellow button on remote control removes a product from the shopping cart, the blue button on remote control adds the product to the shopping cart, and the green button on remote control finalizes the choosing process and proceeds to the purchase. These buttons are enabled when the user navigates the menu item (Figure 4b). When the user navigate through the items and presses the blue button over one, the item selected is added to the shopping cart, and one indicating image (a little cart) is rendered over the item, showing to the user which products are in the shopping cart.

At any time the user can press the green button on the remote control to finish the shopping process. At the end of the shopping process, the application saves the shopping cart information and sends it to a remote application, using the return channel. The scope of this work is limited to the choosing process, the effective purchase and its mechanisms are not discussed.

4. USAGE SCENARIO

This section describes an use example of the prototype, in order to show the use of the available resources supporting the visual analysis on the iDTV environment. The database selected for the sample was constructed with information from the local notebook market, it contains 6 columns being 3 categorical and 3 numerical, with a total of 15 records. The database contains information on the model, brand, processor, storage capacity of hard disk and main memory, and display size of the notebooks.

The limitations pointed by Marques [Marques, 2011] on the iDTV environment were determinants on this work, especially about the limited interaction device and the low processing power of the STB's. These limitations imply in a reduced dataset, because as large is the number of items, more difficult is to the viewer reach all of them using the remote control.

As test environment, we used a virtual machine that simulates a STB with Brazilian middleware Ginga [GingaNCL, 2010]. Thus, in the usage scenario, we analyze which Sony notebook has the most powerful processor in a price range between 1k and 2k.

To find that specified notebook, the user can select the category laptops in the mosaic (Figure 3). Then, the user is directed to the next screen where the brands and price ranges can be selected to reduce the number of notebooks displayed. Choosing the Sony brand, the product menu is reset to show only Sony's notebooks. After this filter, the user can select a price range, at $ 1,000 - $ 2,000 (1K - 2K), to show the notebooks with price between one and two thousand dollars. The next step is to select the notebooks to analyze through the parallel coordinates visualization. Thus, the user can analyze the products that match the previous established characteristics, get details about the ones that best suit its need and opt or not for buying one.

5. FINAL REMARKS

This paper presented a prototype that offers visual analysis to assist the process of t-commerce, facilitating the search, analyses and choose of offered products of a similar nature. This prototype was developed in NCL and Lua, in the context of the Brazilian middleware Ginga. Part of the prototype was built with NCL, as the user interface and media control. The Lua language is used to manage the dataset, the shopping cart and the visualization.

A parallel coordinates visualization was modified for the digital TV as a way to reduce the occlusion problem, once the use of navigation techniques to approach this issue would increase the complexity of the interaction, which can hinder and frighten inexperienced users in the use the TV applications. In this sense, the Brazilian iDTV environment still needs to find a way to surpass the remote control limitation.

In future works, we plan to implement more customization mechanisms into the prototype, allowing axis positioning in the visualization, dynamically control over attributes displayed in the visualization, user definition of filter/menus and realization of user tests in a real scenario usage. The dynamic generation of the user interface is a working in progress, which will reduce effort necessary to load different datasets.

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E-INTERNSHIP PREVALENCE, CHARACTERISTICS, AND RESEARCH OPPORTUNITIES

Debora Jeske[1] and Carolyn Axtell[2]
[1]*Jacobs University Bremen, Campus Ring 1, 28759 Bremen, Germany*
[2]*Institute of Work Psychology & Management School, University of Sheffield, S10 2TN, United Kingdom*

ABSTRACT

The following paper examines a new form of internship as we know little about the prevalence and characteristics of e-internships to date. 187 e-internships were examined as part of a qualitative review of internet postings. The results demonstrate that postings for e-internships can be found in numerous countries and are posted online in various languages, with marketing postings making up the majority of cases. The remuneration, hours, and duration of e-internships vary widely. Further attention is given to exploring the particular challenges of and research gaps associated with such virtual work placements for the interns, the supervisors, and organizations alike. A number of research recommendations are outlined to address these issues.

KEYWORDS

e-internship, virtual internship, virtual work placements, internet

1. INTRODUCTION

The use of technology mediated communication enable virtual workers to keep in touch with their main offices and collaborate with others colleagues across space and time zones. Using technology to track and monitor employees are becoming acceptable means for supervisors to track progress made by their employees (Shellenbarger, 2012). A more recent evolution of virtual working is the emergence of new, computer-mediated internships which are also called 'virtual' or e-internships (van Dorp, 2008). In the present context, we use the term e-internship to describe such internship arrangements. Such internships, or work placements, are temporary, often part-time positions. Many students and graduates complete such internships as part of their studies (e.g., for dissertations or more formal placements as part of their degree program, e.g. Cheney, 2008; Franks & Oliver, 2011; Vriens & van Petegem, 2012). E-internships allow students and graduates to work with organizations at distant locations via computer mediated technology without having to relocate (Loretto, 2012). This is an advantage when such opportunities are short term or part time. For organizations it offers an opportunity to access fresh talent and ideas, irrespective of their location, at relatively little cost to themselves.

The current paper examines preliminary internet research data about the emergence of new forms of internships, that is, those that are heavily computer-mediated. These e-internships share a number of important characteristics with traditional internships and virtual work. In addition, we discuss some of the repercussions of greater computer-mediation for recruitment, development and training initiatives run by organizations offering computer-mediated internship.

2. SEARCH PROCEDURE AND CRITERIA

A good example of a particularly successful transition to these new modes of work and internships has been observed in the USA. In response to the need for work experience and the technological advances, the USA has seen a slight change in the way that internships are being made available to students. The number of online or virtual internships (as e-internships are commonly referred to) have increased exponentially

(Damast, 2012). Numerous websites and blogs have cropped up over the past five years that publish e-internship positions and give advise about how to select them (for an overview, see Patterson, 2011; Schuman, 2012; Teggart, 2011). The change to e-internships in the United States is particularly interesting as the number of traditional paid internships continues to decline in line with the most recent recession (EON, 2010). At the same time, U.S. companies reach out to identify any talented future employees anywhere (see US cases published by MacGregor & Torres-Coronas, 2007). We also see increasing success of such e-internships resulting in offers of employment being made, often as a result of new internship schemes run jointly by universities and private as well as public organizations (e.g. Columbia University). In addition, the U.S. State Department recently launched a Virtual Student Foreign Service (Groux, 2012; Damast, 2012), which provides support for students wishing to find online internships in domestic and diplomatic posts.

Fewer press articles and reports about e-internships are available outside the USA, possibly because e-internship opportunities are known under different names, such as 'telework' or 'work from home' internships. In the United Kingdom, Cornelius et al. (2008) wrote an article about case studies of virtual placements replacing traditional work placements in geographical sciences. The publication preceded articles in the popular press such as The Guardian (Thomas-Bailey, 2010) and The Times (Whateley, 2010) on graduate opportunities. UK graduate and student recruitment sites have also only recently taken up the topic of e-internships. On a wider European level, a number of research examples demonstrate the interest in e-internships. An early article about the benefits of virtual internships in education was put together by Kristensen, Källström, and Svenkerud (2002). In addition, van Dorp (2008) provided a useful overview of a European platform for clearing e-internships called Cross Sector Virtual Mobility, a platform which is still operational at this point, providing a matchmaking service for students seeking internship offers, connecting them to various organizations seeking interns. Virtual mobility in the form of virtual work placements (e-internships) has recently also been discussed and examined by Rintala and Schrader (2010) and Vriens and van Petegem (2012).

In view of these reports, our first goal was to examine the prevalence of e-internships across different countries, in Europe and North America as well as beyond. This resulted in a qualitative overview of the different types and forms of such internships presented next. The search was conducted with Google chrome and Mozilla. The search engines utilized include: google.com, google.fr, google.co.uk, google.md, google.ro, google.ru, rambler.ru and yandex.ru. We focused on e-internship postings that were published in Europe, Asia, North Africa and North America in English and French. We further searched for e-internships in Eastern Europe using additional three languages, Russian, Ukrainian, and Romanian. Keywords across the countries are as follows: in Australia (work from home internships/virtual internship Australia), Canada (stage teletravail/ stage en ligne, internships telework/, virtual internship); France (stage pour étudiants teletravail); India (work from home internships); Malaysia (virtual internship/telecommute); Morrocco (stage teletravail, internship telework); Romania and Moldova (stagii de practica studenti la domiciliu, locuri de munca practica la domiciliu); Russia (стажировка студент на дому); UK (work from home internship, Freelance internships, Work remotely internship , internships at home, virtual assistant); Ukraine (стажировка студент удаленая работа) and US (virtual internships).

We conducted internet searches for postings published online between autumn 2010 to spring 2012. We compiled a listing of internship postings across 13 countries that we classified as e-internships, computer-mediated or 'virtual' internships. We focused primarily on e-internships in the United States of America and the United Kingdom in our search. Our key search terms (translated into several different languages) were: e-internships, telework internships and home internships. Each posting was checked to ensure that the posting satisfied the criteria of e-internships. The position in the posting met the characteristics of an e-internship (work from home, work requiring only occasional visits to the office). Second, the e-internships had to be temporary to distinguish it from regular virtual working arrangements (less than 18 months maximum). Third, the e-internships online needed to be differentiated from volunteering opportunities. This meant that postings were checked to see if they mentioned at least one of the following: that the position was remunerated, or aimed at graduates or students, or offered working experience for individuals interested in a career in this area.

2.1 General Results and Internship Characteristics

Most of the internships were posted on job portals, official companies' websites and job search engines. In the UK and USA, most internship postings were located on company's websites. Many of these internships required applicants to be currently enrolled students. The large majority do not provide any age limitations for applicants.

Table 1. Prevalence of e-Internships Following Preliminary Internet Searches

Specific countries	Total	Specific countries	Total
United Kingdom	54	Australia	5
USA	54	Canada	3
India	25	Morocco	3
France	13	Russia	2
Romania	12	Thailand	2
Ukraine	12	Malaysia	1
		Moldova	1
	170		17

Note. For an additional list of e-internship case studies see Vriens and van Petegem (2012). These authors include reports of e-internships in Finland, Denmark, Germany, Belgium, Italy, The Netherlands, and Poland).

V.I. postings were categorized into 9 major categories (Table 2). Generally, 90% (rounded figures) of all postings focused on three areas: Marketing related internships (40%); IT-related (web design, programming, graphic design) (24%) and journalistic/writing (18%). The remaining 10% involved a variety of multi-media and specialty internships that required specific skills or backgrounds unlikely to be widely found in the population.

Table 2. Job Types Listed In e-Internship Postings

Internship postings	Total postings (percent)
1. Marketing positions (e.g. advertising, PR, marketing, market research, sales, insurances)	74 (39.6%)
2. Journalist, web content writer, articles editor	31 (16.6%)
3. Web designer, web developer	24 (12.8%)
4. Researcher/writer of papers	21 (11.2%)
5. Programmer (computer programs)	11 (5.9%)
6. Designer, graphic work/artist	10 (5.3%)
7. Entertainment (radio producer/ music or film specialist)	9 (4.8%)
8. Public Policy Researcher, Law Researcher	7 (3.7%)
9. Other jobs:	5 (2.7%)

Note. Other jobs included: virtual traders, consultants, web translators, psychologist, intern office personal assistant, professor.

We also wanted to find out in which sectors the internships are most likely to be found. The postings were categorized into ten major fields (Table 3). The dominance of certain technology-dependent job types is not surprising, as not all work placements can be successfully turned into e-internships due to the important of social and interpersonal aspects (e.g., in the nursing professions).

Table 3. Sectors Associated With e-Internships

Sector	Total
1. Software/IT/ web sites	41 (21.9%)
2. Marketing media, advertising, PR, market analysis, copywriting	39 (20.8%)
3. Show business/ Media	21 (11.2%)
4. Edition/publication/magazines	20 (10.7%)
5. Business services, entrepreneurship	13 (6.9%)
6. Sales, customer services	13 (6.9%)
7. Research	9 (4.8%)
8. Consultancy	6 (3.2%)
9. Education	4 (2.1%)
10. Charity	4 (2.1%)
Other:	20 (10.6%)

Note. Other includes: Financial services (3; 1.6%), sport industry/ entertainment (3; 1.6%), fashion and art (3; 1.6%), real estate companies (3; 1.6%), insurance (3; 1.6%), tourism (2; 1.1%), medical assistance (1; 0.5%), virtual assistant (1; 0.5%), leisure (1; 0.5%).

Many internship postings provided little information about the lengths of the internships, which suggests that these might be more flexible than common traditional internships (Franks & Oliver, 2011; Loretto, 2012). The majority of those postings we located referred to e-internships of up to 3 months' duration, with a few up to 6 and even 12 months (see Table 4 for details). This also places the burden of enquiry onto the shoulders of the applicants and potentially successful interns to negotiate the length of their internship with the respective company/organization in question.

Table 4. Information (Length) Provided in Postings

Duration	USA	UK	East Europ.	France	India
N/A	16	37*	27	5	-
Flexible	18	-	-	-	-
> 3 mths	18	14	-	6	6
> 6 mths	1	1	-	1	14
> 12 mths	1	2	-	1	5
Total (n=173)	54	54	27	13	25

Note. * Not available, presumably flexible all year round. Eastern European countries include Ukraine, Romania, Moldova, and Russia. Table excludes results (n=16) for Morocco, Canada, Australia, Malaysia and Thailand.

The large majority of internship postings provided limited information about working hours. Information regarding the duration and the workload per week of the posts (specifically, internship hours and length of the internship) was noted for over half of the postings (55.1%, 103 out of 187 postings). However, many internship postings did not specify the number of hours to be worked in their internship postings (only a handful of companies listed these explicitly, Table 5). The situation was a little different for the UK and the USA. Here most of the Internships specified at least some hours. However most of them encouraged a flexible working experience and allowed students to design their own work patterns per week.

Table 5. Information (Hours/Week) Provided In Postings

Duration	USA*	UK	France	Canada	Ukraine
N/A	28	31	12	2	10
> 10 hrs	8	4	1	-	1
> 20 hrs	14	5	-	1	-
> 30 hours	2	7	-	-	-
Unclear hrs (up to 5 days a week)	2	4	-	-	1
Total	54	54	13	3	12

Note. * Numerous N/A included flexible hours. Only includes countries that provided information about hours/week.

We also investigated the extent to which these e-internships were paid, focusing on the 170 postings from six countries for which we were able to locate more than 10 postings. 39% of e-internships were unpaid while 35.3% of e-internship postings provided no information about remuneration. Only about a quarter of internships provided details about remuneration (31%). Focusing on all countries for which we located at

least 10 postings (USA, UK, India, France, Ukraine and Romania), we noted the highest number of such paid positions was found in France (77% of postings), India (72% of postings), and the Ukraine (42% of postings). In contrast, the UK only provided remuneration for 11% of postings, and the US only for 9% of e-internships.

3. CONCLUSION

3.1 Summary and Implications

At present, we know little about the prevalence, awareness, and functioning of e-internships. Our internet research confirms that e-internships (also known as virtual internships) are cropping up in numerous countries and in numerous languages. Such e-internships can be found in numerous countries such as the US (Loretto, 2012), several European countries (see case studies by Vriens & van Petegem, 2012) and New Zealand (Franks & Oliver, 2011). The reviewed postings indicate that e-internships are now available in various sectors, with a strong dominance noted in the customer service jobs (marketing, sales), technical areas (IT-related) and journalism. This is not surprising since all these jobs rely on technology. We might expect the number and variety of such postings to increase with time as globalization via technology increases opportunities and means to work from home. At the present time, the burden of enquiry seems to rest on the applicants (Loretto, 2012). Many important pieces of information need to be requested by interested applicants themselves from potential internship providers, despite calls that internship providers should have a clear socialization and orientation strategies in place to successfully introduce new e-interns to other colleagues and incorporate them effectively in team efforts (see proposed strategies put forward by Vriens & van Petegem, 2012). It also becomes clear that such internships are becoming more popular in specific industrial sectors that are technology driven (such as marketing and computing), offering new opportunities to students and organizations alike to collaborate electronically.

The benefits of internships generally, and virtual positions in particular, have been reported in the press, in various blogs, and on university websites. E-internships are unique in that both employers and interns benefit in different ways: such internships reduce the expenses for both significantly and allow smaller and larger employers to offer (unpaid as well as paid) internships that are mutually beneficial. Employers can identify potential hires early on, while students are able to work from their respective university locations without having to travel significant distances (a benefit especially embraced by American companies and students alike due to the geographical size of the country). In addition, companies try to identify and retain talent as early as possible.

3.2 Limitations

It could be argued that our internet research was not sufficiently international and multi-lingual. The search used only certain words and search engines and languages which is likely to limit the validity of the findings. However, please note that our purpose was to demonstrate that e-internships, or computer-mediated, internships indeed exist across numerous countries. We did not intend to provide a complete overview of all possible internships available, as this would have required a more systematic, multi-lingual search.

One variable not included in the internet review of e-internship postings concerns the size of the firm offering the e-internship. This is important “in that larger firms are more likely to participate” in internship programs, as in the case of the university scheme outlined by Bailey, Hughes, and Barr (2000, pg. 58). Firm size may influence HR practices, selection criteria for e-interns, and potential provisions made available to e-interns. Future analyses of postings might also want to consider the extent to which the frequency with which certain job types are more likely to be offered by larger firms and specific sectors.

3.3 Implications and Future Research Avenues

A number of authors have reviewed internship experiences, made recommendations on how interns should be supported via technological tools, managerial support and training and how they should be selected for their internships (Vriens & van Petegem, 2012; Ostmann, 2011). There is further work that examines the importance and relevance of such internship experiences for interns' professional future and their career decision making (Beenen & Rousseau, 2010; Callanan & Benzing, 2004; Coco, 2000; Eyler, 1995; Feldman, Folks, & Turnley, 1999; Johari & Bradshaw, 2008; Mangione et al., 2006). These guidelines and conclusions may also be worthwhile adapting to e-internships to ensure that the e-internship is an arrangement that is mutually beneficial to both e-interns and their organizations.

Recruitment may represent a specific challenge for organizations interested in offering e-internships. Boswell and colleagues (2003) examined how individuals make job choices and how this was influenced by recruitment practices. The authors identified three practices as important, that is, the opportunity to meet with numerous and senior organizational representatives, site visits and regular follow-up. The first two options are not readily available to companies offering e-internships. The last aspect is particularly important, as it presents a way to build relationships between the organization and applicants (Boswell et al., 2003). However, technology is quickly helping to remedy this. Organizations wishing to diversify their traditional internship schemes by offering e-internships should consider offering interested internship applicants virtual tours and access to testimonials from previous interns. This might prove a useful way to anticipate potentially negative expectations about e-internships and to address potential concerns that individuals might have.

Recruiting e-interns may be particularly challenging in terms of how to effectively screen applicants. Several organizations utilize online tests to ensure that applicants have the necessary skills (e.g., Lim & Morris, 2006). Vriens and van Petegem (2012) suggest that it is important to consider the role and development of intercultural competencies in virtual settings. There is some research available that may provide useful starting points for assessing cultural self-awareness (Roysircar, 2004; Canady et al., 2011) and multicultural competency (Manese, Wu, & Nepomuceno, 2001). We generally recommend that many traditional recruitment practices can be adapted for e-internships, including the utilization of interviews and setting clear guidelines for interns (Ostmann, 2011) so as to give them a realistic preview of what is provided and expected of them.

Another important aspect to consider is the extent to which certain training opportunities will be made available to e-interns compared to traditional interns. Past reports show that one of the reasons why companies may drop internship opportunities are the indirect costs of organizing training for their interns, even more so than the costs associated with the remuneration for internships (see survey report by Bailey, Hughes, & Barr, 2000). This circumstance may be associated with the fear that interns will leave the organization once trained. However, in the case of e-interns, it is more likely that they will not necessarily continue as regular employees. We do not know at this stage if this makes it even less likely for training or mentoring to be offered, or that training is no longer be considered a cost given that e-internships may also result in less costs for the e-internship providers (e.g., in terms of providing office or parking space, InternMatters, 2010; Barkhausen, 2012). Since levels of learning and mentoring have been associated with intern job satisfaction, affective commitment and positive attitude toward the industrial sector (Liu, Xu, & Weitz, 2011), providing some sort of training seems beneficial to the company and the industry overall. No matter what stance individual e-internship providers take, it is important to conduct training needs analysis with e-interns that have a more diverse skills set and educational background to ensure successful e-internship performance.

An additional issue to be clarified in future research pertains to the provisions made available by and expectations of e-internship providers. Bailey et al. (2000, pg. 58) noted that "there is also evidence that firms tend to provide higher quality programs [in terms of training and mentoring] when they expect the interns to stay at the firm" (Bailey et al, 2000). We have no information about the intentions of the e-internship providers whose postings we located online as to whether or not it is their practice to recruit employees from their e-internship pool. This would be a worthwhile issue to explore in surveys conducted with previous e-interns to assess the career prospects available to these e-interns.

We also need to learn about the extent to which e-internship will result in future employment in a similar fashion as for traditional internship experience (Taylor, 1988). Taylor (1988) did not examine the mechanisms by which this occurs, however, she suggests that interns may improve their technical, social and

thus interviewing skills during the internship. Due to the computer-mediated nature of e-internships, e-interns may not have the same opportunity to improve a variety of skills. This is actually in line with the suggestion that some employees may be more likely to receive training as part of their job role than others, resulting in potential skill gaps (see Spell, 2001), a concern that may also be relevant for e-interns due to fewer training opportunities (e.g., interpersonal skills training) being made available to them compared to more regular traditional interns. However, at the other end, e-interns may be more likely to improve their technical skills above and beyond the skill level that may be obtained in more traditional internships. This is, however, pure speculation at this point and merits further attention.

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DEVELOPMENT OF SOCIAL NETWORKS, SEARCH ENGINES AND WIKIS IN THE WEB 3.0 - OPPORTUNITIES AND RISKS FOR USERS, PROVIDERS AND COMPANIES

Arne Eggert, Hannah Heide, Lisa Hermanns, Philipp Lorenzen, Nils Rathjen,
Katharina Schupp and Dirk Frosch-Wilke
University of Applied Sciences Kiel , Sokratesplatz 2, D-24149 Kiel, Germany

ABSTRACT

The recent development and ongoing implementation of the concept "Web 3.0" - the Social Semantic Web, which stands for augmenting existing data in Internet sources with additional information to make them automatically readable for machines - changes the way of acquisition, distribution and provision of information. New Web 3.0 applications like e.g. "Graph Search" launched by Facebook in January 2013 makes it necessary to analyze the impact of these kinds of applications to different Social Media stakeholders. In this paper, we analyze the opportunities and risks, private users and large companies are facing with the use of social networks, search engines and Wikis, in the context of the Web 3.0.

KEYWORDS

Social Media, Web 3.0, eMarketing, Search Engines, Social Networks, Wikis

1. INTRODUCTION

The amount of data in the World Wide Web (Web) that is accessible for its users is growing every minute, rendering the Web the most useful and powerful means to communicate, share and find information [1]. To make use of the information, the process of obtaining it in the first place plays a crucial role and is nowadays mostly accomplished by the use of a search engine like Google or Bing [2]. Up to now, these search engines respond to a search request with a list of links to pages with fitting keywords. This strategy has the fundamental drawback that it does not take into account the relation between the keywords, which would require this relational information to be obtainable in a machine-readable fashion. To overcome this limitation, with the application of the new Web3.0 concept, this information is additionally provided by the online sources of data [3], [4]. Thereby, online searches are changed fundamentally and, in the near future, search engines are thought to be able to understand and answer complex questions directly [5].

In this paper, we explore opportunities and risks different groups of users are facing by the introduction of Web 3.0. We focus on social networks - platforms, where users and companies can communicate and get into contact with each other-, Wikis - Online user-based knowledge systems - and the aforementioned search engines. These are the three places of private and corporate user interaction that we believe to see the biggest changes with the implementation of Web 3.0.

After presenting a common definition of the Web 3.0 and an introduction to some basic concepts of (online) knowledge management in section 2, in section 3 we study the past and current practice of semantic applications for search engines, social networks and Wikis. By evaluating current research and commercial activities regarding the Semantic Web we derive scenarios for the potential development of social media in the Web 3.0. For this reason we have done a comprehensive literature review to identify current Web 3.0 approaches in social media applications. As they provided most information, Facebook and Google formed the basis of our study concerning past and potential development of both search engines and social networks. There are several Semantic Wikis currently in use. As the purposes of different Semantic Wikis are unlike, we focus on general aspects.

The results of section 3 show that most endeavors are aimed at the development of a Semantic Search - providing relational information between the search results - and, in the case of social networks and search

engines, providing personalized advertisement. Opportunities and risks of Semantic Searches and the personalized or context-sensitive advertisement for private and corporate social media users and social media providers are discussed in section 4.

In section 5, we provide a short conclusion and give an outlook on some interesting possibilities for further research.

2. THE WEB 3.0

The Web 3.0 sustains the development of the World Wide Web with its predecessors, the Web 2.0 and 1.0. Version 1.0 has been standardized in 1994 by the World Wide Web Consortium (W3C) [6]. While Web 1.0 focuses mainly on providing static information for users by companies, the Web 2.0 extension lets them actively create content, for instance by enabling them to share their particular knowledge in blogs or by creating or editing Wikipedia articles [7].

The Web 3.0 is commonly understood as the addition of semantic information to the Web 2.0, but it is not standardized [8]. The term 'semantic` means that additional to the bare information also its semantic relation to other parts of information is provided. Furthermore, the information is provided in a way that it can be directly read by machines, which are thereby enabled to automatically infer other - possibly new - information and classify the given information [3],[4]. By this, the Web 3.0 is intended to achieve a higher degree of interconnection between the ever growing amount of online data, enabling a reasonably quick and natural search process for the user.

Since the Web 3.0 relies on a machine-readable representation of information, one can ask how this is achieved in practice. For this, the use of a knowledge representation based on a so called ontology is used. It is a model of a certain domain of knowledge, which provides a simplified formal description of it in terms of primitives which are typically classes and attributes of, and relations between different pieces of knowledge [9],[10],[11].

For the actual representation on physical hardware, a chosen ontology - as it is an abstract, semantic concept - has to be equipped with a suitable underlying database scheme. Here, the Resource Description Framework (RDF), based on the Extended Markup Language (XML), is the W3C standard [12][13, p. 8], [14, p. 7]. It is suited for ontologies which implement subject-predicate-object relations, i.e. directed relations. With the relations between knowledge, represented this way, a means is given to automatically infer new knowledge by their transitivity, e.g. a person related to another person as "mother", where the latter is related to a third person as "father", in turn, also relates to the third person as "grandmother" [5, p. 7].

3. PAST AND POTENTIAL FUTURE DEVELOPMENT OF THE WEB 3.0

This section presents a survey on the state of the implementation of semantic technologies in present-day social networks, search engines and Wikis. With this, the possible future developments of the Web 3.0 are analyzed, which is detailed in sections 3.1.3 and 3.1.4 for search engines and advertisement, respectively, as well as for Wikis in 3.2. 2. On this basis, the opportunities and risks for different groups of users are subsequently discussed in section 4.

3.1 Search Engines and Social Networks by the Example of Google and Facebook

Exemplary, we examine the market leaders for search engines and social networks, Google and Facebook, respectively. Reasons for this choice are firstly that they are already offering semantic applications and secondly, that a lot of information on both of them is available.

3.1.1 Past and Present Development of the Search Engine Google

Google started as a search engine, which they are still most famous for. But in the last years they have been developing many other services on the internet. The ones who are relevant for the future conception of the Web 3.0 or the ones that are already semantic will be described in the following chapter.

Since 2012 Google interconnects the data of the user by combining information from its various services: information from Gmail, the calendar, Google Drive, the search engine and other services. This way, Google becomes the personal assistant of the user and is enabled to, e.g., tell the user when to leave for an appointment by having information about the appointment itself, the position and the traffic situation. This new service is called "Google Now" [15].

Google+ is the social network of Google, which combines the single services Picasa, YouTube, Gmail and Google Talk [16, p. 2]. Additionally, Google+ developed an automatic face recognition called "Find My Face``. By analyzing pictures of the user, "Find My Face`` generates a digital model of his or her face structure. "Find My Face`` is thereby able to automatically recognize the face structure in uploaded photos and suggests the recognized identity of the user [17]. Google itself explained that it could technically be possible to upload a photo and ask Google who is seen on that photo. However, Google admitted, that this thought is too frightening. That is why they decided against implementing this feature [18].

Google also changed some aspects of its search engine in the last years - they invented a personalized search function and a Semantic Search function. These changes are relevant for the scenarios of the Web 3.0 analyzed in section3.1.3.

The personalized search named "Search Plus Your World`` complements the classic web results with personal results. For this, a user needs to be logged in into one of the applications of Google. By knowing his or her friends, interests, and past search keys Google tries to understand, which information might be interesting for the user [19]. In that context, searching for people can become easier as well, e.g., by Google proposing Google+-Profiles which match earlier search keys or interests [20].

The second change is the "Knowledge Graph``- a Semantic Search- released in 2012. In addition to the normal web search results, a box can be found, which bundles information about the search key and further information like a map, curriculum vitae or family relationships [21].

Another service offered by Google, related to the development of the Web 3.0, is advertisement. It is possible to place advertisements according to a search key next to the Google search results, and to advertise on websites outside the Google services [22]. In the latter case, the advertisements depend on the content of the website they are published on - meaning they are context-sensitive. Apart from the possibility of publishing context-sensitive advertisements, it is also feasible to personalize advertisements. By means of analyzing and observing searching behavior, downloaded apps and visited websites by setting Cookies and anonymous IDs, Google collects information about the users. This information is used to build interest categories. If a user is additionally logged in into his Google-account, his or her current location can be determined and also used to place personalized advertisements. An example for this would be a user who first searches for the key "London`` and consequently for the key "Hotel". These searches are combined and it is automatically inferred that information on journeys to London are requested [23].

3.1.2 Past and Present Development of the Social Network Facebook

In 2010, Facebook founder Marc Zuckerberg introduced an early version of the so called Open Graph (OG) at the f8 conference. The idea behind a social data structure like the OG is to show on the one hand relationships between people and on the other hand relationships between people and the things they like [24]. This is achieved, e.g., by representing people or objects as nodes and their relationships as edges in a data structure called graph [25, p.4].

Along with the Open Graph, Facebook introduced the "Like"-button and other social plugins. To support these plugins Facebook launched the Open Graph Protocol (OGP), with which metadata can be added to any Web page so that it can be represented within any social graph [26]. OGP uses the RDF standard and enables websites to become rich-objects in the OG by adding semantic data [27, p. 125].

In 2012, Facebook updated the OGP to a wider range of functionality. Now, users can not only like things on the internet, but via applications they can also read, buy or hear objects on websites [28, p. 177]. With these new actions, it is possible to represent interactions more precisely semantically. This semantic information will also be added to the "timeline``- an online personal user history [27, p. 134].

3.1.3 Possible Future Scenarios for Web 3.0 Search Engines

Mid-January 2013 Facebook rolled out a new product, which is Facebooks' way into the Web 3.0 future – Facebooks' search engine Graph Search. Marc Zuckerberg introduced Graph Search as "[…]a really different

product from anything else that's out there.[…] Graph search is designed to take a precise query and return to you the answer, not links to other places where you might get the answer" [30].

Since, until today, there is no further information about the specific form and function of Facebooks´ new search engine, we are going to take a closer look at a German project on Semantic Search engines. From 2004 till 2007 the project Smart Web worked on what they called "semantic answering engines``. These engines do not need a keyword based request anymore; they can deal with spoken language or with a picture as well. The answer the new engine gives is no longer a list of possible matches, but a specific answer on the asked topic [31]. For example, if someone in New York –Midtown East asked: "Where can I eat sushi?", and the answer might be: "The nearest sushi bar is the 'Kuruma Zushi`at 7 E. 47th St., 1st floor." Along with this answer, the machine might give a map to show the way to 7E 47th Street and a download link of the menu of 'Kuruma Zushi`.

3.1.4 Possible Future Scenarios for Advertisement in the Web 3.0

The development of Web 3.0 means an important change for advertisement. Context-sensitive advertising in Web 2.0 does react to keywords, but is not able to understand semantics. That is why fatal misplacements can be caused, if the relationships between keywords are misunderstood. In Web 3.0, advertisement is based on semantics. Semantic ad placement is not just keyword based but also considers the whole context of the placement. One method placing advertisement fitting into the context is semantic targeting. Therefore, the content of the whole website (and not just a part of it) will be lexically analyzed and categorized. The linguist David Crystal who invented a method of semantic targeting, built content categories consisting of a group of words to analyze and categorize internet content [32].

The Web 3.0 also offers new possibilities for user based advertisement. Google does already analyze consecutive search keys. In the aforementioned example of traveling to London, Google already reacts by advertising a whole trip. In Web 3.0 it will be possible to offer an all-in-one-package. By knowing the location of the user, his or her calendar, interests and destination, they could offer more than a flight and a hotel: Supplementary, the way to the airport, the seat reservation and maybe cultural entertainment at the destination could be included. The journey would be presented to the user with respect to temporal and financial aspects [33].

3.2 Semantic Wikis

A Wiki is a knowledge system that is interconnected by hyperlinks [34,p. 48]. Articles can easily be written and edited by anybody interested, specific programming skills are not necessary [35, p. 10], [36].

The idea behind a Semantic Wiki is to use annotations to enhance information by metadata representing the relations between different pieces of information. This way, the meaning of hyperlinks, articles or other content becomes machine-readable allowing employing semantic searches to gather information scattered across multiple articles much quicker. This also allows for unsupervised creation of new knowledge with the help of inference techniques [37, p. 103], [38, p. 436], [39, p. 251], [11]. As annotations usually correspond to the underlying ontology, Semantic Wikis can also be utilized to conduct collaborative ontology-engineering, i.e. the modification and creation of ontologies. Therefore, Semantic Wikis can be used more efficiently and in a wider range of application areas [38, p. 434].

3.2.1 Past and Present Development of Semantic Wikis

Since 2005, many Semantic Wikis have been introduced, like the Semantic MediaWiki, Freebase, OntoWiki and IkeWiki. Today however, only a small number of Semantic Wikis is maintained [40]. Exemplary, the two Wikis Semantic MediaWiki and IkeWiki are analyzed, since they are differently focused. While the Semantic MediaWiki is a semantic expansion of MediaWiki, which Wikipedia is based on, IkeWiki is focused on ontology-engineering.

By its additional semantic functionality, Semantic MediaWiki provides a Semantic Search and ensures better actuality of the data by automatically updating articles based on updates in related articles. However, Semantic MediaWiki does not provide inference techniques [41, p. 941], [38, p. 436].

IkeWiki was designed for ontology engineering by development of extensive inference techniques. It was angled at bringing together experts from different fields of science [38, p. 436 ff.].

3.2.2 Possible Future of Semantic Wikis

Semantic Wikis already show the most important functionality of the Web 3.0 - a Semantic Search and inference techniques [38, p. 435 f.]. However, only basic Semantic Searches and inference are possible due to the lack of semantic annotations and the problem of the fast growing demand of computational resources with the number of entries in the Wiki. As Semantic Wikis allow experts of different fields of science to easily collaborate, it is probable that most information will be equipped with semantic annotations in the future, allowing for the use of this information in Semantic Searches. The easy access to information distributed over the Wiki renders list created by hand unnecessary. This, in contrast to common Wikis, helps to keep the Semantic Wiki up-to-date more easily [41, p. 941]. Also, articles automatically generated from metadata can help to elucidate the global connection between the sources [42, p. 95]. In contrast, the development of inference techniques is mainly dependent on its usability. Despite their unfavorable computational scalability, we believe, these techniques will, at least partially, be used in the future.

4. OPPORTUNITIES AND RISKS OF THE SOCIAL SEMANTIC WEB

The development of the Social Semantic Web shows one main drive: to know more. Machine-readable data not only allows users to search for information more effectually, but also the information concerning social media users can be used more efficiently for advertisement. This entails chances as well as risks for users. As different groups of users have different interests, their chances and risks of advertisement and Semantic Searches are unlike, and sometimes directly opposed to each other, for the different groups.

In this paper, we distinguish three groups of users with often adverse interests on the basis of their economical objectives, and analyze, both for advertisement and Semantic Searches in the Web 3.0, chances and risks for these groups. The first group are the *"social media users*", which are private users employing social media platforms. This group uses social media mostly for private communication with other users and to obtain information or media. The second group is the "*social media providers*" who run social media platforms like Facebook and Google. Companies using social media to obtain and provide information regarding their business are the third group. To advertise in the internet, companies often pay for the services, social media platforms provide, and can therefore be seen as "*social media customers*".

4.1 Advertisement in the Social Semantic Web

As we discussed in section 3, the evolution of the Web 3.0 will fundamentally change - and has already changed the ways of advertisement to a certain degree. It becomes more personalized and more context-sensitive.

4.1.1 Opportunities and Risks for Social Media Users

The most common concern regarding advertisement in social media is the crucial point of data privacy on the internet. Social media users tend to give away more and more personal information on social media platforms [43]. However, while the development of semantic applications enhances this issue of data privacy, the lack of privacy is neither created by these applications, nor by advertisement. It is in fact the risk of using social media in general.

In contrast, advertisement that fits the interest of the users better can be seen as an advantage of the Web 3.0. The personalized and context-sensitive advertisement is more interesting for the user opposed to generic advertisements. Also, location-based advertisement that is strongly connected with the personalization of advertisement may be considered helpful by the user.

4.1.2 Opportunities and Risks for Social Media Providers

For social media providers, the personalization of advertisement is a big advantage. The collected user-data becomes much more worth with the increasing importance of personal data to companies, allowing the providers to make more profits. However, there is a risk attached to the chance: rising profits usually increase the pressure of competition, making customer loyalty more important than ever.

4.1.3 Opportunities and Risks for Social Media Customers

As for social media users and providers, personalized and context-sensitive advertisement brings with it mostly chances for social media customers. Advertisements, that are interesting for social media users, achieve much higher revenues than randomly placed ads. This allows using less advertisement thus reducing costs or reaching more users with the same amount of costs. However, the more important personalized ads become, the more dependent companies are on social media providers to get the required data. This dependency may increase costs for advertisement to a high degree.

A second advantage for social media customers is the better feasibility to avoid misplaced advertisement. As such ads can severely damage the image of a company; it will be convenient for companies, to be better able to avoid blunders, like ads for a flight next to an article about an airplane crash, in the future.

4.2 Search Engines in the Web 3.0

Lack of data is seldom a problem nowadays. Instead, there is so much data, that it becomes increasingly difficult to find relevant information. Semantic Search engines may simplify searches for information tremendously. However, compact answers of search engines to questions bear risks as well.

4.2.1 Opportunities and Risks for Social Media Users

The most important advantage concerning the development of the Web 3.0 for social media users can be seen in the saving of time because of Semantic Searches. In December 2008 5.8 billion search requests were posed by Internet users in Germany. This equals 2.36 search requests per day per German citizen [44]. The time a user can save, if, instead of having to look for the right information in a long line of websites, getting a direct answer to his question is immense. The personalized Semantic Search will give answers that are probably more interesting to the user because of the knowledge of his whereabouts, his interests and so on. The better the search engines understand human language - and with it questions a user wants to answer - the better the results of a search will become.

Nevertheless, the risks attached to Semantic Searches are not negligible. If a search engine does not show the sources for the answers, a user will not know how trustworthy some information is. It will be difficult for users to identify wrong answers due to incorrect sources or mistakes in the semantic structure of web-content. Especially if information is derived by inferences based on the semantic structure of data, it may not be comprehensible for the user, why a conclusion is drawn. This makes it hard to asses and to trust information.

Some crucial data privacy issues are related to the personalized Semantic Search as well. Personal data that is linked to the name already exists. If it becomes available to everyone who asks, misuse of personal data is bound to occur. As confirmation prompts for resetting passwords of user accounts ask for this kind of data, Semantic Searches will also make the theft of user accounts much simpler.

4.2.2 Opportunities and Risks for Social Media Providers

To social media providers offering the service of a Semantic Search engine is a opportunity and a risk at the same time. On the one hand, it is possible, to increase the loyalty of the users with a good Semantic Search engine. The better the results are, the more likely users are to frequent the services of the social media provider often. However, bad results due to a deficient search engine will annoy users and will cause just the opposite effect. This is particularly important to the personalized Semantic Search, as the social media provider is dependent on user-data to improve this search. User-data, on the other hand, will only be available if the user is satisfied with the services provided.

4.2.3 Opportunities and Risks for Social Media Customers

Opportunities and also most risks in connection with Semantic Search engines are basically the same for the group of social media customers as for social media users. In 2007, a study of "Information Builders`` published that every employee spends over an hour every day searching for information [45]. Quicker and more efficient searches in the intra- and internet could help reduce costs to a substantial extent.

The difficulties, as described above, to judge, whether information is correct and to understand where it comes from, are the same for the employees of a company as for private users, with the difference that mistakes are possibly more expensive for companies than for social media users. The risks due to

personalized Semantic Searches do not affect social media customers in the same extent as social media users.

5. CONCLUSION AND OUTLOOK

The Web 3.0 offers new possibilities to access information online and to automatically process and relate them. As we found in section 3, the large internet companies Facebook and Google, currently, already offer Web 3.0 features and applications relying on semantics. Via Semantic Wikis, users can directly participate in the advancement of the Web 3.0.

The new possibilities, the Web 3.0 offers to private and corporate social media users and social media providers are accompanied by risks. Private users mainly can save a great amount of time and receive better search results. At the same time, the credibility of the results is problematic and the safety of private data becomes a more pressing issue.

For corporate users, advertisement in Web 3.0 is more efficient and can thereby be helpful to reducing costs. The time employees save by using Semantic Search engines also directly lowers costs. The problem that search results are not trustworthy, though, can be much more costly for companies than for private users.

Social media provider can use the Web 3.0 applications to increase the loyalty of their users by the increased value to the users. This allows generating more revenues by using the user-data for personalized advertising. However, this increases the competition on the market for private user-data.

In the future, it will be interesting to analyze the distribution of Web 3.0 features in other online applications like the search engines RelFinder [46], hakia [47] and Wolfram alpha [48, p. 23].

Furthermore, the way private and corporate social media users perceive their personal risks and chances with regard to the Web 3.0 would be worth investigating.

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SECURE AND EFFICIENT PROCESSING OF ELECTRONIC DOCUMENTS IN THE CLOUD

Klaus Stranacher, Bernd Zwattendorfer and Vesna Krnjic
Graz University of Technology, E-Government Innovation Center, EGIZ
Inffeldgasse 16a, 8010 Graz, Austria

ABSTRACT

Electronic documents are often exchanged in e-Government and e-Business processes. In e-Government, the usage and importance of electronic documents has significantly increased particularly in cross-border scenarios, especially due to the implementation of the EU Services Directive. To ensure genuineness, in many situations electronic signatures are applied on the documents exchanged. Besides of their application, verification of electronic signatures is essential. Current solutions for the verification of electronic signatures usually support a subset of existing signature formats only. In addition, electronic documents require some kind of detailed description on higher level, e.g. through meta data. If corresponding meta data are recognized as incomplete or wrong during document exchange, additional costs and time delays may occur. Here, the need of previous data validation arises. To overcome these issues, we introduce an approach for secure and efficient processing of electronic documents, particularly focusing on signature and meta data verification. Our solution follows a generic concept and is not limited to certain use cases. Nevertheless, we present our approach based on the findings of the EU Large Scale Pilot Project SPOCS. Finally, we elaborate on the movement of verification and validation services into the cloud.

KEYWORDS

Electronic Documents, Signature Verification, Data Validation, Cloud Computing

1. INTRODUCTION

Electronic documents are important parts of most e-Government and e-Business processes. Their significance particularly increased with the progressing implementation of the EU Services Directive (European Union, 2006). The main objective of the directive is to establish a framework for easily setting up and exercise a service in another EU Member State by using electronic procedures. Here, electronic documents are one of the key enablers to achieve this goal. To guarantee authenticity and integrity of electronic documents, usually electronic signatures are applied to electronic documents. The validity of an electronic signature can be unambiguously determined by the receiver of a signed document using signature verification services. Current existing signature verification services are limited to verify only certain signature formats. In general, they support several kinds of standard signature formats as defined by the European Commission Decision on *"establishing minimum requirements for the cross-border processing of documents signed electronically by competent authorities under Services Directive"* (European Commission, 2011). In addition, they are able to verify a few other formats suitable for their field of application. Nevertheless, there exists a lack on comprehensive signature verification services supporting a wider field of signature formats.

In addition to the verification of genuineness of electronic documents, automatic processing of electronic documents is essential for a cost reducing, time saving, and efficient public administration. The basis for automatic processing is availability of machine-readable data, i.e. structured electronic documents and appropriate meta data. Nevertheless, additional costs and time delays may arise if electronic documents or meta data are recognized as incomplete or wrong. Here, the need of a previous data validation arises.

The European Large Scale Pilot SPOCS[1] developed an electronic document interoperability framework and document container format, called OCD - Omnifarious Container for eDocuments (SPOCS, 2011).

[1] SPOCS (Simple Procedures Online for Cross-border Services) is an EU co-funded project out of the EU ICT Policy Support Programme and aims to overcome the obstacles raised by the EU Services Directive. http://www.eu-spocs.eu/.

Among other things, this framework defines how to verify and validate an OCD container and all affiliated electronic documents. The focus of the OCD interoperability framework has been given on the verification of the electronic signatures applied to the container and the contained electronic documents. In this paper we present and propose mechanisms for secure and efficient processing of electronic documents.

The remainder of this paper is organized as follows. In Section 2, we describe the electronic document interoperability framework and the Omnifarious Container for eDocuments (OCD). Additionally, we point out existing solutions for verifying and validating electronic documents. Section 3 elaborates on external signature verification services to support an extended set of signature formats. In addition, a data validation mechanism is proposed. These verification and validation facilities base on the OCD but are not limited to this use case. The subsequent Section 4 elaborates possibilities to transfer verification and validation services into the cloud. Finally, we draw conclusions including an evaluation of our proposed solution and discuss future work.

2. RELATED WORK

Basically, electronic documents can be divided into structured, unstructured, and container formats. The content of structured document formats follows a well-defined schema and is therefore machine-readable and can be easily processed. The most popular structured eDocument format is XML. In contrast, unstructured electronic documents, such as the PDF format, cannot be automatically processed. They are mainly used for visual representation of document content. Container formats specify how different types of data are stored in one container. Additionally, all required information, which third parties would need for processing the documents, is stored in the container. One of the first container formats was MIME[2]. In the meanwhile, formats such as Open Document Format[3] (ODF) and Office Open XML[4] (OOXML) have increased in popularity.

Looking at the e-Government landscape in Europe, every country has its own eDocument infrastructure deployed based on existing standards and technologies. Many national applications are using XML-based specifications for information and document exchange. However, national XML specifications cannot be automatically processed nor automatically interpreted by any third party without the knowledge of the schema of the particular document. Due to the EU Services Directive the need of interoperability for electronic documents, especially on a cross-border level, has significantly increased. This need for interoperability has also been discussed by Rössler and Tauber (2010).

The challenge on interoperability has been taken up by the European Large Scale Pilot SPOCS. Here, an interoperability concept has been introduced, which bases on the individual national infrastructures of the participating EU countries and builds an interoperability layer on top of it. This concept is called Omnifarious Container for eDocuments (OCD) and represents an interoperable multi-layer framework for cross-border exchange of electronic documents. The container supports all formats and technologies of electronic documents and is easily extendable to support new formats and technologies too. Additionally, semantic interoperability and authentication mechanisms for guaranteeing the authenticity of an OCD container are provided.

The specification of the OCD container (SPOCS, 2011) consists of a logical and a physical structure. Thereby, the logical structure consists of a payload layer, a meta data layer, and an authentication layer. The payload layer stores all kind of electronic documents, which should be transported in the OCD container. To support automatic processing, the meta data layer has been introduced on two levels. The first level describes each payload document, while the second level describes the container itself. In addition to the signed payload documents, the whole container can be signed as well. This authentication layer is optional and enables the support of authenticity of OCD containers.

Two different physical structures are defined to implement the logical structure. The ZIP based OCD relies on the ETSI specification on Associated Signature Containers - ASiC (ETSI, 2012) and uses XAdES signatures (ETSI, 2009) for the authentication layer. This ZIP based OCD is primarily suitable for back office

[2] MIME (Multipurpose Internet Mail Extensions) are extensions of the standard RFC 822 and defined in RFC 2045, RFC 2046, RFC 2047, RFC 2048 and RFC 2049.
[3] ODF is a standard developed by the standardization organization OASIS and is specified in ISO/IEC 26300.
[4] OOXML is a standard developed by Microsoft and is specified in ISO/IEC 29500.

applications. The second structure is a PDF based OCD where the master PDF represents the meta data and the payload documents are added as attachments. Here, PAdES signatures (ETSI, 2010) are used for the authentication layer. This technology is especially suitable for applications where citizens are directly involved.

To handle OCD in real live scenarios, operations on the core elements of OCDs are defined. The OCD Creation method defines how an OCD container is created. As input, this method takes arbitrarily signed or unsigned electronic documents with appropriate meta data. The resulting OCD container can be signed optionally. The OCD Validation and Verification method defines how an OCD container is validated and how signature verification is carried out. This method takes an OCD container as input. The output of this method represents the corresponding validation and verification report. The described methods have been implemented as open source software modules and are freely available for download on Joinup[5].

In addition to OCD, several other signature verification activities have been established. The European Commission published a tool, called SD-DSS[6], which is capable to verify signature formats based on the European Commission Decision on standard signature formats (European Commission, 2011). Furthermore the EU Large Scale Pilot PEPPOL[7] addressed issues concerning the signature verification in the field of e-Procurement and developed a suitable signature verification service[8]. Nevertheless, these services do not support verification of national and proprietary signature formats.

3. VERIFICATION AND VALIDATION SERVICES

Verification of the genuineness of electronic documents is important to trust the authenticity and data integrity of these documents. Usually, electronic signatures are the means of choice for guaranteeing authenticity and integrity. Verification of these signatures is essential for their further processing. In addition, data validation, i.e. the validation whether the present data are appropriate and correct or not, gains more and more importance. Both, signature verification and data validation are necessary for a secure and efficient processing in e-Government or e-Business scenarios.

The following sub-sections elaborate on signature verification and data validation of electronic documents incorporating external verification and validation services. Thereby, we concentrate on the use cases related to the EU Services Directive and the implementations of the large-scale pilot project SPOCS, focusing on OCD container verification and validation. Nevertheless, our approach is not limited to these use cases and applies for all processes where electronic documents are involved and must be processed. In addition, we show external dependencies to our methods, which are able to be outsourced to cloud computing, enabling high scalability and cost savings.

3.1 Signature Verification

For electronic signatures various data formats exist. On the one hand, there are signature formats which are tightly bound to specific document formats, such as PDF signatures. On the other hand, there exist signature formats which can be used with almost every document format, e.g. XML and XAdES signatures. Based on the EU Services Directive (European Union, 2006) the European Commission established minimum requirements for the cross-border processing of documents signed electronically by competent authorities under the Services Directive. Article 1 (1) of this decision defines three signature formats, namely *"XML or a CMS or a PDF advanced electronic signature in the BES or EPES format"* (European Commission, 2011), as minimum or standard formats to be processed by EU Member States. In addition, Article 1 (2) states that *"Member States whose competent authorities sign the documents referred to in paragraph 1 using other formats of electronic signatures than those referred to in that same paragraph, shall notify to the Commission existing validation possibilities that allow other Member States to validate the received electronic signatures online, free of charge and in a way that is understandable for non-native speakers […]"* (European Commission, 2011).

[5] http://joinup.ec.europa.eu/site/spocs/eDocuments/
[6] http://joinup.ec.europa.eu/software/sd-dss/home/
[7] PEPPOL (Pan-European Public Procurement Online), http://www.project.peppol.eu/
[8] http://www.peppol.eu/peppol_components/esignature/esignature

Actual existing signature verification services are limited to verify certain signature formats. In general, they support the standard signature formats and a few other formats suitable for their field of application. So usually national and proprietary formats, as mentioned in Article 1 (2) of the EC Decision, are not supported. Stranacher and Kawecki (2012) presented a signature verification service, which introduced the concept of external signature verification services. This service can be used to integrate the verification of national and proprietary signature formats. Their concept bases upon the OCD Validation and Verification Module but lacks on a concrete implementation of this mechanism.

In Figure 1 we show the concrete mechanism to integrate external signature verification services on the basis of the OCD Validation and Verification Module. As an OCD container can be signed itself and usually contains signed electronic documents, the container signature and the document signatures are divided. A format detection unit analyzes the signature and recognizes the signature format. The verification of standard signature formats is covered by the internal signature verification unit. National and proprietary formats are verifiable via external verification services. These external services have to be defined in the configuration of the module. Within the configuration, a mapping between the MIME type representing the signature format and the respective external service is given. Based on this mapping, the verification of the national and proprietary formats are outsourced to the external service via a connector. This connector creates the request to the external services and receives the corresponding response. Additionally, the connector converts and transforms the response into the OCD module internal verification result format. Finally, the result generator unit collects all results, including additional validation results from a basic validation[9] (not shown in the figure for clarity), and generates an XML based verification report.

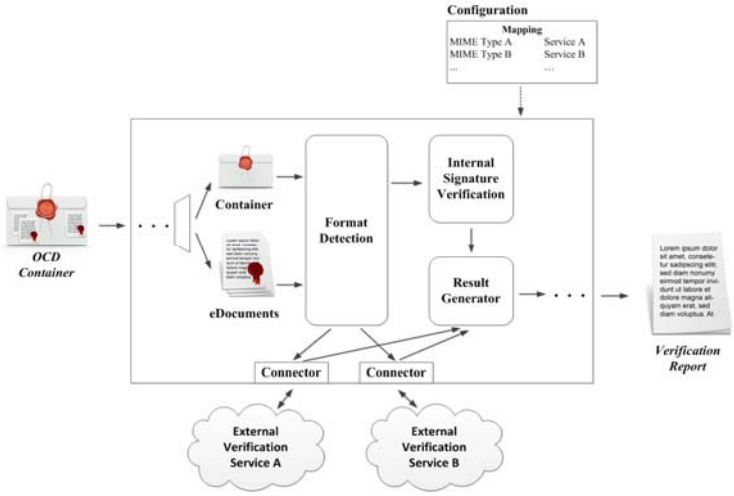

Figure 1. External signature verification services as part of the OCD Validation and Verification Module

Examples for external signature verification services supporting national and proprietary formats are the:

- Lithuanian verification service: This service supports the verification of the ADOC format specified by Director General of the Lithuanian Archives Department (2009).
- Austrian verification service: This service supports the verification of the PDF-AS format. PDF-AS is a proprietary Austrian format based on PDF and explained by Leitold et al (2009). Based on the solution of Zefferer et al. (2011), a Web-Service of this service based on SOAP will be available soon.

These verification services may also be maintained within a cloud. An evaluation of this cloud-based approach is given in section 4.

3.2 Data Validation

Electronic documents are usually received by a service or application to be used for further processing. For instance, a public authority receives a request for opening a business and forwards it to the relevant

[9] The basic validation validates if the OCD container is compliant to the OCD specification.

competent authorities, which actually handle the request. If these documents are recognized as incomplete or wrong during further processing, the entire process must be stopped. To avoid associated costs and time delays, which may occur in such situations due to the necessity of manual interactions, a previous automated data validation is necessary. Data validation simply means that the data is verified if it fulfills the requirements for the subsequent process.

Basically, two different kinds of data can be distinguished. On the one hand, *meta data* provides information about the accompanied data such as the creation date or the creator of the data. Usually, meta data is available as machine-readable data. For instance, the OCD container comprises a meta data layer which describes the container itself (so-called meta data level 2) and the included electronic documents (so-called meta data level 1). On the other hand, the OCD specification (SPOCS, 2011) defines *document data* as a unified and machine-readable description of the content, optionally including the real content data. This document data introduces a mechanism to describe the content of an electronic document, which is available in a non-machine-readable format only[10], but still in a structured way though.

Document data defines a set of information on the level of electronic documents for storing machine-readable content. This set of information includes:

- A type identifier, which indicates the type of the document data, e.g. this is a birth certificate.
- A description of the structure, e.g. a birth certificate must contain the name and date of birth of the person as well as the names of her parents.
- The extracted values out of the original electronic documents satisfying the defined structure, e.g. the real name and date of birth of the person as well as the real names of her parents.

Figure 2 shows the basic principles of meta data (a.) and document data validation (b.). For meta data validation, meta data to be validated serve as input for the validation. For instance, such meta data can be extracted from an OCD container. In addition, a meta data profile ID selects a certain pre-configured meta data profile. Such a profile defines the meta data structure, i.e. which meta data must be present (e.g. meta data must contain a sender and a subject) and optionally which content must be present in the corresponding meta data fields (e.g. the sender must be "John Doe"). Based on this profile, the meta data is validated. First, the structure of the meta data is validated. In the second and optional step, the contents of the meta data fields are validated against the selected profile. Based on these validation steps, a common validation result is generated.

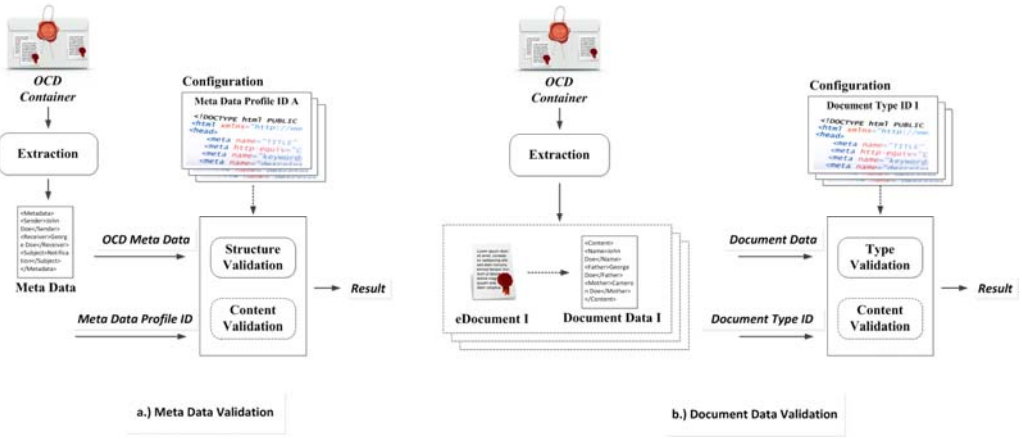

Figure 2. Meta data and document data validation

Document data validation is carried out according to a similar principle. Document data to be validated serve as input. For example, document data can be extracted from an OCD container. As second input, a document type ID is given, selecting a pre-configured document type profile. Thereby, a document type profile indicates the structure and optionally the contents of the document type (e.g. a birth certificate). Subsequently, document data are validated checking compliance against the profile, i.e. the data represent the given document type and – optionally – contain the required content. Finally, a validation result is generated.

[10] E.g. a PDF document containing a scanned copy of a birth certificate

Both meta data and document data validation base on XML schemata. During the validation process the data are verified if it is compliant to the given XML schema.

Figure 3 shows the integration of meta data and document data validation based on the OCD Validation and Verification Module. Here, meta data validation is an internal part of the module as the meta data scheme is OCD specific. Nevertheless, the concept of the proposed meta data validation is adaptable and can be used in various scenarios where validation of meta data is necessary. In addition, the validation of document data is linked to an external service as this validation is not OCD specific and thus follows a universal approach. Finally, the results of the meta data and document data validation are added to the verification report. External document data validation may also be maintained within a cloud. Section 4 elaborates on a possible cloud-based approach.

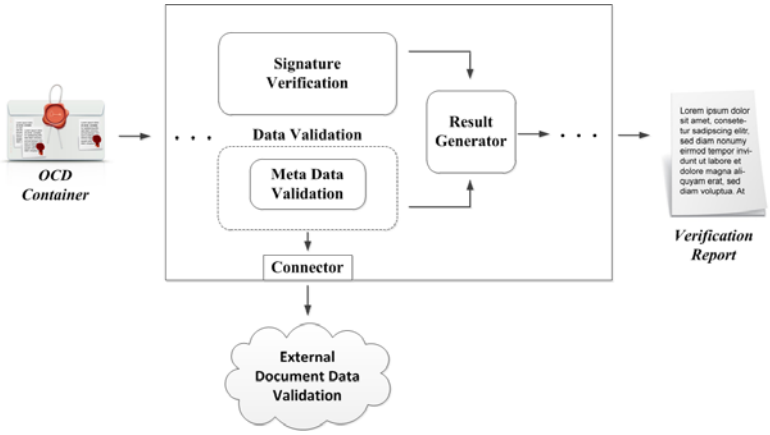

Figure 3. Data validation as part of the OCD Validation and Verification Module

4. VERIFICATION AND VALIDATION SERVICES IN THE CLOUD

Verification and validation of both electronic signatures and corresponding data applied to electronic documents are essential. In this section, we elaborate how cloud computing can be taken up to further improve verification and validation services of electronic documents.

Cloud computing (Mell and Grance, 2010) is currently on of the dominant topics within the ICT sector. The main aim of cloud computing – providing IT resources such as computing power or data storage based on a pay-as-you-go model – promises a lot of benefits. For instance, IT resources can be consumed just on demand and only effectively consumed resources are charged and must be paid. On the one hand, this provides high scalability for online services because required resources can be easily added. On the other hand, due to the flexible pricing model a lot of costs can be saved. By taking up cloud computing also for verification and validation services, these services can also take advantage of higher scalability and cost savings.

Basically, we see two main scenarios where cloud computing can particularly help improving verification and validation services, namely by deploying a

- Single external verification or validation service in the cloud or
- Brokered external verification or validation service in the cloud

We elaborate both approaches in more detail in the next sub-sections.

4.1 Single External Verification or Validation Service in the Cloud

Involving external verification services extend internal signature verification mechanisms, as the applied signature format might be proprietary and hence not supported by an internal service. This especially holds for country-specific signature formats, e.g. the Austrian and Lithuanian signature verification services as mentioned in Section 0. The verification of electronic signatures constitute a frequent process, hence such a national signature verification service may face a lot of requests. In particular, the amount of requests to be

processed may not be constant. I.e. situations may occur where such national services have to cope with a high load. In such situations, simple verification services may not be able to handle load peaks and may tend to break down. More severely, in a worst case this can lead to a denial of service.

To bypass such bottlenecks, the verification service could be easily deployed as cloud service. The cloud guarantees nearly an independent amount of resources. Hence such potential bottlenecks could be easily overcome. In addition, applying the cloud computing paradigm offers some cost savings potential, as only the consumed amount of resources has to be paid. An imaginable scenario would be the implementation and deployment of a central cloud service per country, which is capable of processing individual signature verification requests. A similar approach, where countries host single and central gateways for individual data processing, can be found in the European Large Scale Pilot Projects STORK[11] and epSOS[12].

While scalability issues can easily be solved by applying cloud computing, the use of the cloud might bring up other issues in terms of security or privacy (Zissis and Lekkas, 2012). Before deploying such verification and validation services in the cloud, a thorough analysis on the cloud model to be applied is required. While public clouds offer the highest cost savings potential, private or community clouds might be favored as they allow higher control on the data to be processed (Catteddu and Hogben, 2009).

Finally, applying such a model is not limited to signature verification services. Needless to say that data validation services could follow such an approach too.

4.2 Brokered External Verification or Validation Service in the Cloud

While single external verification services in the cloud bypass the issue on scalability, they still leave the issue on heterogeneity of external verification services unresolved. Applying the single external verification services in the cloud model can lead to situations, where verification modules still have to manage several different interfaces to those external services. In other words, verification modules must support and implement the interface for connecting to the Austrian verification service, the interface to the Lithuanian verification service, etc. Such a model does not perfectly scale, hence we propose a brokered external verification service in the cloud similar to the brokered approach described by the Cloud Security Alliance (2011) as a second option. In this model, the verification module needs to support one interface to an external verification service only, namely to the brokered external verification service in the cloud. In addition, the brokered external service incorporates several other external verification services interfaces, e.g. the interfaces of several countries. In other words, such a service acts like a broker or hub between the verification and validation module and several external services. Summarizing, this approach provides two main advantages. The first advantage is scalability as the service is deployed in the cloud. The second advantage is the support of individual other external verification services to avoid heterogeneity.

However, this approach has also to deal with privacy and security concerns. Probably, private companies might take up this approach and hence data could be processed in a public cloud, which provide a lower security or privacy level. To bypass these concerns, it might also be feasible that the European Commission itself sets up such a service. Hence, to ensure higher control on the data to be processed such a scenario relates more to the application of a private or community cloud. Again, this approach is valid for both signature verification and data validation services.

5. CONCLUSIONS

Secure and efficient processing of electronic documents and its affiliated meta data are crucial requirements for efficient and security-sensitive applications. Our described approach shows solutions which are capable to fulfill these requirements. We have introduced a mechanism which enables existing signature verification services to integrate external services supporting the verification of national and proprietary signature formats. This facilitates the dynamic enhancement of supported signature formats. In addition, we have highlighted the need for previous data validation and have presented a solution on validating meta and document data. Although we have presented our solutions on the basis of the OCD container format and its

[11] STORK (Security Across Borders Linked), https://www.eid-stork.eu/
[12] epSOS (Smart Open Services for European Patients), http://www.epsos.eu/

software modules, they are also applicable for several other use cases where electronic documents must be exchanged and processed. Anyhow, our presented approach contributes to more efficient, time saving, and cost reducing e-Government and e-Business applications.

Additionally, we have elaborated possibilities to make verification and validation services available via cloud computing. The movement of these services to the cloud allows for additional cost savings and enables higher scalability. The incorporation of encrypted OCD containers and documents in the presented approach as well as the definition of interoperable document data types are subjects to be addressed in our future work. This might also help bypassing security and privacy concerns with respect to cloud computing.

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CROWD BASED SHOPPING WITH THE ANGEL RING

Erion Elmasllari and René Reiners
Fraunhofer FIT
Schloss Birlinghoven, 53754 Sankt Augustin, Germany

ABSTRACT

When shopping, people need to understand complicated or obfuscated information from food labels, like chemical names, E-numbers, etc. This is time-consuming and cognitively demanding. We developed an approach to support quick ”buy/no-buy” decisions during shopping. The system we developed uses implicit interaction to infer the user’s buying intentions and then provides unobtrusive feedback on that intention. The ”buy/no-buy” decision support is given via tactile feedback from a ring. Visual feedback from opportunistic ambient displays tells the reasons for the ”buy/no-buy” advice, as well as additional information. Familiar objects and natural, implicit gestures are used throughout the interaction. Filters, e.g. against allergy-inducing foods, can be programmed via the user’s mobile phone. This paper presents an extension to the system that allows filters to be shared on social networks, e.g. Twitter. On the one hand this approach simplifies customization of the system, since users can "follow" other users on Twitter and get automatic filters from like-minded people without any explicit interaction. On the other hand, such social integration enables new coordinated actions, for example automatically spreading information on dangerous ingredients, boycotting socially irresponsible brands, or favoring brands that take care of the environment.

KEYWORDS

Interaction Technique, Ubiquitous Computing, Implicit Interaction, Social Programming, Social Coordination

1. INTRODUCTION

With the increasing usage of additives, colorants, preservatives, and other chemical substances in food, the once-simple food label has become a tedious list of cryptic chemical names and E-number designations (Comission 1989). Genetically modified organisms, non-bio growing methods, and trace ingredients due to shared production lines are also reported. Such warnings and designations increase the information density of the label, making it time-consuming to read and difficult to understand. Several studies prove that the probability that this information gets at all read is influenced, among others, by the time constraints of the buyer (Beatty & Smith1987), (Becker 1977), (Nayga 1996).

To aid the user in dealing with this cognitive overload, we developed a system that detects the ingredients of a food item the user has picked, compares them to the user’s preferences, and subtly gives feedback to support the user’s decision. Sections 1 and 2 of this paper give an overview of this system and the results of its validation through a user test with a functioning prototype. We then went on to tackle the question of how the user can best configure her preferences into this system. Section 3 presents our approach for easily configuring preferences by combining personal and community-based filters. We integrate shared experience from social networks, in particular Twitter.

After observing a typical shopping session and analyzing the task flow, we decided not to base the interaction around a mobile phone. We did not want to introduce a device with which people scan and identify food, because this is not a part of the natural task flow. It is not a habitual gesture. To take advantage of habitual gestures, we looked into what objects are present in a shopping scenario and how we could augment them to our purposes. User interviews revealed that a wearable everyday object, like a ring, is suitable for this interaction. The resulting Angel Ring system is described in detail in (Elmasllari 2011).

1.1 Use Case Scenario

Malina, a Czech student, prefers to eat bio food. Her student budget does not allow her as much bio food as she wishes, though. So she compromises: she also buys non-bio, but without colorants or taste enhancers. She is allergic to nuts so she also takes care to avoid them. Her food preferences cost Malina too much time in reading labels. Additionally, when she travels abroad she has to ask people to translate for her, but most of them do not know the ingredient names in English. This week Malina is backpacking in Germany. Before coming here she bought a new electronically augmented ring. Using her computer at home, Malina configured her ring with her food preferences and allergy profile. She also configured it to get new filters by following on Twitter the users @czgov (the Czech Government) and @truthordie (her best friend, who leads the local branch of the "Truth in Advertising" NGO). Now at a supermarket in Essen, Germany, Malina wants to buy bread and a ready-made salad. As soon as she picks a bread package the ring detects the bread type and ingredients. This particular bread contains nuts, so the ring immediately vibrates in an alerting pattern. Malina leaves the bread back, then notices the price tag on the shelf blinking. It is explaining the reason for the alert – in her own language! She recognizes an egg-salad from a company she loves and trusts, so she quickly picks it up. But the ring vibrates again. Surprised, she reads the clarification displayed on the price tag: both the Czech government and her friend have tweeted an alert for this salad, because just three hours ago a high dioxin level was discovered in the eggs from the company's main supplier.

2. DESIGN APPROACH AND CONCEPTS

Our research draws heavily from the Ubiquitous Computing vision first expressed by (Weiser 1991). According to Weiser, the more computers are embedded in the environment, the more they will become mundane and people will be unaware they are interacting with machines. This will allow people to exclusively focus on their own tasks and goals, rather than on how to interact with the machine (Norman 1999).

Two important additions to this idea are, first, to always keep the human in the decision loop and support her with all necessary information for taking a decision[1], and second, to not request the human's attention unnecessarily. Another idea that influences our work is "interaction by doing", or "implicit interaction" (Wilson & Oliver). We applied an iterative design approach as proposed by (Nielsen 1993). To understand the interaction context, we surveyed users to find out what objects are already ubiquitous and can be augmented for our purposes, and what habits and choices people have regarding food. Our concept of the system, described in the following sections, stems from this feedback.

The ring was chosen as the primary device because it is ubiquitous in today's society (Nielsen 1998). Sixty-seven percent of our women respondents wore at least one ring. Even though only 25% of men had one, none of them expressed unwillingness to wear a ring. According to the survey results, people almost never remove their rings. This strengthens the case for rings as ubiquitous devices, but it also raises the necessity of a ubiquitous power source.

We found no strong correlation between the dominant hand and the hand where the ring is kept, so the system will for now focus on users who keep the ring on their dominant hand, i.e., the same hand used for picking objects while shopping. A ring with the required computational power has been available since 1998 (Curry 1998). To minimize the power needs, intensive computation can be offloaded to a mobile phone in the user's pocket; 100% of our survey respondents stated to have a mobile phone with them often or always[2]. We further miniaturize the ring and its power needs by offloading food ingredient databases to cloud services.

[1] Namahn: Interview with N. Streitz (2010) about Cities of the Future. Held at Brussels, on 29 April 2010. http://www.namahn.com/resources/interview/norbert-streitz-cities-of-the-future

[2] While it is tempting to use the mobile phone to scan food items, this goes against our focus on implicit interaction. Additionally, it is difficult to use a phone single-handed, e.g. when carrying a bag or baby in the other hand. See section 1 for the complete reasoning.

2.1 Prototype Architecture

The prototype for evaluation was realized with the Arduino hardware toolkit. It can be easily programmed in a language with C++ syntax and includes support for many I/O devices and operations, both digital and analog. The prototype had access over the network to a database of ingredients for each product and a database of shelves where alternative products could be found. Network communication was realized with the LinkSmart[3] Middleware. Services in LinkSmart can run wherever it is most appropriate, e.g. the user profile can be at an identity provider in the cloud, the food databases at an appropriate UN/EU agency etc.

Real food packages were marked with 135KHz RFID tags (least susceptible to metals and liquids found in food and its packaging). A 5mm vibrating motor and RFID reader were mounted on a plastic ring in such a way as to not disturb the "pick" or "grab" hand posture.

Several LCD displays were used to simulate e-paper price tags on the supermarket shelves. On picking a product, the system instructed these displays to show additional information, e.g. the reason for rejection, a map of alternative products, or details about the picked product. This information was localized to the user's own language, derived from the user profile.

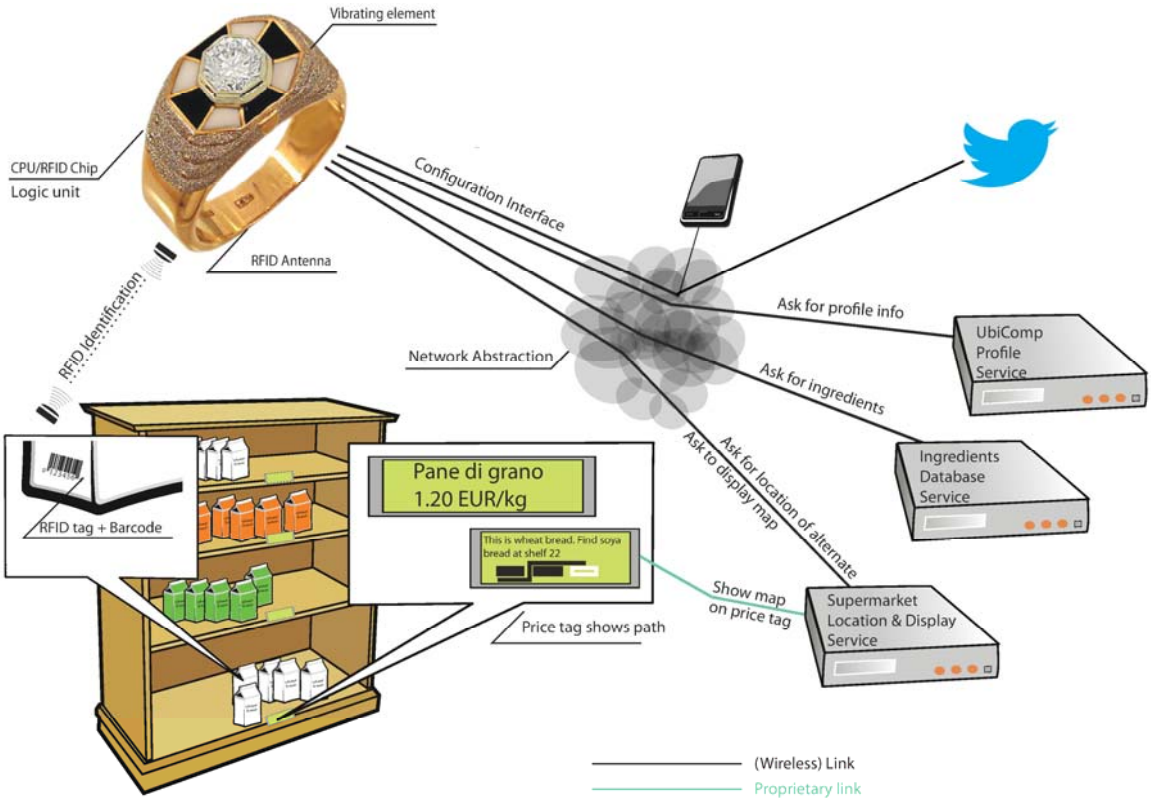

Figure 1. Conceptual Schema of the Angel Ring System

2.2 Design Assumptions

In our prototype implementation we made use of technology which is expected to become commercially available in the very near future. The system can also be built right now, with existing, off-the-shelf technologies, but this is not yet cost-effective. Printable RFID tags will shortly be available for a negligible cost, thus items in supermarkets will be tagged via RFID (Jung et al. 2010). Supermarkets have desired this for a while and are waiting for the cost of tags to drop (Weiser 2007). E-paper displays will become

[3] http://www.hydramiddleware.eu

commonplace in the near term, replacing current price displays on supermarket shelves (Osterman et al. 2009). Furthermore, advances in power harvesting will allow for a suitable power source for the system. We assume that a UbiComp user profile exists and is accessible everywhere. We also assume that the databases that list the ingredients of each food will soon be publicly available[4].

2.3 First Evaluation of the Prototype

The prototype ring was evaluated in a test with 16 users, to determine whether the ring interaction concept was useful, whether parts of the system were superfluous or in need of improvement, and whether the interaction method and system were easy to learn and use. None of the users in the evaluation had taken part in previous design iterations.

Evaluation consisted in performing two shopping tasks according to a scenario similar to the one in this paper. The participants were initially briefed on the rationale behind the system and its application scenarios. In order to test ease of learning, we did not tell participants when feedback would come, nor what it would mean. They had to figure out the meaning on their own. Participants were also asked to think aloud while interacting with the system.

Fifteen participants (94%) completed the task successfully without receiving any training and with no undue delays during task completion. A majority of 13 participants out of 16 considered the system easy to use (Median = Agree, Mode = Agree, $\chi^2(4, N = 16) = 12.125$, $p < 0.05$). Without receiving any training, 11 out of 16 considered it easy to learn (Median = Agree, Mode = Strongly Agree, $\chi^2(4, N = 16) = 9.625$, $p < 0.05$). People with no computer- related background found the system even easier to use than their computer-related peers (Mann-Whitney test, $U = 8.5$, $n_1 = 6$, $n_2 = 10$, p(one-tailed) < 0.01). Thirteen participants (80%) both liked having information on the price display and found the information useful.

The system response time in test conditions averaged 0.021 seconds until ring feedback, (95% CI: 0.020 - 0.022) and 0.022 seconds until price display feedback (95% CI: 0.021 - 0.024). Participants perceived response time as being very short ($\chi^2(4, N = 16) = 18.375$, $p < 0.01$).

2.4 Related Work

A smart ring was first used in JavaWorld 1998 as a security token (Curry 1998). It was based on an ”iButton” device from Dallas Semiconductors, a true computer in a tamper-resistant housing only 16mm in diameter. The ring incorporated a relatively large amount of RAM and a CPU running the Java Virtual Machine and a RSA module. iButtons were used in large scale as tickets in the public transport system in Istanbul, as mailbox identifiers for the US Postal Service, and as earrings for tracking cows in Canada.

Picking task support for warehouses was studied in (Prause et al. 2009) and (Prause et al. 2011). This kind of task is often accompanied by errors, such as picking the wrong item or the wrong quantity. Additionally, inexperienced workers need too much time to find objects. The MICA system augmented a trolley cart with RFID readers and the packages with RFID tags. A display on the trolley showed instructions and navigation guidance to find the appropriate shelf. Audio instructions repeated to the user what to pick. Interaction between the user and the system happened implicitly. The act of putting a package in the trolley was detected via RFID readers and was interpreted by the system to mean that the user wanted to take that package. This allowed the system to support the user by checking that the correct package had been picked.

An extension to the MICA prototype resulted in an RFID glove that sped up identi- fication, since objects could be identified upon grabbing, without the need of putting them into the trolley (Voong 2008).

While the MICA approach and its glove-based extension handle similar situations to the Angel Ring, there are key differences regarding the kinds of user feedback used and the requirements for privacy, comfort, and responsiveness. The approach presented in this work uses a combination of haptic and visual feedback, while MICA uses an aural and visual combination. The warehouse scenario needs no privacy, whereas privacy is paramount in the presented shopping scenario. The time for grabbing a food item and throwing it in the shopping cart is very short, thus putting much harder time constraints on response time.

[4] Examples for such databases can be found at: http://www.fao.org and http://foodessentials.com

The EBBITS project (EBBITS 2012) develops a comprehensive system for product traceability. It focuses, among others, on meat traceability from raw feed to the cooked steak. Consumers access ingredient data and alerts via a mobile phone app, while products are marked with RFID tags. The Angel Ring works with and improves on the EBBITS vision by making the interaction simple, efficient and implicit, all while using the same underlying infrastructure.

Jung et al. have developed printable RFID tags. The technologies used to print are standard ones: roll printing and rubber-stamping (Jung et al. 2010). The inks contain silver, carbon nanotubes, and a nano particle polymer. They combine to form the electronic circuits and components of the RFID tag.

The Sixth Sense project from MIT Media Lab uses object and marker recognition to augment physical objects in the real world with additional digital information (Mistry and Maes 2009). Colored markers on the fingertips are tracked, enabling the system to detect hand and finger gestures very easily. Depending on the object and gestures, additional information is projected onto the object itself via a small portable projector that hangs from a necklace. In a similar scenario, the Sixth Sense also recognizes products from a supermarket and projects the price on them.

In terms of short message communication within communities, Twitter has been often used outside of its primary function as a status update mechanism. One of the earliest uses was to tweet messages from movement sensors and other home automation devices. Then it was used to control such devices by sending commands to them in the form of tweets. People also used Twitter to cooperate and respond to the petrol shortage crisis in Atlanta in 2008 by tweeting the location and price of stations that were still selling petrol[5].

etoro.com is a stock trading platform where people can invest in stocks in a "social trading" way. It makes it easy to see who is trading what, and to "follow" the best performers. It also allows the user to invest their money in the same stocks as the people the user is following. De facto, etoro allows users to program trading rules for themselves by simply "following" someone else (in the social-network sense of "follow").

3. EXTENSION: INTEGRATION WITH SOCIAL NETWORKS

Our system can be useful to people with all kinds of preferences, e.g. concerning health-consciousness, diets, allergies, religious observation, fair trade, or civil and political beliefs. Before the system can be adopted, however, an easy way of configuring the user's preferences must be found.

In order to make a "buy/no-buy" decision at a supermarket, people use certain background information that they gather during their lives. For example: "Wine with too much sulfites causes me headache", "Brand X uses too many conservants in their cakes", "fresh bio milk tastes better", etc. Crucially, this information does not come only from personal experience; a large part of it comes from the people in one's social circle or people that are widely deemed to be authorities in the field. It also takes time for this information to "traverse the grapevine", since explicit interaction between people is required in each step of the traversal. Suppose we only gave users a personal configuration interface, i.e., everyone configures their own filters. Each user would have to codify all of their "food knowledge base" into filters for his own device. Even after doing this, the filter set would still be incomplete, as new information would still be on its way traversing the grapevine.

By the reasoning above, a strictly-personal configuration interface would put undue burden on the user. By making preference filters shareable with one's social network, the Angel Ring would embrace the social communication process rather than offer a cumbersome alternative to it. Our extension to the Angel Ring system consists in integrating it with social networks, taking Twitter as an example.

Every user has some strictly personal food preferences, for example their allergies or taste preferences, which, by virtue of being personal and sensitive, should be configured via a personal configuration interface. Other preferences stem from the users agreement to a certain ideology, plan, facts, or way of thinking, e.g.:

- Public recommendation lists (Nutrition advice, Green/Social responsibility)
- Public administration suggestions concerning health
- Diet lists from mainstream magazines

[5] Evan Williams reported on "Listening to Twitter users" on his TED Conference talk in February 2009.

- Suggestions from organizations the user is member, of, e.g. the local green movement, the user's religious community
- Suggestions from friends and trusted connoisseurs

This second kind of preferences applies to more than one person and is usually shared, at least between the members of the group who originated the preference. This means that there is at least one entity (user, organization) that can configure filters for these preferences and share these filters with the other members of the group. Sharing saves time and ensures a fast spread of the information to the interested parties. We envision this "crowd-configuration" process as taking place over Twitter. Every social network platform that allows sharing with a group will do, but Twitter's "follower" concept provides a very good metaphor on which to model the social aspects of our system. The "follows" relationship not only gathers all followers into a common social group, but also defines the hierarchy of information spread and the hierarchy of trust within the group. To configure the ring then, a user would first configure her strictly-personal preferences via a traditional configuration interface. Then she would tell the Angel Ring to "follow" on Twitter those people or organizations that influence her food choice. As soon as a new tweet arrives with a filter definition, the ring would automatically import that filter. Because the filters are, in essence, just normal tweets with a specific format, the user can also re-tweet these "imported" filters as well as create and tweet her own filters to her followers.

3.1 Implementation Details

We have identified the following pieces of information that make up a preference filter:

- Action keyword: *prefer* or *forbid* a food that matches the filter
- A property whose value is checked, like: *ingredient, producer, price, fat-content, production-place, animal-origin,* etc. Any field of the food database is a valid property to check
- A relationship of that property's value to a criterion. Such relationships may be defined by mathematical operators, e.g. *E-771 >= 0.001%*, or by ontology relationships, e.g. *production-place is-part-of Africa*.
- A freetext explanation or description about the reason behind this filter

In the tweets from the Angel Ring, a predefined hashtag, e.g. *#RingFilter* allows the tweet to be identified as a filter and serves as a marker to divide the human-readable explanation from the machine-readable definition. The filter tweets would then look like this:

Doing a low-fat diet #RingFilter prefer fat-content < 10%RDA

forbid E-122 > 0 #RingFilter Red colorant E122 banned in half of the world

We choose the format of the first example, with the free text in the beginning. This way people can read and understand the filter's meaning without being forced to read the formulas that are intended for the machine, like in the second example. This in turn allows people to use the same Twitter account both for real tweets and for filter sharing, thus removing a barrier to adoption and making the Angel Ring a natural part of their social network use.

We also envision an interactive website where the machine-readable part of the filter can be automatically parsed, dissected, and explained to the user in simple, plain language. This will allow users to verify the imported rules, thus increasing trust in the system. An example explanation for the tweet above is:

Your Filter: *Red colorant E122 banned in half of the world #RingFilter forbid E-122 > 0*

Explanation: This filter will alert you for foods that contain any amount of the colorant E-122. E-122 has been banned in Canada, Japan, Norway, USA due to health risks.

More information: [E122 on Wikipedia] [List of E-numbers] [US FDA website]

Figure 2. Example view of how an explanation website could automatically explain the tweeted filters via easily-understandable words and links to the relevant information sources.

3.2 Privacy and Safety Implications

Food preference filters, especially those having to do with religion or health, are potentially very private information. For this reason, we envision that the filters a user creates shall be private by default. They have to be tweeted explicitly. It is possible for filters from different sources to conflict with each other. We propose that the user's own filters have the highest priority in case of a conflict, but we are not yet certain how to resolve conflicts between filters from two external sources. The most obvious idea is to sort filters by "freshness", so that new, current knowledge can replace the old one. This, however, does not take into account the trust that a user places on this filter source. Finding a way to solve these kinds of conflicts is one of the goals of our future work.

4. SUMMARY AND FUTURE WORK

People who are conscious about what they eat, those who have specific requirements on their diet, as well as allergy sufferers, spend lots of time and effort reading labels to find out whether foods fulfill their preferences. Others' food choices are influenced by political reasons: religion, ideologies, etc., which necessitate reading labels just as much. Our system supports all these users in their shopping experience by giving them clear and timely feedback on their choices. We developed an interaction and discovery method based on the concepts of implicit interaction and ubiquitous computing. The aim was to support faster, easier shopping decisions and to lower the cognitive load associated with such decisions. The interaction follows a calm computing philosophy, thus it does not interfere with the user's flow of thoughts and actions. An augmented ring signals unwanted foods via tactile feedback and works opportunistically with supermarket price displays to give detailed visual information.

After arguing why a personal configuration interface should not be the only way of configuring the Angel Ring, we extend the system concept to integrate it with social networks. The system can work with any social network, but Twitter's "follower" metaphor was deemed very similar to the way food information spreads within social groups. Therefore our extension uses the Twitter network as a basis of sharing, by having the user "follow" people whose food-related opinions she trusts.

We also discussed the ways our extension could impact privacy and safety and proposed methods to overcome that impact. We proposed a format for the tweets, taking care that the format remains very user friendly and human-readable, so as to blend into the traditional information exchange between people.

Future work shall focus on solving the main issues discovered with the current prototype design:

- Find ways to signal failures and false negatives caused by excessive network delays, while always respecting the user's causality perception.
- Implement and investigate how well the social network integration performs, how it is used, and how it mixes with the rest of the social interaction happening on the network.
- Find an easy, safe way to solve conflicts between filters from different social network sources.

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ROBOTICS IN SURGERY: DESIGNING A SIMULATOR-BASED TRAINING CURRICULUM

Dimitris Alimisis, Maria-Anna Fengou and Emmanouil Zoulias
School of Pedagogical and Technological Education
Achaikis Sympoliteias 20, 26441, Patras, Greece

ABSTRACT

In this paper the development of a problem-based curriculum for robotic surgical training is presented. The aim and objectives of the curriculum are defined and the background learning theories that have guided our work are introduced. The methodology for designing the simulator-based training is presented and finally the output of this work, the SAFROS training paradigm, resulted as a balanced synthesis of sound learning theories, is reported.

KEYWORDS

Curriculum, Learning Theories, Simulator, Robotic Surgery.

1. INTRODUCTION

During last decade advanced technologies such as robotics radically change how surgery is practiced. This in turn has necessitated for the medical profession to familiarize and train in the emerging technologies. Societal demands for greater accountability in medical performance and for optimizing patient safety, combined with economic pressures that demand cost-effectiveness in training and responsiveness to reduced trainee-patient exposure have led to new professional requirements for training and have brought at the forefront the integration of simulation into the medical curriculum as a reasonable solution 0). Virtual Reality simulators have the potential to support effective and competence-based training programs 0). Even though several simulation models are available for robotic surgical training, the lack of specific and structured training curricula and their assessment represents the major constraint to the expansion of the simulation-based training method 0). Teaching robotic surgery presents new and not previously encountered difficulties. This novel surgery requires innovative training methods with safety and efficacy as required outcomes 0).

This is one of the main directions where the research project "Patient Safety in Robotic Surgery-SAFROS" (FP7-ICT, 2010-13, www.safros.eu) focuses with the aspiration to contribute to the further development of robotic surgical training and to offer to the community of surgical robotics a simulator-based training program supported by sound contemporary theoretical concepts from the field of human learning theories. The work reported in this paper was carried out in the frame of the task "Development of a problem-based curriculum for robotic surgical training" with the main objective to develop new specific training methods for robotic surgery. The curriculum focuses specifically on the two surgeries selected in SAFROS project: the Abdominal Aortic Aneurysm and the Pancreatic Tumor Enucleation. However, an expansion of the proposed training methodology might be considered for implementation in other procedures as well after necessary specific adjustments.

2. AIM AND OBJECTIVES

The overall aim of the SAFROS training curriculum is to improve performance of the surgeons in robotic surgery. The training is expected to lead to better results in robotic surgery improving safety for patient. The curriculum is structured so that trainees can master the skills necessary for using the robotic surgical systems in order to execute one of the two pre-mentioned surgical procedures. Surgeons targeted by the curriculum

are surgeons experienced in open surgery either in AAA or in pancreatic tumor enucleating surgery but novice in robotic surgery. The aim of the training curriculum is specified in the following main objectives:

- To provide a stepwise approach for a step by step acquisition of technical skills in robotic surgery.
- To offer a clear performance guide towards the trainee's achievement of expected outcomes helping trainees to understand the training context.
- To promote learning through interaction of the trainee with the simulation technology (hard- and software).
- To support self-directed action allowing trainees to learn independently.
- To provide guidance and immediate feedback to the trainees using supportive technology.
- To support the development of "real" training clinical scenarios including decision-making and encouraging the engagement of the trainee in authentic medical problem solving .
- To enhance the trainee to make decisions in order to be able to cope with specific problems such as unforeseen situations related to the two surgeries.
- To adjust training to trainee's needs and interests by creating parameterisable training tasks
- Finally to provide methodology and tools for the overall evaluation of the training program.

3. METHODOLOGY: ALIGNING TECHNOLOGY WITH LEARNING THEORIES AND TRAINING STRATEGIES

Traditionally, in surgery skills have been acquired by trainees through an apprenticeship model according to which trainees' role is to observe the senior surgeons and to perform under their direct guidance (the Halsted model) until "mastery" is achieved. However, a novel surgery, like the robotic one, requires new innovative teaching methods with safety and efficacy as required outcomes (Shah et al, 2006). The rapid introduction of robotic procedures necessitates new training methods. Next to the more traditional forms of surgical teaching, the robotic system seems ideal for integrating various forms of simulation 0. To develop a curriculum that is robust enough to accommodate modern requirements for safe and efficient patient care, and flexible enough to handle changes that lay ahead, a paradigm shift in thinking is required (McClusky et al, 2008). Based on the study of the state-of-the-art in training methods and programs of robotic surgery and on the current virtual reality training systems, a number of proposed necessary shifts are identified in the next sections.

3.1 Shifting Focus from Technology to Pedagogy

Recent work on situated learning underlines the potential for simulation to feed into and enrich everyday clinical practice (see for example (Kneebone, 2003). Virtual reality (VR) becomes a serious candidate for a learning environment offering complex surgical skills and the opportunity for a competence-based learning process before the surgeon enters the clinical stage (Kommers et al, 2004). Simulators have been considered the end point for improving surgical learning but, as Satava notes, the real fundamental issue is not the simulator; rather, it is the curriculum. The simulator is just another tool, and it is the curriculum that will determine the training of the surgeon (Satava, 2007). We concur with Aggarwal et al. 0 that training programs must be aligned with educational theories of learning. An appropriate educational philosophy, curriculum and learning environment are some of the important elements leading any educational innovation to success. The emphasis should be shifted from the technology of simulation towards partnership with education and clinical practice putting the emphasis on the curriculum than on the technology (Kneebone, 2003). The curriculum is the keystone to surgical training and according to Satava (2007) it is necessary to incorporate the basic principles of adult education and curriculum design, setting quantitative performance metrics for outcomes and validation of the curriculum.

3.2 Shift from Didactic, Guided Behaviourist Training to Engaging, Challenging and Flexible Training

Current surgical training is based far more heavily on guided didactic pedagogy, with the learner being dependent on the trainer to grant learning opportunities in a formal and hierarchical manner; the learner currently has a very limited role in shaping his/ her learning 0Gallagher et al, 2005). In addition, there is widespread use of highly standardised and rigid curricula where the emphasis is on didactic tasks repeated in a mechanistic manner and objectively assessed until a pre-defined score is achieved. What trainee has to do is just to repeat the tasks again and again following instructions in the right sequence and the right way in order to achieve the established criteria. Perhaps this is due to the ethical challenge of the conflict between patient safety and training junior surgeons to perform operations to the same level of clinical excellence as surgical trainers (Sharma, 2011).

However, learning theories like constructivism and adult learning have been shown to play an important role in developing learners' self-confidence and autonomy (Sharma, 2011), to offer finally a positive learner outcome within surgical teaching. Giving learners practice in making their own choices is possibly harder to implement in an operating theatre, where performing a surgical procedure does not generally allow for "go back a step and try again" but in a simulated virtual environment this is well accepted (and should be encouraged!) since there is no risk for patient. According to Morshead (1995), the subject-centered curriculum should be replaced with academic content that has the flexibility to meet learner interests and needs. The challenge for designers of training courses is to design a more flexible curriculum that might offer a more learner-centered training while at the same time will safeguard high standards of care and high levels of patient safety. The implementation of problem-based learning in some medical school curricula has, in part, helped bridge a gap between behavioural and humanist theories and could perhaps have a role in surgical teaching (Sharma, 2011).

3.3 Shift from Time-Based Training to Criterion-Based Training

Currently surgeons are trained for a certain length of time, number of days or number of trials (Gallagher et al, 2005). While surgical skills simulators are being produced in ever-increasing numbers, there is still confusion about how to use simulators to teach surgical skills. There seems to be a prescriptive approach to use simulators in training: trainers require trainees to "train" on simulators without much systematic thought about what they are trying to achieve. The underlying assumption seems to be that individuals who have performed the required number of procedures will be safe practitioners. This approach ignores individual variability with respect to skill acquisition. Setting a fixed number of procedures or number of training hours is not an optimal approach to learning.

Simulators offer the ability to assess the performance of an expert or experienced surgeon and then to use those performance measures as the benchmark or criteria to which trainee must perform. This makes possible to transform training from time-based to criterion-based: training as long as necessary until the trainee achieves the criterion measures on two successive trials (Satava, 2007). In practical terms, the simulator informs trainees for the objectively established goals they will have to reach and monitors their achievements on the successive trials. Criterion-based training on a simulator has been found to reduce operating time by 29% and errors by 85% (Seymour et al, 2002). In this sense, simulations provide the unique opportunity to radically change the method of surgical skills training changing from time-based training to criterion-based training (Satava R., 2007) in order to help the learners move beyond memorization, to apply the new knowledge, and then transfer the skills learned to real-life situations in operating room.

3.4 Shift from "Shaping" to "Fading" and "Scaffolding" Strategy

Shaping is a training process which "shapes" the appropriate performance of trainees in the "correct" sequence in a skills laboratory. This concept comes from the behavioural science literature and means that successive approximations of the desired response pattern are reinforced until the desired response occurs (Gallagher et al, 2005). Very differently from shaping, the "fading" training strategy gives trainees major clues and guides at the start of training. Indeed, trainees might even begin with abstract tasks that elicit the

same psychomotor performance as would be required to perform the task in vivo. As tasks become gradually more difficult, the amount of clues and guides is gradually faded out until the trainee is required to perform the task without support. “Fading” is used by a number of simulators such as the GI Mentor II (Simbionix, USA) and endoscopic sinus surgery simulator (Lockheed Martin, Akron, Ohio).

Fading strategy can support training in a more flexible way since, after initial support, it allows trainees to act with autonomy and to execute the task by their own skills. Such a strategy is in line with the Vygotskian “scaffolding” approach and with the constructivist principle that learning proceeds from the known to the new, while the new is constructed on top of the known. The “scaffolding” metaphor describes this kind of training where trainee is seen as builder of new cognitive structures leading to the development of new technical or mental skills based on the foundation of what is already known and can be done. The training environment has to provide the “scaffold” to support this construction and the underlying learning processes in the context of a training task. One of the problems with training is that the learning processes are internal, hidden, and abstract. Scaffolding should begin from what is near to the trainees’ experience and build to what is further from their experience. Likewise, at the beginning of a new task, the scaffolding should be concrete, external, and visible. Eventually these concrete and external models can be internalised by trainees and transformed to new knowledge and skills which will be applicable and transferable in new learning or professional situations/problems.

3.5 Inserting Some Serious Gaming in Surgical Training

Serious games are video games whose main purpose is not entertainment but rather teaching and learning. Virtual simulations and serious games are similar and employ identical technologies. However, serious games, being video games, attempt to be fun and involve the primary aspects of games: challenge, risk, reward, and loss (Sabria et al, 2010). According to Begg et al (2007), one of the main challenges to implementing game-based education for health care practitioners is the fact that the embodied experience of professional practice cannot be reproduced online in anything like its full sensorial richness. Creating the embodied experience is particularly problematic for health care, since so much of the practice is a composite of many things above and beyond the formal training environment (Begg et al, 2007).

However, the advances made in the video game industry might be leveraged in the frame of serious gaming to overcome some of the problems and limitations associated with traditional surgical training techniques. More specifically, serious games allow users to experience situations that are difficult (even impossible) to achieve in reality due to a number of factors including cost, time and safety concerns (Sabria et al, 2010). Virtual environments and video games offer students the opportunity to practice their skills and abilities within a safe learning environment, leading to a higher level of self-efficacy when faced with real life situations where such skills and knowledge are required (Mitchell et al, 2004).

In contrast to traditional training environments whereby the trainer controls the learning (trainer-centered approach), serious games can offer a learner-centered approach to training in which the trainee acts as “player” and controls the learning through interactivity with the gaming/training environment. Such a learner-centered environment can promote the engagement of the trainee-player in an active and critical learning approach (Stapleton, 2004). Games inherently support engagement and if engagement is sustained, it may facilitate experiential learning (Kolb, 1984) by providing trainees with concrete experiences and active experimentation (Squire, 2008). In addition to that a gaming/training scenario can enhance retention of the surgical steps, decision making and troubleshooting surrounding a surgical procedure as compared to traditional training techniques (Sabria et al, 2010). Trainees who are pre-trained with the simulator in a gaming environment perform better technically due to their better understanding of the cognitive process and ability to focus exclusively on the technical aspects of learning (Sabria et al, 2010). Analytical and spatial, strategic and psychomotor skills as well as visual selective attention can be supported through serious gaming (Mitchell et al, 2004).

4. RESULTS: THE SAFROS TRAINING PARADIGM

There is a strong demand for surgical training curriculum to safeguard high standards of surgical achievements leading to high levels of patient safety. In the case of surgical training a Socratic method

wherein the trainer has the "right" answer and the trainee's task is to guess/deduce through logical questioning that correct answer is not recommended; a radical constructivism holding that the "fitting" of knowledge to our experiences is the key mechanism by which we learn (Glasersfeld, 1987) is also not recommended in surgical training; nor is a discovery learning model since none surgeon would wish to be left alone to "discover" the outcome of a training task. However, it is unlikely that a single behavioural theory can be efficient for achieving effective outcomes for the learner and safety for the patient. Constructivism and adult learning theories can be implemented alongside behavioural theories to enhance the process of surgical training with a learner-centered approach leading to a more flexible curriculum (Sharma, 2011). A wise balance seems necessary between the need for surgeon's performance to a high level of excellence assuring patient safety and the need for an engaging, challenging and learner-centered constructivist approach. For designing a problem-based curriculum both behavioural and constructivism theories might be used (Sharma, 2011). Such a balanced synthesis is behind the SAFROS training paradigm, inspired from three learning theories and subsequent training strategies: Rasmussen's model, constructivism and adult learning theories are combined to offer a sound basis and useful insights for designing a problem-based training curriculum. In the next sections we emphasise the most important principles and ideas coming from the theories which seem to be most relevant to SAFROS curriculum design.

4.1 Exploiting the Skills- Rules- Knowledge-Based Behaviours Model (SRK)

Inspired from information theory (Shannon et al, 1949), the information processing theory views the human problem solver as an information processing system that manipulates symbolic structures (Newell et al, 1972). The SRK model determines the behavioural level at which the training is to be achieved; the training methods can be therefore classified at the level of the surgeon's behaviour (Rasmussen, 1983). The following three levels of human behaviour are aimed to be achieved:

Skill-based behaviours: Very little attention is required for control once a skill is acquired; this automaticity allows operators to free up cognitive resources for higher cognitive functions like problem solving. Example from surgery is a suture task performed by an experienced surgeon.

Rule-based behaviours: operators use rules and procedures to select a course of action; instructions are acquired by the operator through experience or given by supervisors and former operators; operators are not required to know the underlying principles of a system. Examples from surgery are recognition of anatomy and pathology or procedural steps to be followed while executing a procedure.

Knowledge-based behaviours: more advanced level of reasoning is employed when the situation is novel and/or unexpected; operators are required to know the fundamental principles and laws by which the system is governed; there is a need for analysis of the system and greater cognitive workload. Examples from surgery: incidents of uncontrollable bleeding or unsuspected situations such as the encountering of an unusual or a rare human anatomy require problem solving.

4.2 Inspirations from the Constructivism / Constructionism Theory

According to the constructivism theory human learning is an active process of knowledge construction based on experiences gained from the real world and linked to existing personal, unique pre-knowledge (Piaget, 1974). The constructionist educational philosophy of S. Papert (1992), an extension of constructivism, added that the construction of new knowledge is more effective when the learners are engaged in authentic learning tasks that are personally meaningful to them and emphasized the hands-on aspect of learning. In constructivist/constructionist surgical training a learner-cantered approach is adopted, whereby engagement in clinical scenarios and problem solving is encouraged instead of a passive trainee role (Sherralyn et al, 2002).

Does constructivism work in medical education? There have been voices in literature claiming that constructivist, discovery, problem-based, experiential, and inquiry-based learning is less effective and less efficient than approaches that place a stronger emphasis on direct instruction of students/trainees (Kirschner et al, 2006). However, outcomes from a recent study (Schmidt et al, 2009) are at variance with those voices. The performance of students and graduates from a constructivist medical school was compared with the performance of students and graduates of various conventional medical schools. In addition, student perceptions of the quality of problem-based versus conventional education were reviewed. The results

showed that students and graduates from the constructivist curriculum perform much better in the area of interpersonal skills and with regard to practical medical skills. In addition, they consistently rate the quality of the curriculum as higher. They demonstrated that constructivist curricula can have positive effects on learning even if they deemphasise direct instruction (Schmidt et al, 2009).

4.3 Inspirations from the Adult Learning Theory

The principles of adult learning appropriately fit the characteristics and circumstances of surgical trainees. According to adult learning principles (Knowles, 1984; Rogers A., 2003. "*What is the difference? a new critique of adult learning and teaching, Leicester*" NIACE.Jarvis, 1987), adults are able (and prefer!) to learn independently; they use to relate to their past experiences while solving new problems, and they learn best when they actively participate in problem solving. Adult trainees respond best to immediate feedback regarding their performance. Positive reinforcement is a powerful tool for learning, so is insightful critique of trainee's performance. A clear performance guide toward the trainee's achievement of expected outcomes helps trainees who lack sufficient experience in practice to understand the training context (Sherralyn et al, 2002). Adult learners are more engaged when tasks are autonomous and self-directed, based on life and work experience, goal-oriented, relevancy-oriented and practical (Knowles, 1984). Training tasks should be properly selected to fit trainees' needs and interests. A criterion-based (or goal-oriented) approach where the trainee quickly passes through those tasks or elements of a task, in which he/she is already proficient, to his/her appropriate level tasks prevents disengagement or frustration and results in self-directed learning.

4.4 Towards a Problem-Based Training Curriculum

Both constructivism and adult learning theories support problem-based learning (PBL) as a learning strategy being consistent with current philosophical views of human learning (Camp, 1996). The constructivist view of learning facilitates the adoption of PBL from pre-school education to adult learning, and broadens its application far beyond medical training (Camp, 1996). PBL model was developed in medical education in the early 1970's and since that time it has been refined and implemented in medical science curricula where it replaced the traditional lecture-based approach. A PBL approach can be realized by designing an appropriate learning scenario (Savery et al, 1995). Such a scenario, using the medical environment as the focus, might include this sequence: the learners are presented a problem in the form of a patient entering with presenting symptoms; the learners' task is to diagnose the patient and provide a treatment; the design of this scenario is meant to simulate and hence engage the learner in the problem solving process that it is hoped a practicing surgeon would be engaged in.

Learning optimal conditions set by constructivism and adult learning theories are relevant to the whole environment supporting a PBL curriculum. There is evidence (Norman, 1992) that PBL learners retain knowledge much longer than learners taught conventionally, although their initial learning may be less extensive. In studies requiring integration of basic and clinical knowledge, problem-based learners tend to do better in providing causal explanations of the pathophysiologic processes underlying disease; there are substantial differences in retention of knowledge and learning attributable to PBL. Finally, PBL does have a large impact on self-directed learning skills, and on learners' motivation. Thus, established principles of learning, such as motivation, relevance, practice, active learning, and contextual learning operate significantly in a PBL environment, and to a much lesser extent in conventional curricula (Norman, 1992).

5. IMPLEMENTING THE TRAINING PARADIGM IN THE SIMULATOR

Some representative innovative characteristics that highlight how the above analysis is implemented in the SAFROS curriculum and might be realised with the simulator are listed below.

– The problems are presented as abstracted tasks, that is training situations where one or a few elements are abstracted from reality to be emphasized. Simulations to be effective do not necessarily have to be a realistic portrayal of the training situation. Low fidelity simulations can be used in basic skills training

tasks. Some more fidelity can be added to the simulations of surgical tasks but keeping them abstracted to the necessary extent.

- Trainees should “own the problem”, that is they perceive the medical problem as a real problem which has personal relevance for them. To this end an authentic scenario with the medical problem is suggested and virtual elements in a simulation are combined in an engaging, interesting and challenging way to make the trainee care about the problem.
- Trainees can "engineer" or alter a proposed scenario; they can design their own surgical scenarios and personalize the training environment. This will allow the trainees to steer the case moving towards a more self-directed approach. The simulator is designed to allow greater agency to users. Simulations offer customizable parameters (i.e. sliders) and trainees can make their own selections among different possible ones.
- Making training into “serious gaming”: it is achieved setting a final goal (i.e. offer safe treatment of the problem for patient, “save life” etc.) and making trainee to want to “win”, not just directed to the “right” answer. Some ways for making simulation into a game: trainee has to successfully complete the surgical task minimizing the time and maximizing the score; goals are built-in to the simulation or can be self-imposed; a timer shows continuously the time of the trial and score points are added based on the trainee’s actions; the simulator saves trainee’s previous scores; then simulation is reset and new measurements start from beginning; trainees repeat their trials and continue their efforts until to “win”.
- Making decisions and problem solving: unexpected problems (simulated “bad” scenarios) can be activated on the simulator requiring from trainee to make decisions and act immediately.
- “What if” experimentations: simulations offer opportunities for trainees to try in safety “what if” experimentations (not possible in operating room!).
- Training is optimized when feedback is proximate to when an achievement or error is committed: the simulator provides automatic recording of performance measurements (scores) in the end of each trial (points are added based on the trainee’s actions), alerts when an error is committed or deviation from predefined action occurs etc.
- Guided skill development: trainees can select, if they wish, to be guided for the execution of difficult or crucial parts of the tasks, especially during their first trials. Virtual fixtures are integrated in the training environment (for example defined trajectories to be followed and forbidden regions in the human body) to guide the trainee along the optimal paths.
- Scaffolding strategy: at the beginning of a new task, the scaffold should be concrete, external, and visible; the level of guidance can be gradually faded out until the trainee is required to perform the task without support. The trainee may select to start with complete guidance (where the simulator behaves as an automated system with no possibility for the surgeon to intervene on the pre-computed trajectory) and to repeat the task with less and less and finally none guidance where the “slave” replies directly to the “master’s” movements without any additional guidance.
- Active reflection upon the task: during the execution of the task the trainee can stop execution and ask for feedback and take time for some reflection on his/her previous action. Reflection is built-in the simulation; the simulator offers a mode to replay what happened, so trainees can watch and reflect upon their action approximately when it takes place.

6. FUTURE WORK

The implementation and evaluation of this training program has been planned for the winter 2012-13. An evaluation plan has been developed to answer the basic question: do the trainees improve their skills by the end of training? The plan includes objective evaluation based on performance data that will be collected and evaluated for each trainee according to pre-defined assessment criteria derived from the virtual simulator. The plan includes subjective evaluation as well based on trainees’ ratings on each training session using questionnaires and diaries from trainees. The evaluation is expected to provide valuable experiences and feedback for further refinement and improvement of the training curriculum resulting in safer introduction of robotics in surgery and finally in improved patient care in the 21st century.

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E-MOTION1.0: A VIRTUAL SERIOUS GAME TO ASSESS THEORY OF MIND IN CHILDREN

Esther Lázaro, Imanol Amayra, Juan Francisco López-Paz, Amaia Jometón, Imanol Pèrez and Mireia Oliva
University of Deusto
Avda Universidades, 24 Bilbao-Spain

ABSTRACT

Introduction: Virtual reality has emerged as a potentially effective way to provide health care services, and appears poised to enter mainstream psychotherapy delivery. Given the interactive media characteristics and intrinsically motivating appeal, virtual serious games are often praised for their potential in assessment and treatment. Aim: to validate a virtual serious game (eMotion1.0) lead to evaluate emotional facial expression recognition and social skills, components of theory of mind. Emotion 1.0 has two sections: 1) emotional recognition tasks which includes different static and dynamic faces with basic emotions: surprise, anger, fear, happiness, sadness, disgust and neutral; 2) empathy and social skills task contains virtual scenes in which each participant has to answer to different questions related to interpersonal relationships. This study describes the results of the first section, the emotional recognition task. Methods: The total sample was composed by 1.236 children classified by age (8-12 years old), gender (male = 639; female = 597) and educational level (3º - 6º Primary level). Ten schools from Basque Country and twenty trained evaluators participated in this study. Results: There are differences in eMotion1.0 scores between groups of children depending on age ($p < 0.01$) and gender ($p < 0.05$). Moreover, there is a moderate significant correlation ($p < 0.05$) between emotional recognition scores of eMotion1.0 (Amayra et al., 2010) and Feel facial recognition test (Kessler, 2002). Conclusion: These results indicate that eMotion1.0 shows concurrent validity with instruments which assess emotional recognition. Results support the adequacy of eMotion1.0 in assessing components of theory of mind in children.

KEYWORDS

Virtual serious game, theory of mind and children.

1. INTRODUCTION

Serious games represent a growing area of computer applications to improve or evaluate different skills. They are appealing, interactive, enhance ecological validity and allow players to take on realistic roles, to cope with problems and to make decisions (Riva, 2002).

The use of computer software has several advantages: the environment is predictable, consistent and free from social demands, and users can work alone. Furthermore, lessons can be repeated over and over again and motivation can be maintained through rewards and feedback. Virtual and mixed realities represent the possibility to create a new, immersive and motivational space where patients can be evaluated and trained while playing (Fox et al., 2009).

There are games for training skills, prevention, psychological therapy or cognitive training (Cobb et al., 2002; Botella et al., 2004; Rizzo et al., 2004; Klinger et al., 2005). Other types of games help users to deal with special needs, such as elderly people, people with physical disabilities or blind children (Gamberini et al. 2008).

An example of serious games is Happy Farm (Gamberini et al., 2009), a software for young people designed to increase their awareness of the risks related to psychoactive substances. Another program, VEPSY (Riva et al., 2001), was created to investigate the effects of virtual reality systems aimed at facing several clinical disorders such as social phobia, obesity, bulimia or male impotence. The project combines treatments and assessment of virtual reality. Similar games have been developed to induce mood enhancement on both clinical and non-clinical samples. EMMA (Alcañiz et al., 2003) project provides

innovative ways of coping with distressful emotions for users who suffer from psychological problems, users with restricted mobility or for general population.

Other group of serious games has been created to assess and to train components of the Theory of Mind (Baron-Cohen, 2000). This concept covers mental capacities related to understanding, explaining and predicting psychological states of others and the self. Theory of mind was first established in animal studies of chimpanzees and later in infant developmental psychology and in autism. The Theory of mind permits typically functioning individuals to infer mental and emotional states of others as a means of engaging reciprocal communication and maintaining relationships.

While attempting to teach the Theory of Mind components to people with autism spectrum conditions computer-based training or virtual environments have been used. A relatively new multimedia computer program used to address emotion recognition as Mind Reading: The interactive Guide to Emotions includes an emotion library, a learning center and a game zone in a systematic and comprehensive format (Baron-Cohen & Kingsley, 2007). Results of this study have revealed that the use of the program improves significantly the emotion recognition skills in adults with autistic spectrum conditions.

There are collections of material with emotion face information and photographs, pictures or virtual faces. Different questionnaires have been developed to assess facial recognition ability, for example, The Florida Affect Battery or Feel test (Bowers et al, 1999). However, there are not many types of software that evaluate the facial emotion recognition in children through serious virtual game.

The aim of this study was to develop and to validate a serious game´s program, e-motion1.0, for assessing a component of Theory of mind: the recognition of facial emotions in 1.236 healthy children and 40 children with Attention deficit-hyperactivity disorder (ADHD) aged 8-11.

2. METHODOLOGY

2.1 Participants

One thousand and two hundred children between eight and eleven years old participated in the study (males = 639; females = 597).

The mean age was nine (SD= 1,11). The table 1 shows the number of participants in each age group is similar. The validation took eight months to be completed. Children were recruited from ten different schools in The Basque Country (Spain). Participants were excluded if there was any indication of an existing neurological or psychiatric disorder according to the school psychologist's criteria. The inclusion criteria were: Spanish-speaker, eight-eleven years old, studying Primary Education and normal IQ range (> 90). Signed parental or school consent was obtained from all participants prior to commencement, and no remuneration was provided to either students or their parents for taking part.

Table 1. Age and Gender of the Participants

	Age	8	9	10	11	Total
Gender	Male	148	169	151	171	639
	Female	121	163	139	174	597
Total		269	332	290	345	1236

2.2 Instruments

Two instruments were applied: e-motion 1.0 (Amayra et al., 2010) and Feel test (Kessler et al., 2002).

E-motion (Amayra et al., 2010) is a serious game which evaluates facial recognition and empathy in 8-11 years old children. e-motion1 contains two sections placed in a virtual school settings and requires about twenty minutes to be completed. It is designed to be played on a personal computer during psychosocial skills assessment. Each level follows a preset structure that integrates static and virtual scenes. E-motion1.0 has two versions: a) a virtual one which includes a head mounted display, a motion tracker and a joystick

input device; b) a serious game version. The present study presents the validation results of serious game´s Spanish version of e-motion1.0.

The first section of e-motion1.0 (figure 1) measures the ability to recognize facially expressed basic emotions. This study describes the results of the first section. The internationally known and applied cross-cultural concept of six basic emotions: happiness, sadness, anger, disgust, fear, surprise and neutrality by Ekman et al. (1972) was the reference for the selection of the pictures. This first block consists of four sections of twenty four items: a) seven static facial emotions; b) six dynamic facial emotions which include faces morphing from neutral to other emotion; c) four dynamic facial emotions which show faces changing form one emotion to another; d) seven static facial emotions.

Each face is presented on a computer screen for a maximum time of thirty seconds. Subjects have to classify the respective emotion by clicking on the appropriate label in a forced-choice format (happiness, sadness, anger, disgust, fear, surprise or neutrality). Responses for all tasks are scored as correct or incorrect. The e-motion1.0 automatically records the sum of total correct answers, the sum of static facial emotions scores, the sum of dynamic facial emotions scores, error scores and reaction time for each emotion.

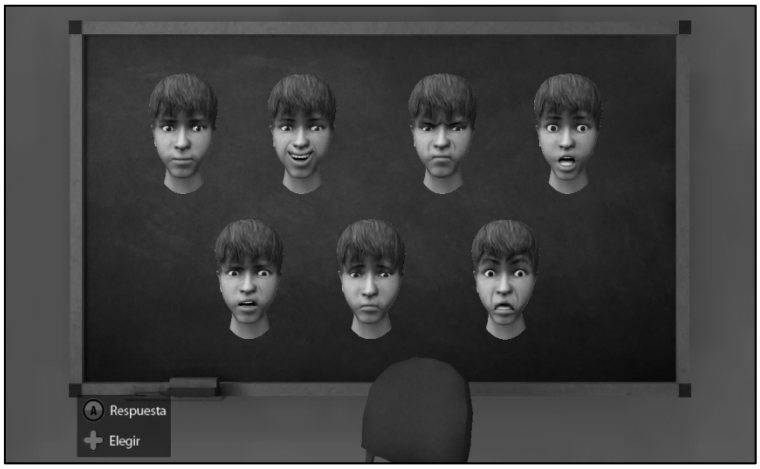

Figure 1. First Section of E-Motion 1.0: Facial Recognition

The second section (figure 2) consists of different virtual scenes placed in a virtual school setting. The narrative develops through 30 items, each one lasting about half a minute or a minute. After presenting each situation, the participant is asked to choose among the six emotions (happiness, sadness, anger, disgust, fear, surprise) and the neutral expression. Examples of such situation are:

> "Your friends have planned an unexpected party for your birthday. How would you feel? How would they feel?" A child wants to play but he is in a wheelchair, and another child asks him how he plays if he's in a wheelchair. How would he feel? How do you feel?
>
> "There is a child who never plays, but today he wants to play". How would his classmates feel? How do you feel?
>
> "Two children are arguing in the playground. The teacher tries to mediate between them". How would the teacher feel?

The answer options: happiness, sadness, anger, disgust, fear, surprise or neutrality. In addition to registering the choice of answers, e-motion1.0 recorded the time taken for participants to select and answer each question.



Figure 2. Second Section of E-Motion 1.0: Empathy

Feel (Kessler et al., 2002) is a computer-based test which measures the ability to recognize facially expressed basic emotions. This test was used, together with the e-motion1.0 to obtain concurrent validity ratings. It consists of forty two computer screen photographs showing facial displays of six basic emotions (anger, fear, sadness, happiness, surprise and disgust) developed by Matsumoto and Ekman (1988). Subjects have to classify quickly and accurately the respective emotion by clicking on the appropriate label in a forced-choice format. In total, forty two pictures of adults are shown, and seven examples of each six emotions are used. The test includes a previous assay. The Feel test score considers the correct answers, error scores and reaction time for all of emotions.

2.3 Procedure

The validation took 8 months to be completed. Children were recruited from ten different schools in The Basque Country (Spain). Twenty trained volunteers and two coordinators collaborated in this research. Participants were individually tested in a quiet room outside the classroom. Each subject was told that the experimenter was going to show him some games. Children were initially instructed about the tasks and questionnaires. After the individual explanation, they completed the task during thirty minutes under standardized conditions in school settings. The child, seated at a table facing the computer, was introduced to the materials and the task was always presented in the same order: e-motion1.0 (Amayra et al., 2010) and Feel test (Kessler et al., 2002).

The ability to recognize facial expressions of the six basic emotions was investigated by means of virtual faces using e-motion1.0. Facial stimuli were presented to the subjects in 4 different blocks in the following order: 1st) seven static facial emotions: neutral, happiness, anger, sadness, fear, surprise and disgust; 2nd) six dynamic facial emotions which include faces morphing from neutral to other emotion: neutral-happiness, neutral-anger; neutral-sadness, neutral-fear, neutral-surprise, neutral-disgust; 3th) four dynamic facial emotions which show faces morphing from one emotion to another: neutral-happiness-anger-sadness; 4th) seven static facial emotions: neutral, happiness, anger, sadness, fear, surprise and disgust. The 24 virtual faces were shown one at a time and the subjects was asked: How is this person feeling? They were asked to indicate the emotion depicted by the particular face as spontaneously as possible by choosing one button according the following categories: happiness, anger, fear, sadness, disgust, surprise or neutral. The order in which the blocks were presented to subjects was the same in all the presentations. The duration of the stimuli was decided by a pilot study which revealed that children needed about 3000 ms in order to make a response. Emotional faces and labels were visible on screen at the same time. The program provided no feedback to the participants about the accuracy of their answers.

Feel test (Kessler et al., 2002) consists of 42 photographs of actors and actress showing emotional static faces (anger, fear, sadness, happiness, surprise and disgust) on a computer screen for 300 ms. Clicking on the appropriate box, subjects have to decide which emotion they saw previously. Emotional pictures and labels

were not visible on screen at the same time. The Feel score takes the correctness and reaction time of the answers into consideration and ranges from 0 to 84 points.

Participation in the study was voluntary, confidentiality was ensured and all the requirements established by the bioethical commission for studies with human beings.

2.3.1 Statistical Analyses

Descriptive analyses (mean, SD, frequencies) were performed to assess the socio-demographic and clinical characteristics of respondents. A Kolmogorov-Smirnov test was applied to evaluate the normal distribution of variables. The analysis showed that all variables are non-normal ($p< 0.05$). A Mann–Whitney U and Kruskal Wallis test were used to investigate differences with regard to age and gender for continue variables. X^2-test was applied for categorical variables and Spearman test for correlations. The SPSS statistical package version 15 was used to analyze the data. A p-value < 0.05 was considered statistically significant.

3. RESULTS

3.1 Content Validity and Piloting

A team of five psychologists was involved in the design phase, generating ideas, characters, scenes and instructions through brainstorming. Interjudge agreement was assessed with Kappa calculations (k= 0.85). The values were within the range of fair to good agreement.

The created virtual facial expressions were validated in a pilot study. For this purpose 30 volunteers evaluated the facial material (48 faces) according to the expressed emotion. A final set of 24 items were chosen.

After face and content validation, the tool was piloted. A total sample of 100 children was asked for their overall impression of the software, whether any items had been difficult to answer. Following the pilot phase, the wording of item number 25 was modified slightly to prevent misunderstanding and a section was added from the previous version because of the improvement of the fear static face. After this modification, the game was clear and understandable.

3.2 Internal Validity of the e-motion1.0

Internal validity of the instrument was examined using Spearman correlations. Total score correlated positively with static facial emotions' score ($r_s = 0.812$, $p = 0.000$) and dynamic facial emotions' score ($r_s = 0.872$, $p = 0.000$). Static facial emotions' score correlated with dynamic facial emotions' score ($r_s = 0.424$, $p = 0.000$). The reaction time scores of static faces correlated positively with the reaction time scores of dynamic faces ($r_s = 0.706$, $p = 0.000$).

3.3 Concurrent Validity of the e-motion1.0

Concurrent validity compares scores on an instrument with current performance on some other measure. In this study it was determined by correlation analysis (Spearman rank order correlation) with the first section of e-motion1.0 (Amayra et al., 2010 and López-Paz et al., 2011) specifically between the section which includes facial recognition task and Feel test (Kessler et al., 2002). The correlation coefficient between facial recognition total scores of e-motion1.0 and those of Feel was ($r_s = 0.339$, $p = 0.000$). The correlation coefficient between facial recognition`s reaction time scores of e-motion1.0 and those of Feel was ($r_s = 0.508$, $p = 0.000$). The results showed small to moderate significant correlations between all e-motion1.0 scales and Feel scales in total scores and reaction time scores.

3.4 Effect of Age and Gender on Facial Recognition

With regard to gender and age the comparison of answers and reaction times' scores on virtual scenes was made by using the Mann Whitney (reaction time X gender) and Kruskal Wallis test.

A Mann Whitney test was used to compare genders. Overall, there were no significant differences except for static score (U= -2.12; p = 0.034), dynamic score (U= -2.32; p = 0.020), sadness score (U = -2.10; p = 0.035) and disgust score (U = -2.85; p = 0.004).

A Kruskal Wallis was conducted to investigate age differences. There were significant differences in static score (X^2 = 20.900; p = 0.000), dynamic score (X^2 = 18.99; p = 0.000), neutral score (X^2 = 18.99; p = 0.000), disgust score (X^2 = 29.46; p = 0.000), surprise score (X^2 = 29.46; p = 0.000), and all of reaction time scores (p<0.000). Results showed that the older the participants the higher the score and the slower the reaction time.

Overall, there were no significant differences in gender. However, age is an important variable to compare both total answer scores and reaction time scores. As in facial recognition task, results showed that the older the participants the slower the reaction time.

3.5 Differences between Control and ADHD Group

We calculated percentiles from the results of normal sample, and then we compared the percentiles of control group with a group of forty children with attention deficit hyperactive disorder. Preliminary results of the present study have shown that on total correct scores (percentiles between fifteen and forty) the attention deficit hyperactive disorder group scored worse than the control group and showed more reaction time (percentiles between sixty-five and ninety). These differences have to be analyzed in the future, but the results indicate that emotion could be useful to assess the components of theory of mind in this disorder.

4. CONCLUSION

It should be noted that this study is not without its limitations, and results should be considered with caution. First, the results only indicate comparability of the classic basic emotions as described by Ekman. However, on a daily basis pure basic emotions are encountered only rarely. Future research should especially focus on investigating more ambiguous and nuanced emotional expressions. Second, the Feel test presents only static pictures of adults of Asia and Europe whereas e-motion1.0 presents static and dynamic virtual faces of a boy.

Based on the result of this study we can conclude that: 1) The age is an important variable to compare both total answer scores and reaction time scores with regard to emotion recognition skill. 2) The attention deficit hyperactive disorder group scored worse than the control group and showed more reaction time. 3) We can conclude that the present study supports the usefulness of the emotion to test the emotion facial recognition ability and provides evidence on the psychometric properties of this Spanish version of the program in terms of structure, internal consistency, and concurrent validity. Furthermore this software could be useful to assess social skills of children with attention deficit disorders or behavior disorders.

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PASSING AND PASSING ON IN THE DIGITAL WORLD

Elke Brucker-Kley *, Thomas Keller *, Lukas Kurtz *, Kurt Pärli **, Claudia Pedron *,
Matthias Schweizer ** and Melanie Studer **
Zurich University of Applied Sciences, School of Management and Law
Stadthausstrasse 14, 8401 Winterthur, Switzerland
http://www.sml.zhaw.ch/en
*Department General Management, Institute of Business Information Management **
*Department Business Law, Center for Social Law ***

ABSTRACT

What happens to the great amount of information on social media and other Internet platforms after our death? Even while alive it is hardly possible for anyone to control the storage and dissemination of personal data on the Internet. How and for what reasons should we therefore try to make arrangements regarding what happens to this data when we pass away? Our next of kin do not usually know much about our various online activities, nor do they have access to the passwords necessary to deactivate profiles or delete or move information. At the same time, platform providers follow different practices and their terms and conditions vary considerably. This paper summarizes the results of an interdisciplinary research project[1] aimed at clarifying the many open questions that arise in connection with this topic and proposes an extended perspective on how the many facets of this subject matter might be approached.

KEYWORDS

Digital Estate Planning, Digital Inheritance, Digital Legacy, Social Media, Right to Be Forgotten

1. INTRODUCTION

It may be considered slightly morbid to calculate the mortality rates of social network users, especially if this is done in the context of digital estate planning, a relatively new field of business. Drawing on this, Nathan Lustig, one of the founders of Entrusted[2], a company offering digital estate planning services, has calculated that 1.5 million Facebook users died worldwide in 2010 (Lustig, 2010). His calculation is based on age-group mortality rates in the US, which he applied to Facebook user statistics. The results of this numbers game were reflected in the impressive headline: "Three Facebook Users Die Every Minute", thus positioning the concept of "digital death" in countless blogs and articles and increasing the awareness that social media users are neither forever young, nor are they immortal. Those numbers were recently updated. As the headline "2.89 million Facebook Users Will Die in 2012" indicates, the number of deceased Facebook users has almost doubled since 2010 (Lustig, 2012). We cannot know how many of these profiles have remained unchanged or how many have been transferred to "memorial" status. Facebook does not remove inactive profiles. It can therefore only be assumed that an unquantifiable portion of all profiles of deceased members continues to "exist", not only in the membership statistics relevant to sales, but also in the form of bizarre birthday reminders, networking recommendations, etc. Facebook is only one of many platforms through which, over the course of a lifetime, large amounts of data are amassed. This paper illuminates the main issues related to a digital estate and evaluates approaches to digital estate management.

[1] Co-financed by the Commission for Technology and Innovation CTI, Innovation Promotion Agency (Swiss Federal Department of Economic Affairs)
[2] Entrusted (Madison, WI) was acquired by Swiss online data safe provider SecureSafe (DSwiss AG) in April 2011.

2. THE DIGITAL ESTATE: ITS RELEVANCE AND PROBLEMATIC NATURE

The main issue in dealing with a digital estate is not only its actual **content**. What is equally important are the **platforms** – increasingly Internet-based – where this content is stored and shared with others, the **accounts**, including personal profile data, to which it is linked, and, finally, the **traces** we leave behind, and which can be analyzed, as we move through the Internet. What are these digital assets and traces that are accumulated on the Internet over the course of a lifetime? Are they actual assets or do they have emotional value? Are they aspects of a "digital identity", "digital belongings" - or mere "garbage data"? It is difficult to describe the content of a typical digital estate or make statements about its scope or relevance. The range of possibilities extends from data storage in the Cloud, to social media profiles and all the way to avatars which store personal characteristics such as voice, appearance, or preferences. The contents may be everything or nothing, valuable or meaningless, intimate or confidential, under copyright or actually illegal. The individual behavior patterns of the various Internet generations and individual users are too distinctive; the Internet business models are too dynamic, permanently introducing new offers, and opening up new possibilities for accumulating, disseminating, and evaluating data. As opposed to physical documents, folders, address books, or photo albums, digital assets are, by definition, intangible. During a user's lifetime this is a normal feature of the increasing digitalization and virtualization of our daily lives. When a user dies, however, this immateriality presents problems which make it more complicated for the next of kin to deal with the digital estate of a deceased family member:

- **Knowledge**

Increasingly, an individual's digital estate is not stored locally on the deceased's end devices but has been dispersed over various Internet platforms. The dependents usually have no knowledge of the decedent's Internet accounts or social media activities. An Internet reputation service can be useful but may not necessarily find all the traces, in particular if the deceased user has taken full advantage of the available privacy options. In addition, digital identity may not correspond with actual identity if the deceased adopted different online personas (avatars, nicknames, aliases, etc.). Whether these "digital identities" should continue to exist without the knowledge of that person's next of kin is not only a question of piety. It can have serious financial consequences, for instance when a contract with a commercial website hosting provider is automatically renewed, or when a Paypal account still has a balance.

- **Access**

Unless the deceased deposited access information for online accounts, his or her dependents will have no easy way of accessing this data and will therefore have to rely on the practices and the general terms and conditions of the platform providers. There are only a few Internet services which have explicitly stated guidelines for dealing with data and accounts in the event of a user's death (Chapter 4). Some Internet services will grant access to family members who submit a death certificate, regardless of the deceased account owner's privacy rights. Others have very strict rules which prohibit access by third parties even in the event of a user's death (e.g., Yahoo! Terms of service (Yahoo!, 2008) expressly state: "*No Right of Survivorship and Non-Transferability. You agree that your Yahoo! account is non-transferable and any rights to your Yahoo! ID or contents within your account terminate upon your death.*").

- **Ownership and Control**

The issues of access and ownership are closely linked. Sole usership of internet content is in most cases waived by the users themselves – be it by accepting the provider's general terms and conditions or by sharing data with other users. When the user dies, the heirs or other surviving dependents find it almost impossible to (re-)gain control over the digital estate, assert their claim to the deceased's data, or succeed in having them deleted (Avok, 2012).

- **Data Worth Preserving and their Format**

Dying is closely linked to memory. How and with what would I like to be remembered? What might I leave behind that could tarnish people's memories of me? If important things like photos, family recipes, or correspondence only exist in digital form, it makes sense to preserve at least part of this "digital estate" for posterity and to make it accessible in the long term.

- **Erasability and "Digital Forgetting"**

Even while a user is still alive, it is almost impossible to wipe out all traces of his or her Internet use. Technological advances such as the indexing and analysis of Internet content, multisite postings, or exchange

formats make it easier for users to search for and share information. At the same time, they also make it harder to enforce the "Right to Be Forgotten" on the Internet. A picture or a profile can be deleted from a platform, but it will continue to exist in the cache of the Internet search engines and web archives, and erasing these widely spread traces takes effort and persistence.

3. SCENARIOS FOR THE DIGITAL ESTATE

Do our online lives continue when we pass away? Not necessarily. What happens to Internet accounts, profiles, and data in general after a person's death largely depends on the actors concerned:

1. Myself - Self-determined user	**Should I dispose of my digital estate?** ▪ By what means (conventional will, digital estate planning service, sharing access data)? ▪ How should the accounts, profiles, and data be treated?
2. Surviving dependents, friends	**Do/Should my family and friends have access to my digital estate?** ▪ Do they have enough Internet or social media know-how to carry out my wishes? ▪ Do my wishes match those of my next of kin or friends and are they enforceable?
3. Platform provider	**How do platform providers treat the accounts and data of deceased users?** ▪ What terms of use/terms and conditions or other regulations apply?
4. Legislation, jurisdiction	**What legal provisions apply specifically to digital estate planning and the execution of a deceased's will?** ▪ Are the digital assets relevant in terms of succession law or copyright law, or are they covered by an individual's personal rights)? ▪ Enforceability: What country has jurisdiction and what is the applicable law?

Figure 1 provides an overview of the scenarios which can arise as a result of the fundamental decision for or against digital estate planning.

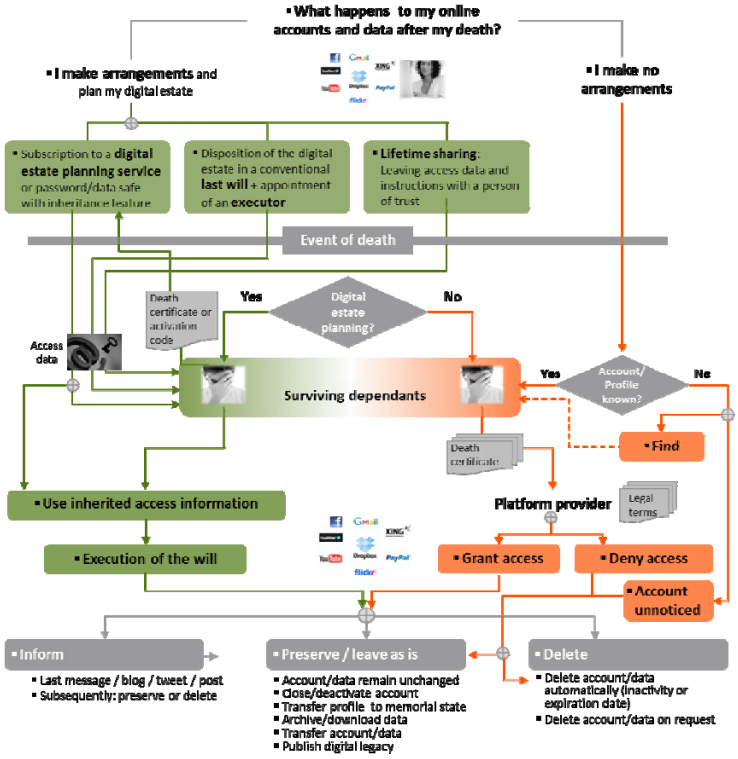

Figure 1. Scenarios for digital estate planning and execution of a will

The outcomes of the two scenarios clearly show:

- **Various ways already exists for Internet users to dispose of their digital estate in a self-determined and proactive manner** (Chapter 5).
- **Internet users who dispose of their digital estate create transparency and prevent access problems from arising for their dependents after they pass away.** Digital estate planning places the control and the power of disposition mainly in the hands of the dependents. They can use the access details that have been deposited to carry out the last will of their deceased relative.
- **If Internet users do not dispose of their digital estate while they are still alive, the platform providers will dictate what happens when they pass away.** The different practices of platform providers are discussed in the next chapter.

4. PRACTICES OF ONLINE PLATFORM PROVIDERS

It is mainly the major international online platforms which have regulations relating to a user's death, usually communicated through the terms of use or the online help feature. Some national or regional providers have regulations which are available from customer services.

	Options during lifetime or with inherited access data			**Options enabled by platform providers in case of a deceased user**						
					Dependents may request:					
	Close Account (profile and data remain undeleted)	Delete account and data	Download data (synchronize, archive)	Provider deletes inactive accounts automatically	Access to the account	Closure of the account	Removal of the account (delete profile and data)	Copies of data	Memorial state	**Current practice to handle the case of a deceased account holder**
Face-book	+	+	+	-	-	-	+	-	+	**Option 1: Memorialize profile** (Facebook, n.d.): Facebook transfers profiles of deceased members to memorial status. A deceased member can be reported by family or friends (+obituary). Once memorialized, only confirmed friends can find, view and post on the deceased persons profile. The profile no longer appears as a suggestion. **Option 2: Delete profile**: Verified immediate family members can request the removal of the profile (+birth and death certificate of the deceased, proof of identity and kinship)
Xing	+	+	+	-	-	+ when repor-ted	+ after 3 months	-	-	No published practice: Network contacts or dependents may report a deceased member to the Xing customer service (no death certificate or other proof required). Profiles of deceased users are closed (i.e. turned inactive) and deleted after 3 months to avoid deletions based on a false call or a mistaken identity.
Gmail (Google)	-	+	+	-	-	-	in rare cases	in rare cases	-	Practice published in the Gmail help (Google Inc., 2012): Google may provide access to the Gmail content (not the account) «in rare cases» to an «authorized representative of the deceased user». Dependents have to start a two stage process. In stage 1 the authorized representative has to furnish a notarized death certificate in English, proof of identity and a copy of an e-mail conversation with the deceased to Google Support (Mountain View, CA). Stage 2 may require an order from a U.S. court and/or submitting additional materials.
Flickr (Yahoo!)	-	+	+	(+) after 4 months	-	-	+	-	-	Yahoo! Terms of service (Yahoo!, 2008 : « Accounts are non-transferable and any rights to Yahoo! ID or contents terminate upon the users death ». Free and expired Pro accounts may be deleted after 4 months of inactivity based on the Yahoo! Terms of Service. However Flickr states in their support forum that they currently do not delete inactive accounts. Dependents can request the removal of a Flickr account (+death certificate).
Twitter	+	+	-	+ after 6 months	-	+	+	-	-	Practice published in the Twitter help center (Twitter, n.d.): An authorized dependent or representative may request the deactivation of the Twitter account (+death certificate, obituary, various documents proofing identity and authorization). Deactivated accounts are deleted after 30 days.
PayPal	+	-	-	+ after 3 years	-	+	-	Funds are payed out	-	No published practice: The dependent or executor may report the death of a user to the PayPal customer service (+notarized proofs of death and authorizaton). If approved, the account will be closed. If there are funds in the PayPal account, a cheque will be issued in the account holder's name.

Figure 2. Practices of platform providers to handle the case of a deceased account holder

The majority of online platform providers, however, do not seem to see any need for addressing the issue by publishing relevant regulations. Member mortality rates or the proportion of "dead" profiles are not analyzed, and only a few providers actually delete inactive accounts. One explanation for this is the declining cost of storage. At the same time, the general legal requirements do not really provide a stable basis for formulating uniform, legally enforceable provisions for the death of a user. Just how shaky the ground underneath the regulations of platform providers can be when there is a conflict, is illustrated by the case of Justin Ellsworth, a US soldier killed in action in Iraq. Ellsworth's parents went to court to successfully fight for access to their son's Yahoo! e-mail account after Yahoo! refused their request, citing their terms of service and the deceased's right to privacy (BBC Online, 2005).

Thus, platform providers need to deal with the conflicting requirements of data protection provisions, dependents, and the personal rights of the deceased users. It is obvious that in times when platform providers are watched closely and have to continually update their terms of use and their data use policies for living users, such problems are not a top priority. Figure 2 provides an overview of practices currently in use by major international and European Internet platform providers. These practices cover a wide spectrum of applications and clearly show how different such practices can be and what a high level of Internet competence and persistence they sometimes require on the part of the user.

5. EXISTING SOLUTIONS FOR DEALING WITH DIGITAL ESTATES

There are already ways and means of dealing with the digital estate of a deceased Internet user (Table 1). Whether these measures are legally enforceable in cases of conflict (inheritance disputes, conflicts with platform providers, or conflicts of the law) and what obstacles must be overcome for the disposition of a legal estate to be legally binding, depends on the respective legal framework and is subject to legal analysis of the applicable law and jurisdiction.

Table 1. Options for digital estate planning and the execution of a will

Digital Estate Planning Options	Purpose and Benefits	Drawbacks
Digital estate planning services (e.g. SecureSafe, LegacyLocker)	☊ Transparency and access: Enables user to store information on existing Internet accounts including access data and instructions in the event of his/her death. ☊ Governance by depositing access data, i.e. less need to depend on platform provider. ☊ Privacy : If the digital estate planning service acts as executor of the user's will, data may be deleted without being passed on to dependents. ☊ Expertise of the service in the areas of estate planning, execution of wills, and practices of platform providers.	☋ The digital estate planning service may no longer exist at the time of user's death. ☋ Accumulation of access data may constitute a security risk ☋ A person appointed as the executor of the user's will needs to be instructed. ☋ Access information may become outdated or obsolete. ☋ The dispositions and instructions regarding beneficiaries may not meet the formal requirements of a legal will (e.g., holographic will or public certification).
Disposing of the digital estate in a conventional will and appointing an executor	☊ Increases the probability of the will being executed. ☊ Formal requirements are met. ☊ Recommended, in particular in the case of content which is protected by copyright and thus of some relevance in terms of succession law. ☊ May increase the enforceability of instructions	☋ Data covered by personal rights, which end with a person's death, may be of no relevance in terms of succession law ☋ Deposited access data can become outdated or obsolete. ☋ Media-friendly wills in electronic format are generally not yet legally recognized.

Digital Estate Planning Options	Purpose and Benefits	Drawbacks
Leaving access data and instructions with a person of trust	⊕ Simple ⊕ Relevant for users making provisions in situations involving a severe illness or the anticipated loss of mental capacity.	⊖ Beneficiaries have access to the user's data while he/she is still alive. ⊖ Access data can become outdated or obsolete.
Password safes (local software, browser, USB or on the Internet)	⊕ Access data remain up to date if the user is consistent in maintaining them in a password safe while he/she is alive.	⊖ Does not address the problem of succession. Dependents must be given access to password safe/master password. ⊖ Accumulation of access data may constitute a security risk ⊖ Documents or instructions can usually not be left in an ordinary password safe.
Digital legacy services (e.g., 1000memories, VirtualEternity)	⊕ Helps to preserve important memorabilia (e.g. photos, music, texts) by allowing the user to specifically select them while he/she is still alive and thus make them accessible to his/her dependents.	⊖ Only relevant for a small portion of a user's digital estate. Does not address the problem of succession of/access to the major portion of the digital estate.
Farewell message/e-mail/tweet services	⊕ Allows the user to leave a farewell message which is mailed out after his/her death.	⊖ Does not address the problem of succession/access.
Archives/downloading Internet data (e.g., SocialSafe, dataliberation.org)	⊕ Local backup or synchronization of Internet data (profiles, e-mails, contacts) ⊕ May allow dependents to access the data through the user's end device	⊖ Data quickly become outdated or obsolete if they are not synchronized periodically. ⊖ Does not address the problem of access to or removal of Internet accounts

5.1 Digital Estate Planning Services

A digital estate planning service ensures that a digital estate is transparent and accessible. By storing the following information deposited by the user while still alive, it supports the user's digital estate planning concept:

1. Access details (username and, usually, a password) for Internet accounts (Facebook, Gmail, etc.) as well as other password-protected online data;
2. Instructions or wishes indicating what is to happen to a specific account/profile/set of data in the event of the user's death;
3. Names of persons of trust who will notify the service of the user's death, be sent the access details, and carry out the wishes deposited by the user.

These basic sets of functions are shared by most existing digital estate planning services. However, there are variations in how they are implemented by the providers. These fall into one of the following categories:

a. Type of data or information deposited:

Usually, the name and the URL as well as the user name and password of an account are encrypted and deposited. Certain services only allow users to deposit the user name or the e-mail address linked to the account in question. If a complete set of login data can be deposited, access for the beneficiaries in the event of a user's death is a straightforward matter, provided passwords are continuously kept up to date. However, the service's safeguards must be examined critically, since the storage of all passwords in one place presents a serious security risk.

In addition to the depositing of access details, some services (such as Swiss provider SecureSafe) also enable users to deposit data files. The focus is on providing a service for everyday use as a secure online storage facility for the safe exchange of critical documents, e.g., with banks and the authorities. A user can also nominate beneficiaries who will receive files and passwords in the event of an emergency or death. In this specific business model, data inheritance is not the value proposition of the service but an added benefit.

b. Responsibility for the execution of the will

In the case of Dutch provider Ziggur.me, the "keep private" function enables customers to keep the existence of certain accounts from dependents in order to protect their privacy. If a customer wants to ensure

that such an account is deleted, the provider acts as the "digital executor" of his or her will. Providers like Legacy Locker or SecureSafe expressly state that they do not act as executors; the safety mechanisms on which their services are based prevent any access to the deposited access data. In such a case, the executors are the persons of trust whose names have been deposited and who must be advised of their role while the user is still alive. Beneficiaries do not have to be next of kin or friends. Other people entrusted with an estate, such as an attorney, can also be nominated and instructed to handle the digital execution of a will.

c. Procedure following a user's death

In the event of a user's death, the estate service has to be informed, following which it will grant the nominated beneficiaries access to the deposited access details and instructions to execute the will of the deceased. The currently available services use one of three forms of initiating the digital inheritance:

1. The person of trust reports the death to the digital estate planning service, e.g. by **submitting a death certificate** or another official document. Some digital estate planning services, e.g., Legacy Locker, require two persons of trust to confirm the user's death independently.
2. The digital estate planning estate service has an **arrangement with an authority or a public registry**, which registers the existence of a digital estate plan and will notify the service when a customer dies. Swedish provider My Web Will, which is no longer active, had such a cooperation agreement with the Swedish citizens register.
3. A trusted person receives an **activation code** from the customer of the service (e.g., SecureSafe), as well as instructions on how to proceed in the event of his or her death. When the user dies, that person will log on to the service's website, enter the code and thus set the wheels in motion.

Usability and **security** are key criteria for a digital estate planning service. The basic requirement, however, of such a service should be that it will still exist at the time of the customer's death. If I entrust my digital estate planning to a startup company which folds after only a few years, my data will be destroyed or transferred to another company, at best. A service may also suddenly go offline and be no longer reachable. In such a case, the whereabouts of the data are uncertain, and the monthly, annual, or even lifelong fees will have been for nothing. The sustainability of the business model and the size of the company may be indicators of a service's **reliability and chances of survival**.

"The Digital Beyond" portal provides a list, not intended to be exhaustive, of digital estate planning services, last e-mail services, and online memorial sites, that operate internationally in this relatively new business segment (The Digital Beyond, 2012). The 16 listed services which offer digital estate planning were mostly set up between 2008 and 2010. In 2011, only two new providers were added. Three of the providers listed have already discontinued their service, were acquired by another company, or are offline pending re-release. It appears that the first wave of startups is over and a certain disenchantment and consolidation has set in. If a digital estate planning service is not part of a larger range of services, which **adds value while the users are still alive**, or if there is no backing from an investor or a parent company, survival, especially in Europe and in domestic markets, seems to still be difficult.

6. CONCLUSION: AN INTEGRATED PERSPECTIVE ON DIGITAL ESTATE PLANNING AND PROTECTION

The analyses of the existing options and legal requirements show that digital estate planning and will execution alone do not constitute a satisfactory solution. A more comprehensive perspective is required which needs to incorporate all aspects of a digital estate and provides effective solutions that are sustainable in the long term (Figure 3).

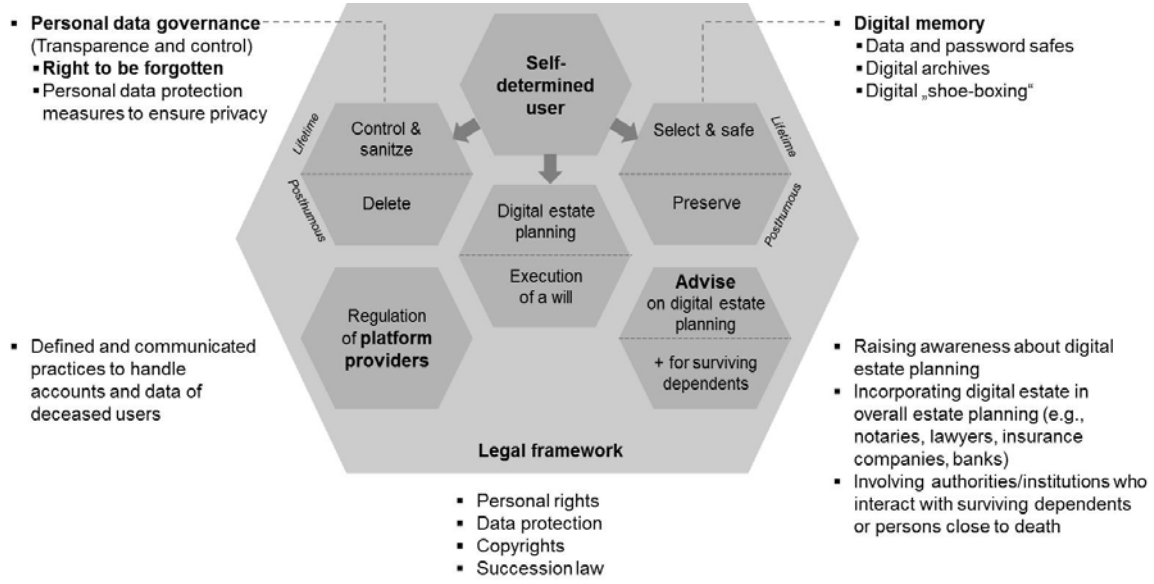

Figure 3. Extended solution space for the digital estate

- **Personal data governance**

Loss of control over personal data already begins while we are still alive. Effective, practical solutions must therefore be implemented in the course of our "digital daily lives" to help us organize and control our personal data. Self-determined users make use of practical measures (such as browser settings based on P3P) to protect personal data and to avoid leaving a data trail on the Internet.

- **Digital legacy**

In view of the mountains of data that are accumulated in the course of a lifetime, there is an increasing need for bookmarking important content or for keeping it in a special place. In addition to Internet safes for important documents and passwords, there are specialized digital legacy services that help document key events in a person's life (e.g., 1000memories, VirtualEternity). Other solutions include download or synchronization options offered by platforms or specialized providers (e.g., SocialSafe). These enable users to backup Internet data or social media profiles.

- **The "Right to Be Forgotten"**

The need to select, secure, and preserve data as "digital memories" beyond death may conflict with the demand for the "Right to Be Forgotten on the Internet". Practical solutions to implement the "Right to Be Forgotten" in our daily Internet usage, such as expiration dates for Internet data (Mayer-Schönberger, 2011) or digital erasers like X-pire are still far from being commonly known or used. The lifespan and the protection of Internet data are not primarily technological issues. Technologies can however be a useful means of improving the enforceability of the "Right to Be Forgotten" on the Internet, provided they are practical in their implementation. This corresponds to the principle of "privacy by design" (Cavoukian,, 2009), which is also postulated in the strategy paper "A Digital Agenda for Europe" (European Commission, 2010). It calls for the right to personal data protection and privacy to be embedded in the whole lifecycle of information technologies and information, from their creation to their elimination. Such a concept not only requires commitment and initiative on the part of Internet users and technology providers but also the examination and, if necessary, revision of legal provisions.

- **Responsibilities of platform providers**

Even if the self-determination and individual responsibility of Internet users is at the heart of any workable solution, platform providers must still be held accountable to some degree. Guidelines on how to proceed in the event of the death of a subscriber must be put in place and communicated to users. At this stage, there is little motivation for platform providers to address this issue. Moreover, the existing legal framework does not really provide a sound foundation for uniform, binding regulations.

- **Raising awareness and offering support**

Since digital estate planning is still in its infancy and the relevant regulations put in place by platform providers are diverse and often insufficient, there is a great need for advisory services, to provide information

on digital estate planning and to advise the surviving dependents after a death has occurred. Help can take the form of explanations/information provided by public authorities or private service providers (e.g., data protection authorities, insurance consultants, attorneys, notaries, etc.). It can also include assistance to the surviving dependents in identifying and handling a digital estate (as offered by German service provider Semno, which identifies digital estates by analyzing the personal computing devices of deceased persons.

- **Legal framework**

The question of how to treat a person's digital data after his or her death has various legal ramifications. For one, the problem must be examined from the perspective of succession law: Can data be inherited? Can data be disposed of in a will? Next, we need to consider an individual's personal rights: How can the rights of a person be protected beyond his or her death. What options do the next of kin have? Some protection is provided by personal data protection regulations. However, the question remains whether there should be rules that determine how the data of the deceased must be dealt with and if the "Right to Be Forgotten" on the Internet can be enforced.

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APPLYING A KDD PROCESS IN AN ORAL PUBLIC HEALTH UNIT AT RIO GRANDE DO SUL, BRAZIL

Luciano Costa Blomberg[1], Rodrigo Coelho Barros[2], José Antônio Poli de Figueiredo[3] and Duncan Dubugras Alcoba Ruiz[1]

[1]*Graduate Program in Computer Science – Pontifical Catholic University of Rio Grande do Sul (PUCRS) Porto Alegre/RS - Brazil*

[2]*Graduate Program in Computer Science and Computational Mathematics - Institute of Mathematics and Computer Science - University of São Paulo (USP), São Carlos/SP - Brazil*

[3]*Graduate Program in Dentistry, Pontifical Catholic University of Rio Grande do Sul (PUCRS) Porto Alegre/RS - Brazil*

ABSTRACT

This study aims at conducting and documenting a complete Knowledge Discovery in Databases (KDD) process for inducing predictive models in order to investigate new hypotheses about the causes of dental diseases such as periodontal and dental caries. We analyze data concerning the dental records of 598 low-income patients, treated by the Brazilian Unified Health System (UHS) in a collaboration work with Pontifical Catholic University of Rio Grande do Sul (PUCRS). Predictive models induced suggest there is a genetic origin in the incidence of new cases of periodontal disease, as well as a possible influence of hypertension and high-cholesterol diseases in the incidence of new caries cases.

KEYWORDS

Databases; data mining; data warehousing; Knowledge Discovery in Databases; dental diseases.

1. INTRODUCTION

Despite the significant improvement of the caries index in the Brazilian child population for the last two decades, dental caries still constitute a public health problem directly related to the patient's life conditions. Tooth decay is the most common chronic childhood disease, five times more common than asthma and seven times more common than hay fever (Montenegro, 2008). According to the Brazilian epidemiological study of 2003 on oral health (Brazilian Ministry of Health, 2006), periodontal diseases was highly incident in all age groups, given that less than 22% of the adult population and less than 8% of elderly patients presented healthy gums.

Considering the incidence of malocclusion in the population, the prevalence data at age 5 revealed moderate or severe occlusal problems in 14.5% of the population, ranging from a minimum of 5.6% in the north region to a maximum of 19.4% in the south region. Furthermore, there was also an increase in mortality caused by mouth cancer in the years 1979 to 1998, from 1.32 to 1.82 per 100,000 citizens, a fact mainly observed in males (Brazilian Ministry of Health, 2002). Given the severity of the epidemiological scenario, it is extremely important that researchers and public administrators adopt new methods for investigating the factors that cause these diseases, in order to plan suitable policies aimed at improving public oral health.

This work applies and documents a complete KDD process in the oral health area, exploring its benefits in the generation of predictive models related to oral diseases. Related work usually perform a straightforward performance comparison of data mining techniques applied to oral health, neglecting important steps of the KDD process, such as the validation and interpretation of the discovered knowledge. Through the KDD process, we verified that the quality of the generated predictive model is directly related to the quality of the collected data, i.e., there is a strong influence of data quality on the performance of the predictive models.

Considering the importance of information and knowledge management as an instrument of diagnosis and planning, the goal of this study is to conduct and document a complete KDD process for inducing predictive

models that may help to identify new hypotheses on the causes of dental diseases such as periodontal and dental caries. We intend to encourage the application of a complete KDD process, providing to researchers and managers a comprehensive view of steps typically not discussed in the literature, but which are fundamental to the analysis of the obtained results.

2. KDD OVERVIEW

The rapid advance in data collection and storage technologies has allowed organizations to accumulate large amounts of data over the past decades. However, human beings cannot naturally analyze a large amount of data, resulting in the need of techniques that can automatically analyze data in an intelligent way (Tan, 2006). With that in mind, the KDD process has emerged as a great approach to identify valid, new, potentially useful and understandable patterns in data (Fayyad, 1996).

2.1 Steps of the KDD Process

According to (Fayyad, 1996), the KDD process comprises five steps, but we can summarize them in three major steps: pre-processing and data cleaning, data mining, and interpretation/evaluation data.

i) Pre-processing and data cleaning: consists of performing operations such as exclusion of outliers, handling missing and unknown data. Many authors consider it to be the most time-consuming step in the KDD process;

ii) Data mining: step in which the actual search for patterns of interest in a particular form of representation is performed.

iii) Interpretation/Evaluation: includes interpreting the discovered patterns and possibly returning to any of the previous steps, as well as possible visualization of the extracted patterns, removing redundant or irrelevant patterns, and translating the useful ones into terms understandable by users.

As earlier described, data mining is an important step in the KDD process, traditionally applied in the search for useful information in large data repositories. According to (Tan, 2006), we can divide it into two broad types of tasks: descriptive and predictive tasks. Descriptive tasks are derived patterns that summarize the underlying relationships in the data. Some well known descriptive strategies are association analysis, cluster analysis and anomalies detection. Predictive tasks predict the value to a particular attribute based on the values of other attributes. The attribute to be predicted is commonly known as the dependent variable or target, while the attributes used to forecast are known as independent variables. According to (Tan, 2006), predictive tasks can be used to assign objects into pre-defined categories. This kind of algorithm uses the induction principle to learn classification models from a set of records with known class variable (training set), and apply them to the deduction of other records, where the variable class is unknown (test set). Among the several classification techniques, decision-tree induction is widely employed in several application domains. A decision tree is comprised of a hierarchy of nodes connected by branches. Each internal node (or non-terminal) denotes a logical test on an attribute (independent variable), in which branches represent the test outcome, and each leaf node stores a label for the class (the dependent variable).

3. RELATED WORK

For the past two decades, a number of studies have been performed in order to identify the dental profile of citizens. In a broader scenario, epidemiological surveys conducted by the Brazilian Ministry of Health in 1986, 1996 and 2003 have served as information source to new researches in the area, whose aim are to explore the association between dental diseases and oral health data (eg: anamnesis and dental charts). Among the most relevant researches in state of art, we have highlighted the application of well-known statistical and machine learning-based algorithms for the study of oral diseases, as for example, caries (Stewart, 1991), (Baldani, 1996), (Powell, 1998), (Zhang, 2006), (Montenegro, 2008), (Tamaki, 2009) (Ito,

2011) and oral cancer (Majumder, 2005), (Shuang, 2011), (Sharma, 2011). Additionally, the performance comparison of traditional machine learning methods also has been common in these studies, such as decision trees, neural networks, support vector machine and k-nearest neighbor (Oliveira, 2005), (Montenegro, 2008) and (Sharma, 2011).

However, few papers in oral health literature have documented the whole steps and benefits of the "mother process" named KDD. Regarding this issue, the closest studies have been done by (Gansky, 2003) and (Lin, 2009). In (Gansky 2003), data of 466 children up to twenty-four months of age were analyzed in order to predict the caries risk. Logistic regression, classification and regression trees, and neural networks were used and compared. Although fundamental KDD concepts have been introduced, this is still a work eminently oriented to performance's comparison of machine learning methods. (Lin, 2009), on the other hand, applied a complete KDD process in order to help the third-party payer to prevent fraudulent claims and overcharges against insurance programmes. For that, SOM neural network unsupervised clustering approach was used in conjunction with domain experts, although more details about the preprocessing were desirable.

In this paper, we seek to document a complete KDD process, investigating the use of predictive models for analysis of oral diseases. By surveying similar works that attempt to use dental diseases data for performing knowledge discovery, we concluded that:

a) Typical statistical approaches that exploit the predictive analysis of dental diseases are particularly limited, since they are focused in the validation of pre-defined hypotheses (instead of allowing the discovery of new hypotheses), and do not offer a simple, intuitive and easy-to-interpret predictive model;
b) Approaches related to this study are excessively oriented to the strict comparison of data mining techniques. They tend to ignore important steps in the process of knowledge discovery, especially the evaluation and interpretation of the models that are generated.

This study differs from others since it promotes a deeper discussion regarding the KDD process in oral health, thus providing to domain specialists a broader view of its important role in quality control of collected data, and also allowing the validation of new hypotheses concerning the incidence of oral pathologies.

4. APPLYING A KDD PROCESS IN AN ORAL PUBLIC HEALTH UNIT

The School of Dentistry at PUCRS has over 50 years of experience in teaching, developing research and supporting social in Porto Alegre, Brazil. Together with the Undergraduate Program, the Graduate Programs with areas of concentration in Surgery and Buccomaxillofacial Traumatology, Restorative Dentistry, Endodontics, Clinical Stomatology, Dental Materials, Orthodontics and Facial Orthopedics, and Dental Prosthesis have all combined efforts to developing Dentistry in Brazil. With this broad area of activity, a large quantity of clinical data, laboratory exams, image exams (radiography, tomography and echography) and auxiliary charts are created daily, making the manual analysis of the collected data an extremely exhausting process (Blomberg, 2009).

In order to improve and automate the information and knowledge management in oral health area, the School of Dentristy at PUCRS developed in partnership with the Graduate Program in Computer Science – PUCRS an environment for storage, organization and retrieval of data from dental records.

Due to the diversity of areas involved in the partnership and the short period of time to collect data, we selected a single area (Social Dental Care – Vila Fátima CEU) as the unit of study, given its social relevance. This choice is justified as the Vila Fátima CEU develops a social assistance service and dental care through the Brazilian UHS (Unified Health System) to a low-income population, with more than 8000 inhabitants located in the East of Porto Alegre, Brazil.

The solution developed in this study aims to completely document the laborious KDD process, providing to oral health managers a systematic approach to support decision-making and formulation of new hypotheses on the influence of socieconomics and pathological factors in oral diseases. In Figure 1, we present the KDD process proposed for this work, dividing it into three major steps: i) Step A - Data Collection, ii) Step B – Analytical data pre-processing, and iii) Step C – Dental Data Mining and Evaluating Models.

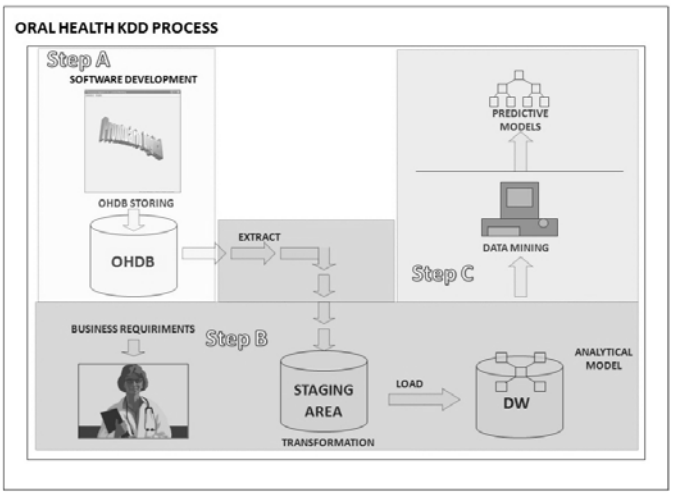

Figure 1. Oral health KDD Process

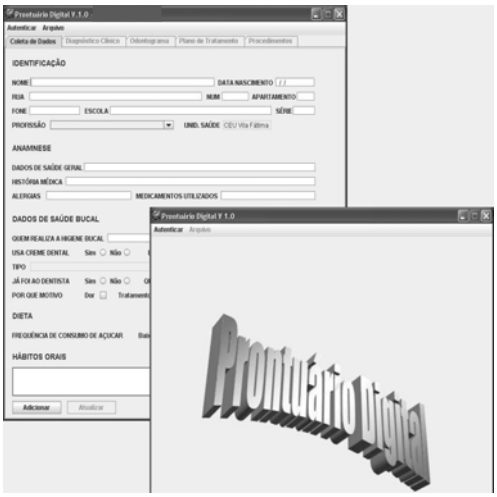

Figure 2. Instrument to data insertion in the OHDB

4.1 Step A – Data Collection

We developed an application in JSE (Java Standard Edition) client/server (see Figure 2) to collect and store the data into the Oral Health Database (OHDB), which is the operational database established in (Blomberg, 2009).

After developing the data collection application, we performed a survey of family files collected at Vila Fátima CEU, in which we identified 675 family files, arranged sequentially by order of creation. We planned a protocol for collecting dental records from the files so we started the data insertion activity through the developed application. In 2009, we had the collaboration of five dentistry students to the data collection step, ending with a population of 642 dental records collected, as shown in Table 1.

Table 1. Results of Data Collection Step

Total amount of family files: 675 Totals:				
Patients	Dental Records	Dental charts	Dental Visits	Dental Procedures
598	642	235	2031	3103

With the conclusion of the data collection step, we observed some peculiarities regarding the poor quality of data recorded in the dental records. Particularly, the number of missing fields of information was quite high, as presented in Table 2.

Table 2. Fields with Missing Data

	Anamnesis		Dental Chart	
Total data	642	100%	642	100%
Complete data	343	53.4%	235	36.6%
Missing data	299	46.6%	407	63.4%

Similarly, we found that the absence of information not only limited the understanding of the patient's dental history (performed through the matching of oral epidemiological factors captured in the anamnesis and oral health fields), but also affected the analysis of dental diseases.

4.2 Step B – Analytical Data Pre-processing

We performed the second step (B) on the data population previously detailed. As an alternative to the (Fayyad, 1996) original process, we chose to build a data warehouse to perform analytical activities. In this kind of environment (see (Han, 2001)), the data is stored in a large historical repository (called Data

Warehouse, DW) and organized under the so-called multidimensional data model. Multidimensional modeling can be understood as a technique for analytical model conception, where typically the data are summarized and presented from different points of observation (dimension tables). Moreover, these observation points are measured by numerical quantities related to facts (fact tables) that we want to investigate.

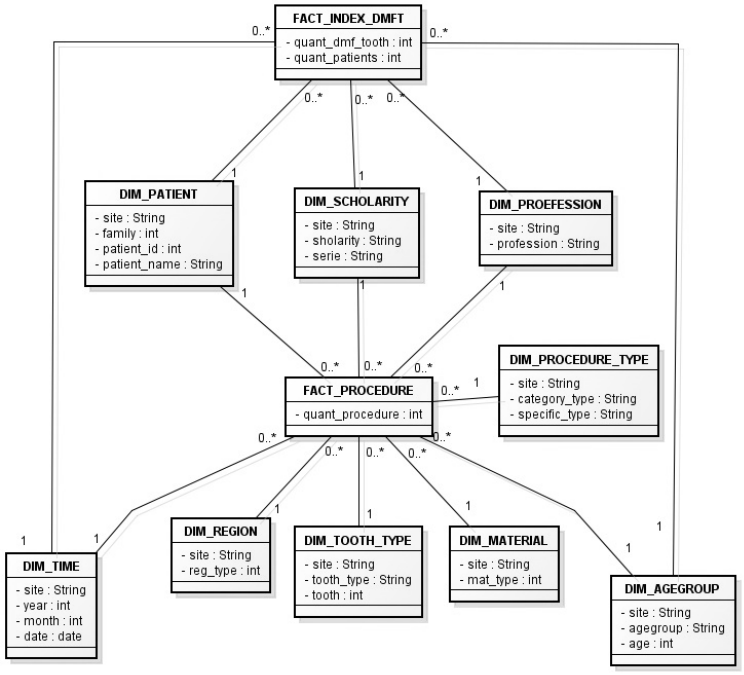

Figure 3. Oral Health Analytical Model

In Figure 3, we illustrate the analytical model we generated in this work. It is composed of nine dimension tables with socioeconomic and oral health data (dim_patient, dim_scholarity, dim_profession, dim_procedure_type, dim_time, dim_region, dim_tooth_type, dim_material, dim_agegroup), and two fact tables (fact_index_dmft and fact_procedure) for generating the amount of caries and enabling dental procedure analysis, such as restorative, endodontic, surgery and periodontal treatments.

In this change of the KDD process proposed by (Han, 2001), the analytical models within the DW are used to identify new opportunities for data mining, as well as to increase the potential for discovery of patterns of knowledge, through the multiple combinations of dimensions in varying levels of granularity. Through the implementation of this analytical model, the process of building the DW also involves the implementation of other operations such as data cleaning, integration and implementation of ETL steps (extraction, transformation and loading) within the DW. These operations (particularly data cleaning, data integration and data transformation) can be understood as the first pre-processing step of the original KDD process proposed by (Fayyad, 1996).

Motivated by the potentials benefits to identify new opportunities for data mining, we include a DW in the KDD process, using the Oracle SQL Developer tool to extract a dataset containing data from 19 tables of the transaction OHDB, as described in Table 3.

Table 3. Transactional OHDB extracted data.

Tables	Information
Patient, Profession_Data, Profession_Type, Scholarity	Socioeconomic
Dental_Record	Dental History
Oral_Health_Data, Oral_Habits, Diet	Anamnesis
Diagnostic	Periodontal Disease Incidence
Dental_Visit	Dental Visits
Dental_Chart	Caries Disease Incidence
Procedure_Data	Dental Procedures
Procedure_Categ	Dental Procedures Categorical Types
Procedure_Specif	Dental Procedures Specific Types
Material	Medications and Restorative Materials

After the extraction step, the data were transferred to a staging area to perform cleaning (missing values treatment, typing errors correction and standardization of nomenclature) and transformation (summarization and aggregation of data). These pre-processing steps are laborious though essential to achieving solid results in data mining. Once extracted and transformed, we loaded the data stored in the staging area to the DW. For this purpose, we used the SQL Developer tool to import data, yielding a total of 6 tables (fact_index_dmft, dim_patient, dim_ scholarity, dim_ profession, dim_time and dim_agegroup).

4.3 Step C – Dental Data Mining and Evaluating Models

In the last step of our KDD process, we selected data from 6 tables loaded from the DW and started to generate the predictive models related to the incidence of dental caries. We also selected and pre-processed data from 4 transactional tables in order to generate predictive models related to periodontal diseases. Table 4 depicts the complete dataset for the data mining step.

Table 4. Dataset for the Data Mining Step

Table	Model	Information
fact_index_dmft	analytical	caries disease incidence
dim_patient, dim_ scholarity, dim_ profession, dim_time, dim_agegroup	analytical	socioeconomic
oral_health_data, oral_habits, diet	transactional	anamnesis
diagnostic	transactional	periodontal disease Incidence

Based on these models, the aim of this study was to identify new hypotheses on the influence of socioeconomic factors and related diseases in the incidence of caries and periodontal diseases. These new hypotheses could be used by managers in oral health so they are able to plan preventive actions directed to specific risk groups.

We used the selected data in CSV format (comma-separated values) and applied the C4.5 algorithm (Quinlan, 1992) (java version implemented in the Weka) data mining tool for inducing predictive models in the form of decision trees. Among the reasons for choosing a decision-tree induction algorithm, we highlight the fact that decision trees offer a graphical representation that resembles the human reasoning, so it makes it easier for the domain specialist to interpret the results and make decisions accordingly (Freitas, 2010) and (Barros, 2012).

We performed 10-fold cross-validation for evaluating the effectiveness of this approach. Also, we had the support of the domain expert to verify the usefulness of the hypotheses generated by the data mining algorithm.

In Figure 4, we illustrate a predictive model for classifying patients according to the incidence of caries, where Y (leaf node presented as a rectangle) means the positive cases and N negatives cases.

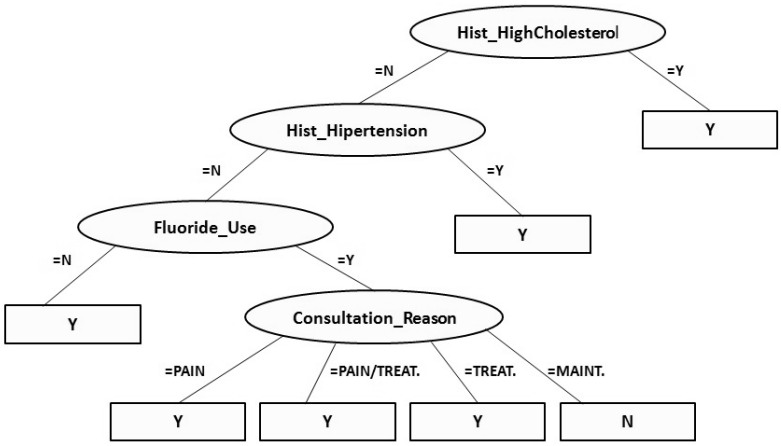

Figure 4. Predictive Model of Carie Incidence

This model could correctly identify the positive cases with an accuracy of 91.95%, even though it presented limitations on the prediction of negative cases. The predictive model suggests that high-cholesterol (Hist_HighCholesterol = Y) and hypertension (Hist_Hipertension = Y) diseases are related to incidence of caries, which is in fact could be a consequence of the type of food involved (excess of salt and sugar).

Similarly, the model suggests that caries are usually verified in dental visits that occurred due to pain or treatment, being less common in maintenance dental visits.

We generated a second predictive model that provides information on periodontal disease incidence, where Y (leaf node) means positives cases and N negatives cases. By analyzing the model illustrated in Figure 5, there seems to be a strong influence of genetic factors, for instance "Periodont_Family" node, in the incidence of new positives cases. Still according to the model, other situations of periodontal disease cases are related to advanced age (over 42 years) or for those patients between 11 and 42 years old with bad brushing habits (Brushes_More1x = N) and high sugar consumption (Sugar_Intake + 4x).

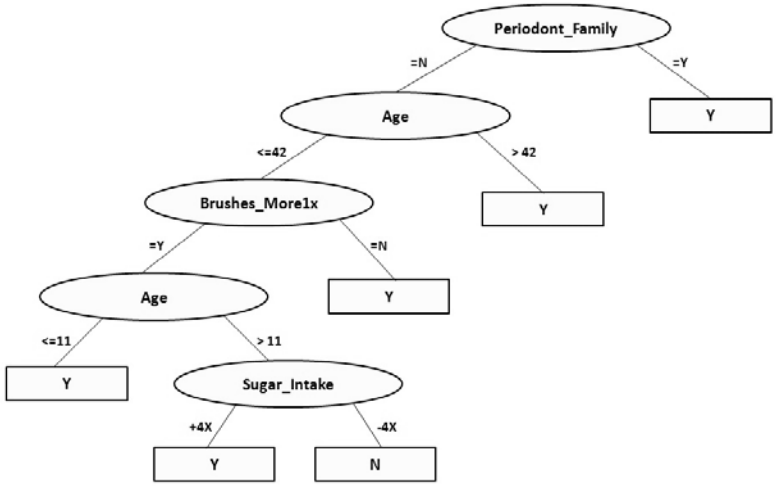

Figure 5. Predictive Model of Periodontal Disease

As we have seen along this paper, data mining should not be viewed as an isolated procedure, but as a step within the process of knowledge discovery. Results of the data mining step are directly influenced by previously-performed steps, such as data preprocessing, which receives as input raw data and provide as output structured data, suitable for being processed by a mining algorithm.

A typical example of this influence can be seen in Figure 6, which illustrates a prediction model induced from data that did not undergo pre-processing steps. In this model, we observed some unexpected distortions

in the relationship between oral health habits, such as the floss use, sweets intake, and fluoride use, to the dental caries indicator (considering "Very low", "Very High" and "Moderate" as levels of severity).

Among the distortions mentioned, observe the classification of "Moderate" for patients that did not consume sweets but used fluoride, whereas those that did not consume sweets but did not use fluoride were classified as "Very Low". This may be seen as a contradiction, since it is common sense to expect the rankings to be reversed. We believe that such distortions have been caused by factors related to data quality (i.e., missing fields) and hence the importance of performing pre-processing steps prior to data mining.

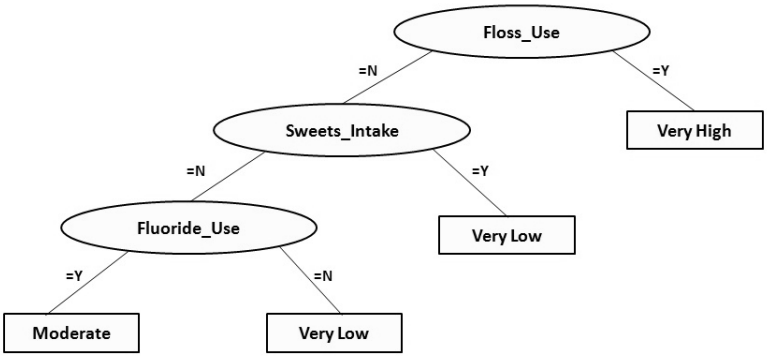

Figure 6. Model induced from Data That Did Not Undergo Pre-Processing Steps

5. CONCLUSION

The main contribution of this study is focused in the developed and documentation of a full KDD process, providing the following advantages:

a) Solution robustness: Through the construction of a data warehouse environment, we add robustness to the solution. The DW enables the analysis of large volumes of data, which is a fundamental requirement for public data management scenarios. Conversely, a DW environment may not be acceptable for analysis of small volumes of data, since it demands a considerable effort to be implemented.

b) Comprehensibility of models: Although the poor quality of data directly influenced the quality of the generated models, we believe that the KDD process we have developed is able to generate models easily understandable by health managers, enabling the generation of new hypotheses and providing a better basis for decision-making. A future solution to the data quality problem would be the adoption of computer systems for recording information of the dental records, instead of manual writing. Thus, we could delegate to the computer system tasks such as information consistency-check, significantly increasing the quality of the data and of the models that are generated.

c) Unconventional data processing: Among the typical characteristics of this type of scenario in healthcare, we highlight the importance of adopting techniques for the treatment of unconventional data such as textual descriptions and temporal data. For the treatment of temporal data, we modeled dimensions that allowed us to observe the factors related to different periods of time. However, for the extraction of predictive models for dental caries, we adopted a selection criterion based on the choice of the latest dental chart of each patient. For extracting the data used for inducing the predictive models, we adopted preparation practices based in the stemming technique. However, we understand that new software based on natural language processing can increase the quality of the processing of unstructured text.

As future work we intend to continue the study at the Vila Fátima CEU by exploring new areas of work with the Faculty of Dentistry, such as the recognition of new patterns from the analysis of medical images.

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EFFECT OF MONITORING TECHNIQUES ON JOB ATTITUDES, CONTROL, INTENTIONS AND BEHAVIORS AT WORK

Debora Jeske[1] and Alecia M. Santuzzi[2]
[1]*Jacobs University Bremen, Campus Ring 1, 28759 Bremen, Germany*
[2]*Northern Illinois University, Department of Psychology, DeKalb, IL 60115, United States of America*

ABSTRACT

This study examines several monitoring characteristics associated with electronic performance monitoring (EPM) as important determinants of attitudes, perceived control, intentions and behaviors related to organizational citizenship behavior (OCB), turnover, and use of performance feedback. Past research has rarely examined several EPM characteristics and employee variables at the same time with the same sample, despite the fact that many organizations will use several monitoring techniques at the same time. This study surveyed predominantly part-time workers in different monitored work settings. Using self-reports and Likert type scales, participants completed several measures on attitudes, control, intentions and behavior and responded to categorical questions about the different forms of monitoring in their workplace. The data were analyzed using means difference analyses, with attention given to several covariates. Results show that monitoring type, particularly phone recording, had a negative effect on work attitudes as well as turnover. In addition, chat response recording had similarly negative effects for OCB and use of performance feedback variables. The purpose of monitoring was another characteristic that resulted in different affective commitment, OCB variables and intended turnover scores. These findings suggest that the monitoring characteristics can influence attitudes, control, intentions and behavior in both positive and negative ways.

KEYWORDS

Electronic performance monitoring, perceived control, job satisfaction, organizational citizenship, turnover, performance feedback

1. INTRODUCTION

The pervasive nature of technology has fostered the increased reliance on electronic tools to aid the assessment of employee performance and productivity. Electronic performance monitoring (EPM) is a commonplace technology tool in the modern workplace that is used for such assessments. Nebeker and Tatum (1993) described it as the use of electronic instruments or devices to collect, store, analyze, and report individual (or group) actions or performance. EPM information often is used to draw inferences about how effective and productive individuals, teams, or larger departments perform their work (Stanton & Julian, 2002). The general purpose of EPM is similar to the purpose of traditional monitoring: ensuring a specific level of performance including work pace and accuracy. EPM systems can be used to monitor several employee actions via any type of technical device that can be monitored electronically, including simple cash registries to complex machinery. EPM also features a number of unique characteristics that are not common in traditional monitoring. For example, EPM can provide detailed, more permanent records and can quickly list the minutiae information captured by the system (Aiello & Kolb, 1995a).

With EPM, employers also have the flexibility to monitor their employees randomly, continuously (Chen & Ross, 2007; Wells, Moorman & Werner, 2007), intermittently, in an unobtrusive vs. intrusive manner, and with or without warning and employee consent (Stanton, 2000b). The general consensus is that performance increases with monitoring (Goomas & Ludwig, 2009). Here, the emphasis tends to be on performance that is objective and quantifiable as in a greater number of units produced (Goomas & Ludwig, 2009). For example, monitoring employees has been shown to increase productivity in the case of simple data entry tasks (Aiello & Kolb, 1995a), handling automated telephone calls, and customer requests (Westin, 1992). However, the

picture might be more intricate for complex and multifaceted tasks. Some studies using more complex tasks revealed that accuracy declined in the presence of EPM, negatively affecting performance proficiency (Galinsky, Schleifer, & Pan, 1995). The decreased performance on complex tasks might be a function of the limits EPM places on individuals' ability to structure their work activities according to their own preferences (Schleifer et al., 1995).

The present study explores the roles of specific EPM techniques on psychological responses to EPM. An introduction of such EPM characteristics and their direct influence as predictors on various employee variables is provided next.

2. EPM RESEARCH AND CHARACTERISTICS

Although numerous characteristics in EPM systems might vary across organizations and jobs, we should mention four EPM features inherent in many techniques. First, several techniques will affect employees' awareness of being monitored while working. Past research (Papini, 2008) has shown that the greater employees' awareness of EPM in the workplace, the more accepting they are in response to these methods being used. At the same time, knowing about monitoring can lower perceived control, thus potentially becoming a negative factor (Stanton & Barnes-Farrell, 1996). A second important characteristic of EPM is the extent to which the monitoring is continuous. For instance, workers who expect their computer activities to be monitored might feel less autonomy in how they manage their time throughout the day (Smith et al., 1981). This may decrease productivity, particularly for more difficult tasks requiring accuracy; the new constraints on how to complete tasks no longer allows employees to utilize their own work styles (Aiello & Kolb, 1995a). Continuous monitoring, if it does not allow for employee input or discretionary control, is likely to result in more negative attitudes on the job and towards the organization. The opposite effect may be obtained if employees are given a say into how they are being monitored. A third EPM characteristic refers to how monitoring data are being used. If employees believe that the EPM system is being used to help them develop their skills (Wells et al., 2007) rather than as a means for punitive measures, they are more accepting of the system, satisfied, and even committed.

As a result, we can also expect a number of effects of monitoring on different types of intentions and behaviors that are relevant to the workplace. We consider three sets of outcome of particular relevance, all of which were selected in response to a call for more EPM research on counterproductive and withdrawal behaviors (Stanton, 2000a). First, there are the intentions and actual organizational citizenship behaviors (OCBs). Different EPM conditions can increase perceived workplace isolation (Mulki et al., 2008) and limit social interaction (Amick & Smith, 1992). Researchers suggest that EPM influences OCBs (Stanton & Weiss, 2000), with more frequent monitoring reducing extra-role behaviors (Niehoff & Moorman, 1993). A second variable of interest relates to turnover. The effect of monitoring on task complexity (which results in tasks being broken up into measurable entities) are likely to reduce employee's perceptions of challenge, required skills, job completeness and meaningfulness (Smith et al., 1992). Chalykoff and Kochan (1989) reported that employees' satisfaction with monitoring was negatively associated with turnover likelihood. And turnover intentions are strongly linked to voluntary turnover behaviors (Chen, Hui, & Sego, 1998). And a third variable of interest pertains to the intended and actual use of performance feedback. Past research has shown that performance feedback can increase subsequent performance (Goomas & Ludwig, 2009). Research has further shown that how monitoring data are used influences whether employees accept being monitored (Stanton & Weiss, 2000). The specific characteristics of the EPM feedback can also be expected to influence how employees intend to and do act upon the performance information. Herold, Liden, and Leatherwood (1987) found that greater frequency of feedback is associated with greater perceived usefulness. The source of feedback and its specificity may play a role in predicting subsequent performance. According to Earley (1988), computer-based feedback and specific feedback had more influence on subsequent employee performance than supervisory feedback or general feedback. Although a full examination of the feedback features of EPM is beyond the scope of the study, practitioners would be well-served to systematically consider the feedback features if adopting an EPM system.

These findings led us to formulate a broad general research hypothesis: Work attitudes (affective commitment, job satisfaction), perceived control at work and intentions and actual behavior related to OCBs and the use performance feedback are higher in those groups when they experience monitoring conditions

that allow for task and situational autonomy, reduce constant surveillance, and monitoring with potential benefits for the employees. Workers who experience electronic monitoring that limits their individual task and situational autonomy, includes continuous surveillance, and has punitive effects will show higher intended and actual turnover-related behaviors.

3. INTRODUCTION TO THIS STUDY

3.1 Data Collection and Measures

The survey was part of a larger data collection effort in Fall 2010 to Spring 2011 and made available to a large student sample of 1155 student workers. Participants were students taking upper level classes at University. The students were invited to participate via email in an online two-part survey. Participation in the survey was voluntary, although registration for extra credit was available to participants towards the end of the survey. Having agreed to participate, participants were given pass code to enter the site, then prompted to create a code. This code was required to match data from the first survey with the second survey part as all data collected was anonymously.

The two surveys included various measures to assess job-related attitudes, control, and various intentions and behaviors. For job satisfaction (α=.85), we used the scale by Brayfield and Rothe (1951) and for affective commitment (α=.80) the scale by scale Meyer, Allen, and Smith (1993). All response options ranged from (1) "strongly disagree" to (5) "strongly agree." Perceived control was assessed using the six-item scale (α=.86) on work control produced by Tetrick and LaRocco (1987). The response scale ranged from (1) "not at all" to (5) "very often." We also used six measures to assess intentions and behaviors. The OCB intention (α=.71) and behavior (α=.83) is based on two subscales by Podsakoff et al. (1990), namely, altruism and conscientiousness. The turnover intention (α=.81) and behavior (α=.68) measures were each based on three items proposed by Bozeman and Perrewé (2001). In addition, we wanted to examine intended (α=.89) and actual use of performance feedback (α=.75), for which we created our own measure. The response scale for these intention and behavioral measures ranged from (1) "strongly disagree" to (5) "strongly agree." To assess how participants were monitored, employees were given a choice to tick any of the following eight monitoring options: "Login/logoff times on computers are recorded. Location/mobility is monitored using electronic media (activation of electronic door keys; swiping of ID cards to gain access). My data entry speed is recorded. Use of passwords to gain access to servers/work folders. Telephone response times/call lengths are recorded. My AIM/online chat response times are recorded. Cameras observe employee at work station/registry/counter. Cameras observe employee upon arrival/departure of work site. Other: If you selected 'other' in the list of electronic media, please specify (open-ended item)." All responses were coded in dichotomous fashion.

3.2 Sample Characteristics

In total, 671 student workers participated in the first survey, with 611 participants completing the second survey. In order for participants to be included, they had to be working at both times of the surveys and had to work in an electronically monitored environment (defined by activity recorded on computers, cash registers, cameras, electronic doors/swipe cards and audio recording). In addition, their responses had to be matched at Time 1 and Time 2. The final sample (n=131) included 33 males and 98 female participants. 52.7% of the participants were between the age of 18-21 and 38.9% between 22-25 years old (maximum was 51 years). Average age was 22.23 (SD = 3.49). The majority of participants worked up to 20 hours per week (57.3%), another 29% worked up to 30 hours a week, and only 13.7% worked more than 30 hours per week. The majority had been working in their current job for up to a year (35.1%), with significant numbers having worked for the same organization for two years (22.9%), three years (17.6%), and four years (10.7%). Tenure ranged from 1 to 8 years with one individual having worked in their organization for 20 years. In terms of industry, the majority of the participants were employed in the retail sector (45.8%), hospitality (19.8%), medical and pharmaceutical (7.6%) and banking (6.9%). As a result, 69.5% indicated that their job was

customer-oriented, 12.2% administrative, 6.1% managerial, 3.1% technical, and 9.2% other (a combination of the other categories).

4. RESULTS

4.1 Monitoring Trends

Intensity of monitoring suggests that individuals in customer-oriented roles were monitored significantly more frequently by at least two to five different means. An overview shows how participants were monitored (Table 1).

Table 1. Percentage of Employees within Occupational Category Being Monitored Electronically

Monitoring	Technical	Administrative	Customer-oriented	Managerial	Other
Logging in and off at work	100.0%	68.8%	76.9%	75.0%	75.0%
Entry of data	--	31.2%	26.4%	12.5%	--
Location monitoring	--	13.9%	30.8%	12.5%	16.7%
Use of passwords	50.0%	68.8%	62.6%	75.0%	58.3%
Phone response	--	18.8%	12.1%	8.3%	--
Phone recording	--	6.2%	8.8%	8.3%	--
Chat response	--	25.0%	2.2%	--	8.3%
Cameras at work stations	100.0%	56.2%	85.7%	75.0%	75.0%
Arrival/departure cameras	75.0%	50.0%	57.1%	37.5%	50.0%

Generally, all participants were monitored using at least one type of monitoring, with a maximum of 8 monitoring techniques reported by participants. Most frequently monitored were employees at their various work stations (80.9% of all monitored employees), employee login/logoff times on computers (76.3%) as well as their password access (63.4%). They are also monitored upon arrival and departure at work (55%).

4.2 Group Differences Associated With Monitoring Techniques

Our hypothesis proposed that different techniques may be more invasive and influential on job attitudes, perceived control, and hence also influence intentions more than simply monitoring status alone. We examined this using analysis of variance, controlling for several covariates where appropriate (such as age, sex, tenure, average working hours per week, and occupational category). Please note that only significant results are listed. The results obtained for the work attitudes and perceived control suggest that phone recording was also associated with lower job satisfaction and affective commitment (Table 2). The results are similar for chat response recording. These statistics suggest that these three monitoring activities have a most consistent yet negative effect on attitudes, possibly because both constrain individuals in terms of how they do their work, since their responses are recorded.

Table 2. Significant Effects of Monitoring Type on Attitudes and Perceived Control

Variables	Monitoring employed		Answering options			
			Yes		No	
		ANOVA results	M	SD	M	SD
Job satisfaction	Phone recording	$F(1,129)=6.054$, $p=.015$	3.10	.73	3.97	1.10
Affective commitment	Phone recording	$F(1,129)=4.180$, $p=.043$	2.39	.64	2.94	.82
	Data entry speed	$F(1,129)=4.740$, $p=.031$	2.62	.86	2.98	.80
	Chat response recording	$F(1,129)=10.668$, $p=.001$	1.94	.55	2.95	.81
Perceived control	Data entry speed	$F(1,129)=9.136$, $p=.003$	2.68	1.04	3.25	.85
	Chat response recording	$F(1,129)=4.868$, $p=.029$	2.38	.90	3.16	.91

We also noted a number of (marginally) significant differences in relation to intentions and behaviors (Table 3). Again, the recording of activities at the desk and away from the desk (via phones, keyboards, and

cameras) seems to increase turnover behaviors while these also tend to reduce OCB intentions and behaviors. Participants seem to be more likely to use feedback if their data entry speed was not recorded. At the same time, they are more likely to use when feedback when they are recorded during chat.

Table 3. Summary of Significant Effects of Monitoring Technique on Intentions and Behaviors

Variables	Monitoring employed		Answering options			
			Yes		No	
		ANOVA results	M	SD	M	SD
OCB intention	Cameras at work stations	$F(1,129)=2.782$, $p=.098$	3.75	.74	4.03	.77
OCB behaviors	Chat response recording	$F(1,126)=5.117$, $p=.025$	3.33	.84	3.84	.74
Turnover intentions	Phone recording	$F(1,128)=6.190$, $p=.014$	4.43	.65	3.50	1.16
	Location monitoring	$F(1, 128)=2.923$, $p=.090$	3.86	1.09	3.46	1.16
Turnover behaviors	Phone recording	$F(1,129)=10.691$, $p=.001$	3.27	1.10	2.25	.95
	Location monitoring	$F(1,126)=9.871$, $p=.002$	2.74	.99	2.17	.95
PER intention	Data entry speed	$F(1,104)=2.614$, $p=.109$*	3.88	.91	4.26	.83
PER behaviors	Chat response recording	$F(1,96)=3.527$, $p=.063$	4.67	.67	3.95	.83

Note. PER stands for use of performance feedback. Total EPM n=131, lower participant numbers for PER variables.* This group difference was the only one that was significant at p<.10 when excluding covariates ($F(1,105)=3.586$, $p=.061$).

There trends are also displayed in Figure 1 to 3. The bar charts clearly delineate the differences between employees who were monitored electronically (EPM) and those who were not (TM) using the mean values (Table 2 and 3). The results in these figures were organized around the various monitoring techniques.



Figure 1. Group Differences Associated with Phone Recording

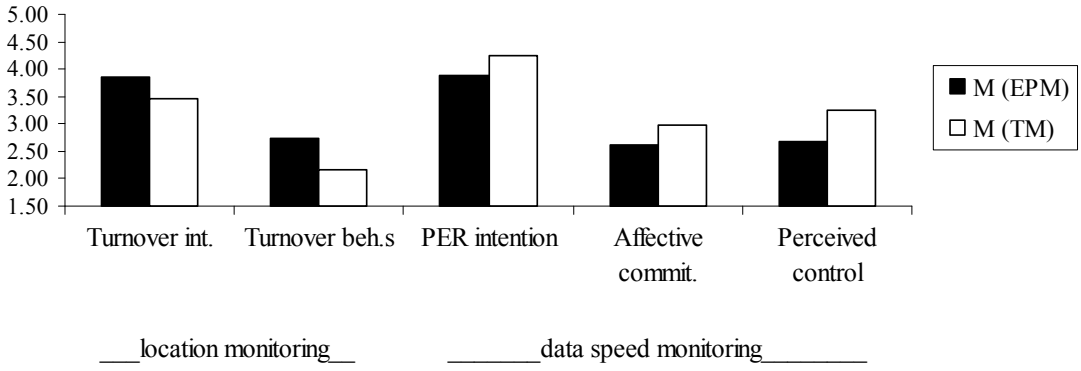

Figure 2. Group Differences Associated with Location and Data Entry Speed Monitoring

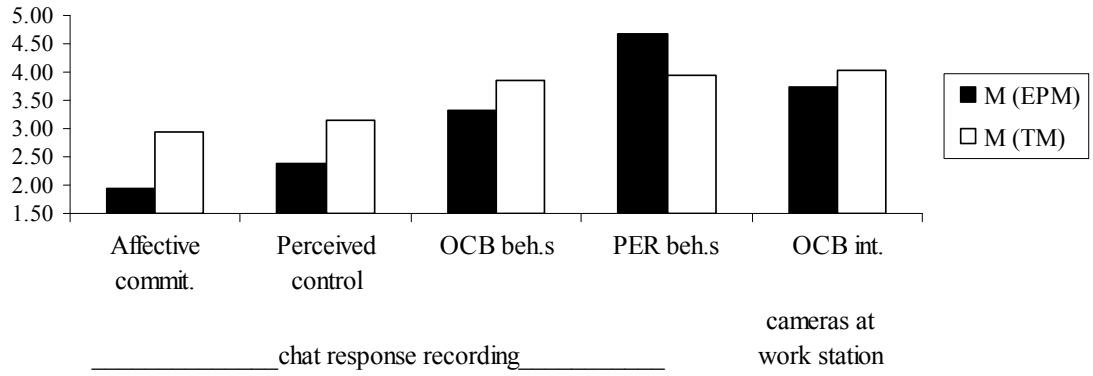

Figure 3. Group Differences Associated with Chat Response and Camera Monitoring

In addition, further exploratory questions were posed to participants, asking them whether the monitoring, as far as they knew, was also used to ensure employee security, prevent abuse of organizational resources, and monitor attendance.

Table 4. Significant Effects of Monitoring Purpose

Variables	Monitoring purpose		Answering options			
			Yes		No	
		ANOVA results	M	SD	M	SD
Affective commitment	Employee security	$F(1,129)=4.832$, $p=.030$	3.00	.77	2.66	.90
OCB intention	Employee security	$F(1,129)= 6.663$, $p=.011$	3.91	.73	3.55	.76
OCB behaviors	Employee security	$F(1,126)= 7.639$, $p=.007$	3.92	.62	3.58	.95
Turnover intention	Prevent abuse	$F(1,128)= 8.883$, $p=.003$	3.74	1.05	3.13	1.29

A small number of significant purpose effects were also noted (Table 4). These results suggest that the perceived purpose of monitoring as a means to ensure employee security has positive effects on affective commitment and increases intended and actual OCBs as well. In contrast, when the purpose is thought to be on safeguarding organizational resources, that is, preventing abuse of organizational resources by employees, the participants also were more inclined to leave their organization.

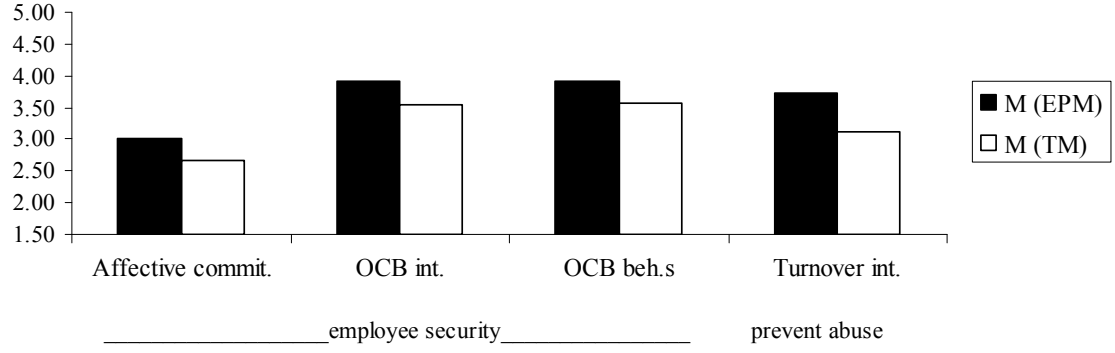

Figure 4. Group Differences Associated with Purpose of Monitoring

These findings have important implications for how the purpose of monitoring is communicated to employees, as they may otherwise come to their own conclusions. The results of these analyses were also graphically displayed in Figure 4 (using the mean values listed in Table 4).

5. CONCLUSION

5.1 Summary

EPM is increasingly being used to supplement traditional monitoring techniques. The present study examined the influence of different techniques of electronic monitoring on attitudes, perceived control and intended as well as actual OCBs, turnover, and the use of performance feedback. The main purpose of the research was to answer the following questions: To what extent did different monitoring techniques influence the attitudes, perceived control, intentions and behaviors of monitored employees? The results suggest that monitoring may play an important role in explaining differences in a number of variables we selected. We found evidence that different monitoring types have various effects on attitudes, perceived control, intentions and behaviors. The current results suggest that phone, chat and data entry monitoring tends to have negative effects on attitudes and perceived control as well as most of the intentional behaviors. It is interesting to note that OCB intentions were also negatively affected by visual monitoring, rather than increased. We further observed group differences when the purpose of the monitoring was varied (for security reasons or to prevent abuse). A purpose that also benefits and ensures the well-being of employees resulted in higher affective commitment, OCB intentions and behaviors, than a focus on preventing abuse of technology by employees. Such monitoring actually increased turnover intentions. The present study therefore corroborates and replicates past work that demonstrated a link between how employees are monitored and how this affects their job attitudes and sense of control at work. The results also support past assertions that monitoring can affect both productive, citizenship, and unproductive behaviors (Stanton & Weiss, 2000).

5.2 Limitations

A number of general limitations arise. Those participants who are electronically monitored may also be traditionally monitored; however, this was not assessed in this survey. In addition, we have no information about the nature of traditional monitoring. That is, the degree of close and frequent supervision was not assessed in the current survey. Also, the study did not consider the extent to which employees had a voice in which aspects of their job and behaviors were monitored (Whiting, Podsakoff & Pierce, 2008), the extent to which they considered the monitoring as being applied in a consistent fashion for all employees, or the possible role of procedural and informational justice (Stanton, 2000b). As the participants came from various different organizations, the work environment experienced by participants may have varied significantly among the final sample. In addition, given that participants were part-time employees, we could argue that this sample is less likely to be committed to the workplace in the long run once they graduate. If we utilize a sample of full-time employees who are likely to be more invested at work and dependent on their job for their livelihood, would we see stronger results? We propose that this will indeed be the case. Having demonstrated negative attitudinal responses and increased employee withdrawal in this part-time sample suggest a significant effect can also be expected for regular employees.

5.3 Implications and Future Research Avenues

The present study corroborates and replicates past work that demonstrated a link between how employees are monitored and how this affects their job attitudes and sense of control at work. Aiello and Kolb (1995b) advocate that organizations inform their employees about which aspects of their work is monitored. Employees are more likely to accept the monitoring of job-relevant activities when they are also given the opportunity to voice their concerns about how they are being monitored to reduce potential invasion of privacy and maintain procedural justice (Alge, 2001). In addition to helping to maintain trust and fairness

(Stanton, 2000b), employees are more likely to accept the monitoring of job-relevant activities when they are also given input into monitoring to reduce potential invasion of privacy and maintain procedural justice (Alge, 2001). Managers are advised to carefully balance the benefits of close monitoring against the negative reactions produced by such monitoring in terms of lower job satisfaction, affective commitment and loyalty. In addition, managers need to carefully consider how EPM data are utilized for employee support, development and assessment.

The wider introduction of EPM in the modern workplace invites new challenges for managers and employees alike. We would like to raise a number of questions of interest. First, does the availability of more electronic performance data increase employees' desire for more and more detailed feedback as suggested by Aiello and Kolb (1995b)? How much of the EPM data should be utilized for performance feedback? Second, to what extent do managers know how to interpret and communicate this information for their employees using performance standards or reference points? It would be further interesting to research the extent to which acceptance, familiarity, and personal use of monitoring software increases and shapes employee expectations to be monitored at work. We know very little about these issues yet. Third, our data clearly suggest that discretionary behavior is affected by monitoring, which supports the findings of other researchers that EPM increases perceived workplace isolation (Mulki et al., 2008), limits social interaction and potentially reduces social contact (Amick & Smith, 1992). Given these workplace situation, is discretionary behavior compromised by continuous monitoring? To what extent are OCBs still discretionary when every move is recorded? We do not have the answers yet, but we hope our results and these suggested research questions will stimulate further research in this area.

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A SURVEY AND ANALYSIS OF NFC BASED PAYMENT SOLUTIONS FOR SMARTPHONES

Thomas Zefferer
Secure Information Technology Center – Austria, Inffeldgasse 16a, 8010 Graz, Austria

ABSTRACT

The recent emergence of smartphones and mobile communication technologies has caused a significant shift towards mobile solutions in many aspects of our daily life. Motivated by this general trend and facilitated by the integration of NFC technology into modern smartphones, stakeholders from the mobile communication sector and from the financial sector have recently started to roll out NFC based mobile payment solutions. These solutions allow customers to pay cashless at points of sale using their NFC enabled smartphones. However, most of these solutions have not managed to make the breakthrough so far and suffer from low user acceptance rates. This is surprising as NFC based payment solutions are usually beneficial compared to other payment methods in terms of usability.
In order to find out the reasons for this observable lack of user acceptance, this paper analyzes existing NFC based payment solutions and identifies their strengths and weaknesses. For this purpose, NFC based payment solutions from all over the world have been surveyed. Based on this survey, a set of distinctive features has been derived. These features have then been used to classify and analyze the surveyed payment solutions. The conducted analysis process has revealed useful findings, which can be used to improve future NFC based payment solutions, and which can help to introduce NFC into other security sensitive fields of application.

KEYWORDS

Mobile payment, smartphone, NFC, Secure element

1. INTRODUCTION

Applications that make use of mobile communication technologies have significantly gained importance during the past years. Powered by the introduction of new and powerful mobile end devices and by the development of mobile broadband communication networks, an emerging trend towards mobile solutions can be observed in various fields of application. This shift towards mobile services can also be observed in various security sensitive fields of application such as electronic payment (e-payment) or electronic government (e-government). The integration of mobile technologies into e-payment and e-government applications has become commonly known under the terms mobile payment (m-payment) and mobile government (m-government), respectively. Mobile payment solutions usually allow customers to use their mobile phones to pay cashless at points of sale. Google Wallet (Google, 2012), which has been introduced by Google in the USA in 2011, is a representative example of mobile payment solutions.

During the past years, smartphones have turned out to be the most relevant and most frequently used end devices for m-payment and related services. Beside typical mobile communication facilities, modern smartphones integrate various additional technologies that allow for the implementation of powerful applications. The various technologies supported by modern smartphones can not only be used to improve the functionality of mobile applications. Some of these technologies are also suitable to improve the security and usability of mobile solutions.

A popular technology that has the potential to improve the security and usability of security sensitive mobile applications is *Near Field Communication (NFC)*. NFC is a wireless short-range communication technology closely related to *Radio Frequency Identification (RFID)* technology. On smartphones, NFC is typically integrated together with a *Secure Element (SE)*. An SE is a simple but highly secure hardware unit that can be used to securely store data and to carry out cryptographic operations. In combination with an SE, NFC represents a powerful technology to improve the security of mobile applications.

The potential of NFC on smartphones has already been recognized. Google Wallet is but one of many NFC based m-payment services that have been introduced during the past years. Similar m-payment solutions that make use of smartphones' NFC capabilities have been introduced all over the world. While the number of NFC based m-payment solutions is constantly growing, the user acceptance of these solutions often remains below expectations. At the same time it can be observed that NFC is less frequently used in other security sensitive fields of application such as m-government. This is surprising, since most security sensitive fields of application share several common requirements regarding security and usability.

In order to find reasons for the obvious lack of user acceptance of NFC based payment solutions and in order to analyze the potential of NFC for other fields of application, we have surveyed existing mobile payment solutions based on NFC. Thereby, focus has been put on solutions that have been designed and developed for smartphones. In this paper, we first provide a brief introduction to NFC and its integration into modern smartphones. We then present the results of the conducted survey and discuss different NFC based payment solutions. Subsequently, we propose a set of distinction criteria to classify the surveyed solutions. From the applied classification and analysis process we finally derive and discuss findings that can help to improve future NFC based m-payment solutions and to leverage NFC technology also in other security sensitive fields of application.

2. NFC ON SMARTPHONES

NFC is probably one of the most promising smartphone technologies that can be used for the implementation of secure and usable mobile payment solutions. Actually, NFC is not a new technology but has already been introduced in 2002. Mainly fostered by the two companies NXP and Sony, NFC is based on RFID technology, which has also been developed mainly by these two companies. Established RFID standards define the transmission of data between a powerful reader device and a simple RFID tag. The RFID tag is usually completely supplied by an external electromagnetic field. This field is generated by the reader device and also used to read data from and write data to the tag using standardized modulation techniques. Due to these technology inherent limitations, RFID based communication is typically extremely limited in terms of distance and bandwidth. The main advantage of RFID is however the automatic and immediate communication set-up. A reader device can communicate with any compliant tag whenever the tag is within the reader's range. RFID tags are therefore suitable as a replacement for barcodes and to store simple information such as URLs. Popular RFID standards are MIFARE (ISO, 2008) developed by NXP and FeliCa developed by Sony.

NFC can be seen as development of RFID and combines the established standards MIFARE and FeliCa. Relevant NFC standards are ISO/IEC 18092 (ISO, 2004) and ISO/IEC 21481 (ISO, 2005). In contrast to RFID, NFC does not define fixed roles for (active) reader devices and (passive) tags. Every NFC device can be operated in three different modes. An NFC device can act both as passive tag (card-emulation mode) and as reader device (reader/writer mode). Additionally, two NFC enabled devices can also directly communicate with each other (peer-to-peer mode). This way, NFC is suitable for much more application scenarios compared to simple RFID solutions but still features the same communication properties such as short-range, low bandwidth, and immediate communication set-up.

Although NFC has been available for about ten years, this technology has not been able to reach the mass market so far. Amongst others, reasons have been a lack of appropriate end user devices and a very limited set of potential use cases and concrete NFC based applications. This situation has changed, when smartphone manufactures have recently started to integrate NFC into their products. Smartphones integrate various powerful technologies, which can be combined with NFC to implement new and powerful services and applications. In this context, especially *Secure Elements (SE)* have turned out to bear a great potential for NFC based smartphone applications. An SE is a secure hardware module that supports the secure storage of confidential data and the execution of cryptographic operations. Secure elements are basically comparable to smart cards (Rankl et al., 2004). However, while the functionality of a smart card is usually determined during the manufacturing process, the functionality of secure elements can also be determined and modified after deployment. For this purpose, a *Trusted Service Manager (TSM)* is able to securely access an already deployed secure element in the field and to securely install special applications on the SE in order to modify its functionality.

NFC and SE are a powerful combination that allows for the realization of secure smartphone applications. Fig. 1 illustrates the general architecture of NFC enabled smartphones. In this architecture, the *Baseband Controller* represents all smartphone components that are required to execute the mobile operating system. Usually, the Baseband Controller does not implement highly secure security measures and is hence potentially vulnerable to malware. The *NFC Controller* complements the Baseband Controller and implements an analogue frontend to the smartphone's *Antenna*, which is used to communicate with external NFC devices. The NFC Controller also implements a digital interface to the Baseband Controller. The Baseband Controller uses this interface to access the smartphone's NFC interface. This can be necessary when the smartphone is operated in the reader/writer mode or in the peer-to-peer mode.

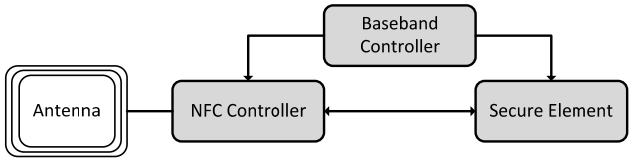

Figure 1. Architecture of NFC enabled smartphones

For security sensitive applications, the *Secure Element (SE)* is of special importance. The SE implements hardware based security measures and is thus resistant to malware residing on the smartphone. As shown in Fig. 1, the SE is separated from the Baseband Controller and is equipped with an own interface to the NFC Controller. This way, there is a secure path between the smartphone's NFC interface (Antenna) and the SE, bypassing the potentially insecure Baseband Controller. The direct path between Antenna and Secure Element allows the smartphone to be operated in card-emulation mode. In this mode, external reader devices can directly access the SE through the smartphone's NFC interface. The card emulation mode is of special relevance for most NFC based payment solutions that are surveyed in the next section.

3. NFC BASED M-PAYMENT SOLUTIONS

A key characteristic of RFID and NFC based communication technologies is their short operating range. The two communicating devices (reader and tag) need to be in close proximity in order to be able to exchange data. This might appear to be a drawback form a functionality point of view. From a security point of view, the limited operating range is actually a benefit as it prevents NFC devices from being used and accessed unnoticed by the legitimate device owner. Several payment solutions make use of this inherent feature of RFID and NFC technology. For instance, MasterCard PayPass (MasterCard, 2012) or Visa PayWave (Visa, 2012) allow users to pay cashless in stores simply by tapping a contactless RFID enabled smart card on a special payment terminal (tap-and-go). An additional authorization such as a PIN is not necessary. This improves usability, but on the other hand reduces security. Thus, these kinds of payments are usually subject to rather low transaction limits.

MasterCard PayPass and Visa PayWave have originally been designed for contactless smart cards. Enabled by the growing availability of NFC enabled smartphones, several solutions have recently been introduced, which are based on the backend systems of MasterCard PayPass and Visa PayWave, but replace the contactless smart card by an NFC enabled smartphone. Such a solution is for instance offered by the Russian mobile network operator MTS in cooperation with MasterCard and the Russian banking institution MTS (NFC World, 2012). Customers are supplied with a special NFC antenna and a special SIM card, which assumes the role of a secure element. Antenna and SIM card can be used to extend existing mobile phones with NFC and SE functionality. The enhanced devices can then be used to carry out MasterCard PayPass based transactions up to 1000 RUB at points of sale equipped with appropriate MasterCard PayPass terminals.

A similar smartphone based m-payment solution that relies on MasterCard PayPass technology has been introduced in Turkey. This solution is called Cep-T Cüzdan (Turkcell, 2012) and has been developed by the Turkish mobile network operator Turkcell. Cep-T Cüzdan allows customers to carry out MasterCard PayPass transactions using their NFC enabled smartphones. Similar to the Russian mobile network operator MTS, Turkcell supplies its customers with add-on solutions to extend older mobile phones with NFC technology.

Moneto (Moneto, 2012) is another mobile payment solution that makes use of smartphones and allows for conducting contactless MasterCard PayPass transactions. Moneto is based on an NFC enabled microSD card developed by the companies DeviceFidelity and Spring Card Systems. This way, this solution is applicable on any smartphone that features an appropriate slot for microSD memory cards and does not require the smartphone to feature NFC. The microSD card also features a SE, which is used to store security sensitive data such as the PIN that can be used to protect financial transactions.

The probably most discussed NFC and smartphone based m-payment solution is Google Wallet (Google, 2012). Google Wallet is the result of a joint initiative of Google, MasterCard, the US mobile network operator Sprint, Citibank, and FirstData. The basic idea of Google Wallet is to provide users with a smartphone app (Google Wallet App) that acts as virtual wallet and stores different kinds of virtual cards such as credit cards, prepaid cards, or loyalty cards. Similar to the above mentioned m-payment solutions from Russia and Turkey, Google Wallet makes use of the existing MasterCard PayPass infrastructure to process transactions. To pay cashless at points of sale, users select a card in their Google Wallet App and tap their NFC enabled smartphone on the MasterCard PayPass terminal. In contrast to other MasterCard PayPass based m-payment solutions, users need to enter a secret PIN into the Google Wallet App in order to authorize the transaction. Although recent security reports have revealed that this PIN is not appropriately protected under certain circumstances (viaForensics, 2011; The Smartphone Champ, 2011), this additional authorization step adds more security to the entire solution.

When introduced in 2011, Google Wallet stored security sensitive data (credit card numbers, etc.) in a secure element residing on the user's smartphone. Full access to the secure element was only provided via NFC and required mutual authentication. This way, only FirstData being the operator of the backend systems was able to access the secure element during a financial transaction through the smartphone's NFC interface. Other smartphone applications were not able to access the secure element and its data. In autumn 2012, Google has suddenly changed the basic architecture of Google Wallet. According to an official announcement (Google Commerce, 2012), Google Wallet now stores security sensitive data centrally on Google servers. Although the introduction of Google Wallet has caused a stir, its success has remained below expectations so far. Main reasons are Google Wallet's limitations regarding supported mobile networks, mobile end devices, and credit cards. The combination of these limitations has significantly reduced the circle of potential customers and has prevented a breakthrough of Google's m-payment solution so far.

ISIS (ISIS, 2012) is another NFC based m-payment solution and follows a similar approach as Google Wallet does. Equally to Google Wallet, ISIS allows users to virtualize payment cards on their smartphones and to use these virtual cards to carry out cashless payments at points of sale. Similar to Google Wallet, ISIS makes use of a secure element and requires the user to enter a secret PIN in order to authorize a payment. However, there are also several differences between ISIS and Google Wallet. ISIS is not restricted to a certain mobile network operator but is supported by the three major US mobile network operators AT&T, Verizon, and T-Mobile. Furthermore, ISIS supports most major credit card brands according to official announcements. The most relevant difference between Google Wallet and ISIS from a technical point of view is the realization of the SE. While Google Wallet relies on an SE that is based on a hardware chip being integrated directly in the smartphone, ISIS makes use of SIM cards to implement the functionality of an SE. This provides ISIS more flexibility regarding the choice of appropriate end devices. ISIS is currently piloted in the US cities of Austin and Salt Lake City.

While Google Wallet and ISIS are – at least for the time being – mainly intended for the US market, NFC based m-payment solutions have also been introduced in other countries all over the world. Japan and South Korea can actually be seen as pioneers in NFC based payment solutions. While contactless payment methods are only slowly gaining popularity in America and Europe, NFC payments are already well established in Japan and South Korea. In Japan, NFC based payment methods have evolved from contactless ticketing systems for public transportations. Later, these tickets have been enhanced by simple electronic purse functionality to allow users to purchase goods at special kiosks. Popular brands of such combined contactless ticketing and electronic purse solutions available in Japan are Suica (JR East, 2012b) or PASMO (JR East, 2012a). Recently, these solutions have also been ported to smartphones. This allows customers to store tickets on their NFC enabled smartphones and to use their mobile communication devices as contactless electronic purses.

A similar solution is available in South Korea. Also in South Korea, the established mobile payment solution T-Money (Korea Smart Card Co., 2012) has evolved from a contactless ticketing system for public transportations, which has later been extended by prepaid based payment functionality. Nowadays, T-Money

is also available on mobile phones. In contrast to the Japanese solutions Suica and PASMO, T-Money implements a proprietary communication standard, which is similar but not directly compatible to NFC.

While RFID and NFC based mobile payment solutions have already been available in Japan and South Korea for several years, Europe is only slowly catching up. However, there are already a few NFC based mobile payment solutions available in different European countries. Beside the already mentioned solutions from Russia and Turkey, NFC based payment methods have recently attracted attention also in Austria, Germany, and the UK.

In Austria, the company Paybox, which has already gained experience with SMS based m-payment solutions, has recently piloted an NFC based payment solution that allows users to pay at selected points of sale using their NFC enabled smartphones (Paybox, 2012). Security sensitive data has been stored in a secure element implemented by the mobile phone's SIM card. For this purpose, Paybox has collaborated with the Austrian mobile network operator A1. For mobile phones without NFC support, Paybox has offered its customers a sticker containing an NFC antenna and an integrated SE. Similar to MasterCard PayPass based solutions, it has been sufficient to tap the NFC enabled mobile phone or the NFC sticker on an appropriate reader device at the point of sale. In autumn 2012, Paybox announced to not prolong the pilot and to withdraw the service by end of 2012 due to a lack of acceptance (Paybox, 2012).

Another NFC based mobile payment solution is currently being piloted in Austria by Raiffeisen Bank International (RBI). The solution is called CardMobile (Raiffeisen Bank International, 2012) and has been developed for the Apple iPhone. As the iPhone does not feature NFC support, CardMobile requires the user to equip the smartphone with a special protective cover that contains an NFC antenna and a SE. CardMobile supports two types of transactions. Micropayments up to 20€ can be conducted simply by taping the iPhone on an appropriate reader device at the point of sale. Payments above this limit are carried out as Visa V Pay transaction (debit) and require the user to additionally enter a PIN.

Contactless payment methods are currently also piloted in Germany. The girogo service (EURO Kartensysteme, 2012), which allows customers to carry out financial transactions up to 20€ without entering a PIN on a prepaid basis, is currently tested in the German cities Hannover, Braunschweig, and Wolfsburg. So far, this service is limited to special issued smart cards and not available on smartphones.

In the UK, the mobile network operator Orange and the credit-card issuer Barclaycard have launched the NFC based payment solution Quick Tap in 2011 (Orange, 2011). Quick Tap is also based on a prepaid model and allows customers to charge their mobile phone with up to 100£. Customers can then pay at points of sale amounts up to 15£ simply by taping their mobile phone on an appropriate reader device. Quick Tap also requires the user to install a special smartphone app. This app provides the user with information on the current balance and optionally with the opportunity to protect payments by entering a secret PIN.

Beside Europe, NFC based payment methods have also been introduced and piloted in other regions of the world. NFC based payment solutions for smartphones have for instances been introduced in Canada by Rogers Communications and CIBC (SureTap) (Rogers Communications, 2012), or in New Zealand, where the mobile network operator 2degrees and the payment company snapper have introduced the payment system Touch2Pay (2degrees, 2012).

4. ANALYSIS

The conducted survey on existing NFC based mobile payment solutions has revealed that these solutions are quite heterogeneous and differ in several aspects. A thorough analysis and comparison of existing solutions hence requires a classification of existing solutions with respect to these criteria. We define criteria and distinctive features of current NFC based mobile payment solutions in this section. Based on the identified distinctive features we then classify the surveyed payment solutions and derive findings that can be useful for the development of future NFC based m-payment solutions and for the introduction of NFC based solutions into related fields of application.

4.1 Definition of Classification Criteria

Despite their heterogeneity, all surveyed mobile payment solutions share some common features. All solutions allow customers to pay cashless at points of sale. For this purpose, the points of sale have to

provide an appropriate infrastructure. This infrastructure typically includes an appropriate reader device, which is connected to the backend systems of a central payment system. All surveyed payment solutions have also in common that they make use of NFC or closely related wireless communication technologies to allow for a contactless payment process. Customers can initiate (and in some cases even complete) a payment simply by tapping a mobile NFC device on the reader device at the point of sale. Furthermore, all solutions rely on some kind of hardware based SE that is used to store and process security sensitive information.

Despite these similarities, existing solutions differ in various technological and organizational aspects. We propose the following set of distinctive features to classify existing NFC based mobile payment solutions.

- **Realization of the SE:** The SE represents a key component of all NFC based payment solutions. Especially on smartphones, secure elements can be realized in different ways. The realization of the SE influences the usability of the entire solution and also affects the set of involved stakeholders. Hence, the realization of the SE is an important classification criterion for NFC based payment solutions.
- **Transaction authorization:** The main benefit of NFC based payment solutions is usability. Customers can carry out transactions simply by taping an NFC device on an appropriate reader device. In order to not disturb this so called tap-and-go experience, most solutions do not require customers to additionally authorize transactions e.g. by entering a secret PIN. As this potentially decreases security, the type of provided transaction authorization is also a relevant classification criterion for NFC based payment solutions.
- **Type of payment:** NFC basically defines the communication technology used by the customer to interact with the payment system. However, the use of NFC does not limit the type of payment. The conducted survey has shown that NFC is typically used for credit card, debit, and prepaid payments. Of course, not all surveyed solutions support all kinds of payment. Hence, the set of supported types of payment is another interesting classification criterion for NFC based payment solutions.
- **Stakeholders:** The development and operation of NFC based payment systems usually requires the collaboration of different stakeholders. Depending on the concrete technical implementation, such solutions require the collaboration of banking institutions, credit card companies, smartphone manufactures, trusted service managers, or mobile network operators. At the same time, a growing number of involved stakeholders potentially reduces the profit for each single stakeholder. Hence, the set of stakeholders being the main drivers behind the development and operation of an NFC based payment solution is another interesting classification criterion.

4.2 Classification

Based on the proposed classification criteria, we have classified the surveyed mobile payment solutions. The results of this classification process are shown in Table 1. For each surveyed solution, the four criteria defined above have been analyzed separately. Findings that can be derived from this classification process are discussed in the next subsection.

Table 1. Classification of surveyed NFC based mobile payment solutions

Payment system	SE Realization	Transaction authorization	Type of payment	Stakeholders
MasterCard PayPass	Smart card	None, PIN	Debit, credit, prepaid	Credit card company
Visa PayWave	Smart card	None, PIN	Debit, credit, prepaid	Credit card company
Google Wallet	Hardware module	PIN	Credit, prepaid	Smartphone OS manufacturer, bank, credit card company, MNO, payment infrastructure operator
ISIS	SIM	PIN	Debit, credit, prepaid	MNO

Paybox NFC	SIM, sticker	None	Debit, phone bill	MNO
Touch2Pay	SIM	None	Prepaid	MNO, payment company
MTS Money NFC	SIM	None	Debit	MNO, bank, credit card company
Moneto	microSD	PIN	Prepaid	Hardware manufacturer, payment company
Cep-T Cüzdan	SIM	None	Credit	MNO, bank
girogo	Smart card	None	Prepaid	Bank
suretap	SIM	None	Credit	MNO, bank
Quick Tap	SIM	PIN	Prepaid	MNO, credit card issuer
Suica/PASMO	Smart card	None	Prepaid	Public transportation operator
T-Money	SIM	None	Prepaid	Payment company
CardMobile	microSD	None	Prepaid	Bank

4.3 Findings and Lessons Learned

The conducted survey on existing NFC based payment solutions and the applied analysis process has revealed several interesting findings. First of all, the conduced survey has shown that NFC and secure elements have evolved to mature technologies that are basically suitable for the development of secure and usable mobile payment solutions. In this context, the short range of NFC based communication has turned out to be an interesting security feature. As users need to intentionally tap their personal NFC device on a reader device to initiate a payment process, additional security measures are often not implemented. Of course, these kinds of tap-and-go transactions that do not require additional authorizations by the user are usually limited to micropayments. The conducted classification process has also shown that in many cases, convenient tap-and-go transactions are furthermore restricted to prepaid payments. In general, it seems that providers of NFC based payment solutions definitely want to make use of NFC's potential to improve the usability and efficiency of payment processes. However, they are also well-aware of the reduced security caused by a missing additional transaction authorization.

For NFC based m-payment solution, the risk can easily be controlled by defining appropriate transactions limits or by restricting the payment solution to prepaid payments. Table 1 shows that this strategy is successfully applied all over the world. If NFC based solutions shall be developed in other security sensitive fields of application, similar risk-limiting strategies need to be applied. The concrete strategies to be implemented of course heavily depend on the actual field of application and require a thorough risk assessment.

Another interesting finding of the conducted classification and analysis process pertains to the implementation of the secure elements and its influence on involved stakeholders. The implementation of the secure element is a major design decision for all NFC based payment solutions. Table 1 shows that in many cases the SIM card is used as secure element. This seems reasonable, as SIM cards are basically available in and compatible to all GSM based mobile phones. Table 1 also shows that in most SIM based solutions mobile network operators (MNO) are involved in the development and operation of these solutions. Other stakeholders typically prefer alternative SE implementations in order to remain independent from MNOs. The appropriate choice of an SE realization is hence not only a question of technical feasibilities, but also a strategic issue. If a SE can be implemented without the help of MNOs, profits do not need to be shared with MNOs neither.

In general, the complex ecosystem of involved stakeholders is one of the biggest challenges of NFC based payment systems. The large number of stakeholders renders the development of strategies and business plans, which satisfy the demands of all parties, difficult. So far, the given complexity has led to collaborations between different stakeholders and to the development of different heterogeneous solutions all over the world. It remains to be seen which approaches will succeed in the end. In any case, the increasing deployment of NFC based payment solutions is a great opportunity also for other security sensitive fields of application as it offers great potential for synergies and joint solutions.

5. CONCLUSIONS

The emergence of smartphones and the recent integration of NFC technology into these powerful mobile end devices have paved the way for the development of contactless payment solutions. These solutions allow customers to pay cashless at points of sale. A heterogeneous ecosystem of different NFC based m-payment solutions has evolved during the past few years.

In this paper, a representative subset of these solutions has been surveyed. In order to facilitate a classification and subsequent analysis of this heterogeneous set of existing solutions, distinctive features have been identified and appropriate classification criteria have been defined. By applying these criteria to the surveyed solutions, several interesting findings could be derived. These findings can help to improve the acceptance of future NFC based m-payment solutions and to introduce NFC also in other security sensitive fields of application.

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MINING FIRST-COME-FIRST-SERVED FREQUENT TIME SEQUENCE PATTERNS IN STREAMING DATA

Atsushi Okamoto and Takayoshi Shoudai
Department of Informatics, Kyushu University, 819-0395 Fukuoka, Japan

ABSTRACT

In this paper, we discuss the data mining problem of finding frequent time sequence patterns of constant length in a stream data. A *time sequence pattern* is an alternating finite sequence of events and positive integers $(e_1,T_1,e_2,T_2,\ldots,T_{k-1},e_k)$. It represents that the i-th event e_i is followed by the $(i + 1)$-th event e_{i+1} within T_i events for $i = 1,\ldots,k$-1. To count the frequency of a time sequence pattern effectively, we define the first-come-first-served (FCFS)-maximal frequency, which is a natural frequency according to the FCFS rule for a stream data. We propose a round-robin and an Apriori-like *lossy counting* algorithm for finding all frequent time sequence patterns with respect to FCFS-maximal frequency, and show that the round-robin algorithm always maintains an ε-deficient synopsis and that the Apriori-like algorithm maintains it for $k \leq 3$. Finally, we present experimental evaluations of our algorithms on real data.

KEYWORDS

Data Mining, Streaming Algorithm, Frequent Pattern Mining, Time Sequence Pattern, Lossy Counting.

1. INTRODUCTION

The rapid growth of high-speed Internet access service provides us not only the benefits of social networking but also a huge amount of raw data that cannot be stored even in recent latest storage devices. In network computing, therefore, many researchers are working on designing algorithms that are faster and that use as little memory as possible. A streaming algorithm is defined as an algorithm that processes a sequence of data units in one pass owing to limited memory resources per unit. The field of streaming algorithms was first formalized in a paper by Alon et al. (1996). They proposed a streaming algorithm that approximates frequency moments in logarithmic space. Demaine et al. (2002) and Karp et al. (2003) independently proposed a deterministic algorithm to find all elements having a frequency greater than a given threshold γ in a stream of length N. The algorithm requires two passes, linear time and space $O(1 / \gamma)$. Manku and Motwani (2002) proposed an ε-approximate algorithm in a data stream, called *lossy counting*, which is based on approximate counting using $O((1 / \varepsilon) \log \varepsilon N)$ space. This algorithm outputs items having a frequency of more than $\gamma - \varepsilon$. Their algorithm maintains an ε-deficient synopsis, which is a criterion of frequency counts for events that have minimum support.

Let E be a finite set of events. A *stream data* is defined as a finite sequence of events $S = (a_1,a_2,\ldots,a_N)$ $(a_i \in E)$. An alternating sequence of k events and $k - 1$ positive integers $\pi = (e_1,T_1,e_2,T_2,\ldots,T_{k-1},e_k)$ is called a *k-time sequence pattern*. An integer sequence $o = (i(1),i(2),\ldots,i(k))$ is said to be an *occurrence* of π in S if $a_{i(\tau)} = e_\tau$ for all $\tau = 1,\ldots,k$ and $i(\tau + 1) - i(\tau) \leq T_\tau$ for all $\tau = 1,\ldots,k - 1$. In the literature, several typical frequency metrics for time sequence patterns have been introduced (Mannila et al. 1997; Iwanuma et al. 2005; Gan and Dai 2012). In this paper, we define a new frequency metric, called FCFS-maximal frequency. The *first-come-first-served (FCFS)-maximal occurrence set* of π in S is defined to be the set of all occurrences that are found by the following procedure: Repeat the next step until S can be not updated: Find the first (earliest) occurrence of π in S, say $o = (i(1),i(2),\ldots,i(k))$, and update S by replacing $a_{i(\tau)}$ with x for all $\tau = 1,\ldots,k$, where x is a special event that does not appear in π. For example, let $S = (a,a,a,b,b,b,b,b,b)$ be a stream data and $\pi = (a,3,b,3,b)$ be a time sequence pattern. The first occurrence of π in S is (1,4,5), and the second one is (3,6,7), which is the first occurrence of π in (x,a,a,x,x,b,b,b,b). Then, the FCFS-maximal occurrence set of π in S is O

= {(1,4,5),(3,6,7)}. This is a natural occurrence set according to the FCFS rule for a stream data. The *FCFS-maximal frequency* of π in *S* is defined as the cardinality of the FCFS-maximal occurrence set.

In this paper, we study a data mining problem of discovering all time sequence patterns whose FCFS-maximal frequency in a given stream data is more than or equal to a given threshold. We propose a round-robin and an Apriori-like *lossy counting* algorithm for the problem. We show that the round-robin algorithm always maintains an ε-deficient synopsis, and that the Apriori-like algorithm maintains it for $k \leq 3$. Finally, we present experimental evaluations of our algorithm on real data.

2. PRELIMINARIES

In this section, we formally define time sequence patterns with respect to FCFS-maximal frequency.

2.1 Time Sequence Patterns and FCFS Frequency

Let E be a finite set of *events*. We use symbols $e,e',e'',\ldots$ or $e_1,e_2,\ldots$ to denote events in E. A *stream data* is a finite sequence of events $S = (a_1,a_2,\ldots,a_N)$ $(a_i \in E)$. Let $e_1,e_2,\ldots,e_k$ be k events and let $T_1,T_2,\ldots,T_{k-1}$ be k - 1 positive integers. An alternating sequence of k events and k - 1 positive integers $(e_1,T_1,e_2,T_2,\ldots,T_{k-1},e_k)$ is called a *k-time sequence pattern*. If all $T_1,T_2,\ldots,T_k$ are equal to some positive integer T, we call it a *(k,T)-time sequence pattern*.

Let $S = (a_1,a_2,\ldots,a_N)$ be a stream data and $\pi = (e_1,T_1,e_2,T_2,\ldots,T_{k-1},e_k)$ a k-time sequence pattern. Let $o = (i(1),i(2),\ldots,i(k))$ be an integer sequence of length k where $1 \leq i(1) < \ldots < i(k) \leq N$. The sequence $o = (i(1),i(2),\ldots,i(k))$ is said to be an *occurrence* of π in S if $a_{i(\tau)} = e_\tau$ for all $\tau = 1,\ldots,k$ and $i(\tau + 1) - i(\tau) \leq T_\tau$ for all $\tau = 1,\ldots,k$-1. For two distinct occurrences $o = (i(1),i(2),\ldots,i(k))$ and $o' = (i'(1),i'(2),\ldots,i'(k))$ of π in S, we say that o and o' are *duplicate occurrences* if there are two elements $i(\tau)$ in o and $i'(\tau')$ in o' $(1 \leq \tau, \tau' \leq k)$ such that $i(\tau) = i'(\tau')$, that is, $a_{i(\tau)}$ and $a_{i'(\tau')}$ are the same event that appears in the same position in S. If o and o' are not duplicate occurrences, the two occurrences are said to be *independent*.

Definition 1. Let S be a stream data and π be a k-time sequence pattern. $\mathrm{Occ}_S(\pi)$ denotes the set of all occurrences of π in S. An independent occurrence set of π in S is a subset of $\mathrm{Occ}_S(\pi)$ such that every two occurrences are independent. An independent occurrence set O of π in S is said to be *maximal* if for any occurrence $o \in \mathrm{Occ}_S(\pi) \setminus O$, there is an occurrence $o' \in O$ such that o and o' are duplicate.

$\mathrm{Occ}_S^{\max}(\pi)$ denotes a maximal independent occurrence set of π in S of maximum cardinality. Similarly, $\mathrm{Occ}^{\min}{}_S(\pi)$ denotes a maximal independent occurrence set of π in S of minimum cardinality. The *maximum frequency* and *minimum frequency of π in S* are defined as $|\mathrm{Occ}_S^{\max}(\pi)|$ and $|\mathrm{Occ}_S^{\min}(\pi)|$, respectively.

Example 1. Let $S = (a,a,a,b,b,b,b,b,b)$ be a stream data. For a 3-time sequence pattern $\pi = (a,3,b,3,b)$, $\mathrm{Occ}^{\max}{}_S(\pi) = \{(1,4,7),(2,5,8),(3,6,9)\}$ and $\mathrm{Occ}^{\min}{}_S(\pi) = \{(3,4,5)\}$.

Definition 2. For two distinct occurrences $o = (i(1),i(2),\ldots,i(k))$ and $o' = (i'(1),i'(2),\ldots,i'(k))$ in $\mathrm{Occ}_S(\pi)$, we write $o \leq_{all} o'$, if for all indices τ $(1 \leq \tau \leq k)$, $i(\tau) \leq i'(\tau)$. Especially, if $o \leq_{all} o'$ and there is an index τ $(1 \leq \tau \leq k)$ such that $i(\tau) < i'(\tau)$, we write $o <_{all} o'$.

Let O be a subset of $\mathrm{Occ}_S(\pi)$. We denote by $\max_{\leq all} O$ (resp. $\min_{\leq all} O$) the maximum (resp. minimum) occurrence in O with respect to "$\leq_{all}$". The *FCFS-maximal occurrence set* of π in S is defined as the output of the FCFS-MOS procedure (Fig. 1) for input $\mathrm{Occ}_S(\pi)$. We denote by $\mathrm{Occ}^{\mathrm{FCFS}}{}_S(\pi)$ the output of FCFS-MOS($\mathrm{Occ}_S(\pi)$). The *FCFS-maximal frequency of π in S* is defined as $|\mathrm{Occ}^{\mathrm{FCFS}}{}_S(\pi)|$. The FCFS-maximal frequency is a natural frequency counter according to the FCFS rule for a stream data.

Example 2. For $S = (a,a,a,b,b,b,b,b,b)$ and $\pi = (a,3,b,3,b)$, $\mathrm{Occ}^{\mathrm{FCFS}}{}_S(\pi) = \{(1,4,5),(3,6,7)\}$.

Procedure FCFS-MOS(O: an occurrence set);
begin
1: $O' := \phi$;
2: **while** $O \neq \phi$ **do begin**
3: $o := \min_{\leq all} O$; $O' := O' \cup \{o\}$;
4: $O := O \setminus (\{o\} \cup \{o' \in O \mid o$ and o' are duplicate$\})$
5: **end**;
6: **output** O'
end.

Figure 1. $Occ^{FCFS}{}_S(\pi)$ is the output of this procedure for an input $Occ_S(\pi)$.

2.2 Frequent Time Sequence Patterns with FCFS Frequency

Let $S = (a_1,a_2,\ldots,a_N)$ be a stream data of events in E. Let $\pi = (e_1,T_1,e_2,T_2,\ldots,T_{k-1},e_k)$ be a k-time sequence pattern. We define $Supp^{FCFS}{}_S(\pi) = |Occ^{FCFS}{}_S(\pi)| / N$, and call it the *FCFS-maximal support*. For example, for $S = (a,a,a,b,b,b,b,b,b)$ and $\pi = (a,3,b,3,b)$, $Supp^{FCFS}{}_S(\pi) = 2 / 9$. Let γ be a real number where $0 < \gamma \leq 1$. We note that $Supp^{FCFS}{}_S(\pi)$ is at most $1 / k$ for any k-time sequence pattern. A time sequence pattern π has a γ-FCFS maximal frequency with respect to S if $Supp^{FCFS}{}_S(\pi) \geq \gamma$. We call this real number γ a FCFS-maximal frequency threshold. We consider the problem for finding all FCFS-maximal frequent time sequence patterns from a given stream data. Let k and T be constant positive integers.

FCFS-MAXIMAL FREQUENT (k,T)-TIME SEQUENCE PATTERN (FCFS-TSP)
Input: A stream data S and a FCFS-maximal frequency threshold γ.
Problem: Find all (k,T)-time sequence patterns π such that $Supp^{FCFS}{}_S(\pi) \geq \gamma$.

If a given stream data S is small enough to be stored in one storage device, then the solution to this problem is not hard to compute, though its computational time strictly depends on k and T. We consider an approximation algorithm for computing FCFS-TSP by using the lossy counting method (Manku and Motwani 2002).

3. A ROUND ROBIN LOSSY COUNTING ALGORITHM FOR FCFS-MAXIMAL FREQUENCIES

An ε-deficient synopsis is defined as a summary of FCFS-maximal frequency counts for time sequence patterns that have a FCFS-maximal frequency threshold, such that the error in the calculated frequencies is bounded by ε and the false positives (i.e., time sequence patterns in the summary that do not have a FCFS-maximal frequency threshold) have a true frequency within ε of the FCFS-maximal frequency threshold (Manku and Motwani 2002). Our goal is to develop an algorithm that satisfies this criterion while maintaining a small memory space.

Definition 3. Let γ ($0 < \gamma \leq 1$) be an FCFS-maximal frequency threshold and ε ($0 < \varepsilon \leq 1$) be an error value where $\varepsilon << \gamma$. An algorithm is said to provide an *ε-deficient synopsis* if the following three conditions are satisfied:

1. There are no false negatives; that is, all time sequence patterns whose true FCFS-maximal frequency are greater than or equal to γN are in the output.
2. No item whose true FCFS-maximal frequency is less than $(\gamma - \varepsilon)N$ is in the output. This is a bound on the false positives.
3. Estimated FCFS-maximal frequencies are less than the true FCFS-maximal frequencies by at most εN. This is a bound on the error in approximating the true FCFS-maximal frequencies.

For a stream data $S = (a_1,a_2,\ldots,a_N)$, we denote by $S[i,i']$ $(1 \le i \le i' \le N)$ the continuous sub-stream data $(a_i,a_{i+1},\ldots,a_{i'-1},a_{i'})$ of S. Especially, we denote by $S[i]$ the i-th event a_i of S. Let k, T be positive integers and ε $(0 < \varepsilon \le 1)$ be an error value. A given stream data $S = (a_1,a_2,\ldots,a_N)$ is processed every continuous stream data of length $1 / \varepsilon + (k - 1)T$. We call each continuous stream data a *bucket*. More formally, we define a bucket as follows. Let $S_\alpha = S[(\alpha - 1) / \varepsilon + 1, \alpha / \varepsilon]$ $(1 \le \alpha \le \lceil \varepsilon N \rceil)$ and $R_\alpha = S[\alpha / \varepsilon + 1, \alpha / \varepsilon + (k - 1)T]$. The last stream data $S_{\lceil \varepsilon N \rceil}$ may have less than $1 / \varepsilon$ events. Then the α-th bucket is defined as $B_\alpha = S_\alpha \cdot R_\alpha$, where "$\cdot$" denotes a concatenation of two sequences. We give an example of a stream data and its division into buckets in Fig. 2.

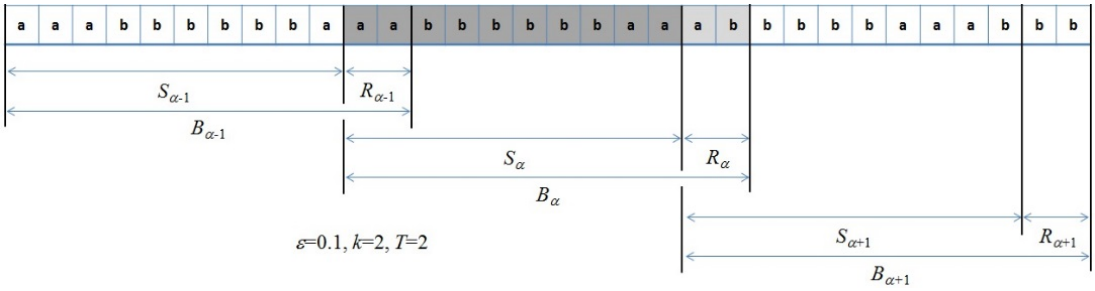

Figure 2. A Stream Data and Its Division into Buckets

Algorithm ROUND_ROBIN-FCFS-MOS(S, γ, ε);
begin
1: $D := \phi$; *Used* := ϕ;
2: **for** $\alpha := 1$ to $\lceil \varepsilon N \rceil$ **do begin**
3: **for** $\beta := 1$ **to** $1 / \varepsilon$ **do begin**
4: $W_{\alpha,\beta} := S[(\alpha - 1) / \varepsilon + \beta, (\alpha - 1) / \varepsilon + \beta + (k - 1)T]$;
5: **Enumerate** all sequences $o = (i(1),\ldots,i(k))$ in $W_{\alpha,\beta}$ s.t. $i(1) = (\alpha - 1) / \varepsilon + \beta$,
6: in increasing order w.r.t. "$\le_{all}$" defined in Def.2, and **foreach** $o = (i(1),\ldots,i(k))$ **do begin**
7: $\pi := (a_{i(1)},T,\ldots,T,a_{i(k)})$;
8: **if** $(\pi,i(\tau)) \notin$ *Used* for $\forall\tau$ $(1 \le \tau \le k)$ **then begin**
9: **if** $\exists(\pi,f,\delta) \in D$ s.t. o is an occurrence of π **then** $f := f + 1$ **else** $D := D \cup \{(\pi,1,\alpha)\}$;
10: **forall** τ $(1 \le \tau \le k)$ **do** add $(\pi,i(\tau))$ into *Used*
11: **end**
12: **end**
13: **end**;
14: **forall** $(\pi,f,\delta) \in D$ s.t. $f \le \alpha - \delta$ **do** $D := D \setminus \{(\pi,f,\delta)\}$;
15: **Remove** from *Used* all elements whose first entry is an index in S_α
16: **end**;
17: **output** all π s.t. $\exists(\pi,f,\delta) \in D$ and $f \ge (\gamma - \varepsilon)N$
end.

Figure 3. A Round Robin Lossy Counting Algorithm for FCFS-TSP

Let $\Pi^{(k,T)}(E)$ be the set of all (k,T)-time sequence patterns whose events belong to E. A *synopsis* D is a data structure that can store and update triplets (π,f,δ) for each $\pi \in \Pi^{(k,T)}(E)$ as necessary, where f and δ represent the following counters.

f: an estimate of the FCFS-maximal frequency of π; δ: the maximum error count of f.

A *window* of S_α is a sub-stream data of length $(k - 1)T + 1$ in S_α. More precisely, for any α $(1 \le \alpha \le \lceil \varepsilon N \rceil)$ and β $(1 \le \beta \le 1 / \varepsilon)$, we define a window of S_α as $W_{\alpha,\beta} = S[(\alpha - 1) / \varepsilon + \beta, (\alpha - 1) / \varepsilon + \beta + (k - 1)T]$. Moreover, according to our requirement, we use the *Used* data structure for representing a set that contains (i,π) for each i-th event a_i and $\pi \in \Pi^{(k,T)}(E)$. For an index i and a k-time sequence pattern π, $(i,\pi) \in$ *Used* if and only if a_i is used to count the FCFS-maximal frequency of π. Initially, let *Used* be an empty set.

For each bucket B_α $(1 \le \alpha \le \lceil \varepsilon N \rceil)$, we move window $W_{\alpha,\beta}$ from $\beta = 1$ to $1 / \varepsilon$ to process S_α in the following way. For all sequences $o = (i(1),i(2),\ldots,i(k))$ such that $(\alpha - 1) / \varepsilon + \beta = i(1) < i(2) < \ldots < i(k) \le (\alpha -$

1) / ε + β + (*k* - 1)*T* and $(i(\tau),(a_{i(1)},T,a_{i(2)},T,\ldots,T,a_{i(k)})) \notin Used$ for all τ ($1 \le \tau \le k$), one of the following operations is executed:

1. *Estimate counter update*: If there is a triplet (π,*f*,δ) in synopsis *D* such that *o* is an occurrence of π, increment its counter *f*, i.e., *f* := *f* + 1.
2. *Insertion a triplet into synopsis*: Otherwise, make a new (*k*,*T*)-time sequence pattern $\pi = (a_{i(1)},T,a_{i(2)},T,\ldots,T,a_{i(k)})$ and insert a new triplet (π,1,α) into synopsis *D*.

In both cases, we add $(i(\tau),\pi)$ into *Used* for all τ ($1 \le \tau \le k$). After all windows $W_{\alpha,\beta}$ ($1 \le \beta \le 1 / \varepsilon$) are processed, we execute the next operation of some triplets in synopsis *D*:

3. *Deletion*: Remove from *D* all triplets (π,*f*,δ) satisfying that $f \le \alpha - \delta$.

We repeat the above procedure for all buckets B_α ($1 \le \alpha \le \lceil \varepsilon N \rceil$). Lastly, according to the request, the algorithm outputs all (*k*,*T*)-time sequence patterns π of (π,*f*,δ) stored in synopsis *D*.

4. *Output*: Output all the first members π of triplets (π,*f*,δ) in synopsis *D* such that $f \ge (\gamma - \varepsilon)N$.

We give a formal description of this algorithm in Fig. 3. We have established the following lemma and theorem similar to the proof by Manku and Motwani (2002).

Lemma 1. Let π be a (*k*,*T*)-time sequence pattern. For any α ($1 \le \alpha \le \lceil \varepsilon N \rceil$), if there are at least α + 1 occurrences of π in $S[1, \alpha / \varepsilon] = S_1 \cdot S_2 \cdots S_\alpha$, then the triplet containing π is stored in synopsis *D* immediately after the α-th outer for-loop (lines 2--16 in Fig. 3), and its maximum error count is at most α.

Proof. We prove this lemma by induction on α ($\alpha = 1,2,\ldots,\lceil \varepsilon N \rceil$). During the first outer for-loop, if there are at least two occurrences of π in S_1, then the triplet (π,*f*,1) with $f \ge 2$ is stored in synopsis *D*. Otherwise, the triplet containing π is not inserted into or is removed from *D*. Therefore, its maximum error count is at most 1.

If there are exactly α occurrences of π in $S_1 \cdot S_2 \cdots S_{\alpha-1}$, then since the triplet containing π is stored in synopsis *D* immediately after the (α - 1)-th outer for-loop, there must be at least one occurrence of π in S_α to ensure that the triplet containing π in *D* is after the α-th outer for-loop. If there are more than α occurrences of π in $S_1 \cdot S_2 \cdots S_{\alpha-1}$, the triplet containing π is stored again in synopsis *D* immediately after the α-th outer for-loop. Therefore, the maximum error count of π becomes at most α. (Q.E.D.)

Theorem 1. The ROUND_ROBIN-FCFS-MOS algorithm correctly maintains an ε-deficient synopsis.

Proof. From Lemma 1, if π occurs at least $\lceil \varepsilon N \rceil + 1$ times in *S*, synopsis *D* stores the triplet containing π. The maximum error count is at most $\lceil \varepsilon N \rceil$. Then, for a given FCFS-maximal frequency threshold γ, since $\gamma >> \varepsilon$, any time sequence pattern π whose true FCFS-maximal frequency is at least γ*N* is contained in synopsis *D* as triplet (π,*f*,δ) with $f \ge (\gamma - \varepsilon)N$. Therefore, from the statement on line 17 of Algorithm ROUND_ROBIN-FCFS-MOS, this theorem is proved. (Q.E.D.)

We note that the ROUND_ROBIN-FCFS-MOS algorithm maintains only *kT* events of a given stream data for the computations during the inner for-loop (lines 3--13 in Fig. 3). When the inner for-loop proceeds to the next iteration for $W_{\alpha,\beta} = S[(\alpha - 1) / \varepsilon + \beta, (\alpha - 1) / \varepsilon + \beta + (k - 1)T]$, it does not need the previous stream data $S[1, (\alpha - 1) / \varepsilon + \beta - 1]$ any more. Therefore, the ROUND_ROBIN-FCFS-MOS algorithm only maintains a sub-stream data of length *kT* to count FCFS-maximal frequencies of (*k*,*T*)-time sequence patterns.

4. AN APLIORI-LIKE ALGORITHM FOR COUNTING FCFS-MAXIMAL FREQUENCIES

We note that *k*-time sequence patterns do not satisfy anti-monotonicity with respect to the FCFS-maximal frequency for $k \ge 4$. Actually, there is a *k*-time sequence pattern $\pi = (e_1,T_1,e_2,T_2,\ldots,e_{k-1},T_{k-1},e_k)$ such that $|\mathrm{Occ}^{\mathrm{FCFS}}{}_S(\pi)| > |\mathrm{Occ}^{\mathrm{FCFS}}{}_S(\pi')|$ for its prefix sub-pattern $\pi' = (e_1,T_1,e_2,T_2,\ldots,T_{k-2},e_{k-1})$. For example, for a stream data $S = (a,b,a,a,b,a,b,b,a,a,b,b)$, we consider a (4,3)-time sequence pattern $\pi = (a,3,b,3,a,3,b)$. For this

pattern, $\mathrm{Occ}^{FCFS}{}_S(\pi) = \{(1,2,3,5), (4,7,9,11), (6,8,10,12)\}$, and for $\pi' = (a,3,b,3,a)$, $\mathrm{Occ}^{FCFS}{}_S(\pi') = \{(1,2,3), (4,5,6)\}$. On the other hand, we have the following lemma for $k \leq 3$.

In Fig. 4, we give a formal description of the Apriori-like algorithm that combines (k-1,T)- and 1-time sequence patterns, in order to make (k,T)-time sequence patterns (on lines 11--15 in Fig. 4).

Algorithm APRIORI-FCFS-MOS(S, γ, ε);
begin
1: $D^{(1)} := \phi$, $D^{(2)} := \phi$, $D^{(3)} := \phi$, *Used* := ϕ;
2: **for** $\alpha := 2$ to $\lceil \varepsilon N \rceil$ **do begin**
3: // Update synopsis $D^{(1)}$.
4: **foreach** $a \in B_\alpha$ **do**
5: **if** $\exists(a,f,\delta) \in D^{(1)}$ **then** $f := f + 1$ **else** $D^{(1)} := D^{(1)} \cup \{(a,1,\alpha)\}$;
6: **forall** $(a,f,\delta) \in D^{(1)}$ s.t. $f \leq \alpha - \delta$ do $D^{(1)} := D^{(1)} \setminus \{(a,f,\delta)\}$;
7: **for** $\kappa := 2$ **to** k **do begin**
8: // Construct synopsis $D^{(\kappa)}$ by using $D^{(\kappa-1)}$ and $D^{(1)}$.
9: **for** $\beta := 1$ **to** $1 / \varepsilon$ **do begin**
10: $W_{\alpha,\beta} := S[(\alpha - 1) / \varepsilon + \beta, (\alpha - 1)/\varepsilon + \beta + (\kappa - 1)T]$;
11: **Enumerate** all sequences $o = (i(1),\ldots,i(\kappa-1),i(\kappa))$ in $W_{\alpha,\beta}$ s.t.
12: (i) $i(1) = (\alpha - 1) / \varepsilon + \beta$,
13: (ii) there is a triplet containing $(a_{i(1)},\ldots,a_{i(\kappa-1)})$ in $D^{(\kappa-1)}$, and
14: (iii) there is a triplet containing $a_{i(\kappa)}$ in $D^{(1)}$,
15: in increasing order w.r.t. "$\leq_{all}$", and **foreach** $o = (i(1),\ldots,i(\kappa))$ **do begin**
16: $\pi := (a_{i(1)},T,\ldots,T,a_{i(\kappa)})$;
17: **if** $(\pi,i(\tau)) \notin$ *Used* for $\forall\tau$ $(1 \leq \tau \leq \kappa)$ **then begin**
18: **if** $\exists(\pi,f,\delta) \in D$ s.t. o is an occurrence of π **then** $f := f + 1$ **else** $D := D \cup \{(\pi,1,\alpha)\}$;
19: **forall** τ $(1 \leq \tau \leq \kappa)$ **do** add $(\pi,i(\tau))$ into *Used*
20: **end**
21: **end**
22: **end**;
23: **forall** $(\pi,f,\delta) \in D$ s.t. $f \leq \alpha - \delta$ **do** $D := D \setminus \{(\pi,f,\delta)\}$;
24: **Remove** from *Used* all elements whose first entry is an index in S_α
25: **end**
26: **end**;
27: **output** all π s.t. $\exists(\pi,f,\delta) \in D$ and $f \geq (\gamma - \varepsilon)N$
end.

Figure 4. An Apriori-Like Lossy Counting Algorithm for FCFS-TSP for $k = 3$.

Lemma 2. For $k \leq 3$, the k-time sequence patterns satisfy anti-monotonicity with respect to the FCFS-maximal frequency; that is, for a stream data S, a k-time sequence pattern $\pi = (e_1,T_1,\ldots,T_{k-1},e_k)$, its prefix sub-pattern $\pi' = (e_1,T_1,\ldots,T_{k-2},e_{k-1})$, and its postfix sub-pattern $\pi'' = (e_2,T_2,\ldots,T_{k-1},e_k)$, $|\mathrm{Occ}^{FCFS}{}_S(\pi)| \leq |\mathrm{Occ}^{FCFS}{}_S(\pi')|$ and $|\mathrm{Occ}^{FCFS}{}_S(\pi)| \leq |\mathrm{Occ}^{FCFS}{}_S(\pi'')|$.

Proof. We discuss the case where $k = 3$ and $|\mathrm{Occ}^{FCFS}{}_S(\pi)| \leq |\mathrm{Occ}^{FCFS}{}_S(\pi')|$. Let $O = \{(i_1,i_2) \mid$ there is a positive integer i_3 such that $(i_1,i_2,i_3) \in \mathrm{Occ}^{FCFS}{}_S(\pi)\}$. Obviously, $|O| = |\mathrm{Occ}^{FCFS}{}_S(\pi)|$ and O is an independent occurrence set of π'. We make the following claims:

Claim: (1) For $o_1 = \min_{\leq_{all}} O$ and $o'_1 = \min_{\leq_{all}} \mathrm{Occ}^{FCFS}{}_S(\pi')$, $o_1 = o'_1$. (2) Let o_i and o'_i be the i-th occurrences with respect to "$\leq_{all}$" of O and $\mathrm{Occ}^{FCFS}{}_S(\pi')$, respectively. If $o'_i \leq_{all} o_i$ and there is an occurrence $o_{i+1} \in O$, then there is an occurrence $o'_{i+1} \in \mathrm{Occ}^{FCFS}{}_S(\pi')$ such that $o'_i <_{all} o'_{i+1} \leq_{all} o_{i+1}$.

(*Proof of Claim*) Statement (1) is obvious. We assume that there is no occurrence $o'_{i+1} \in \mathrm{Occ}^{FCFS}{}_S(\pi')$ such that $o'_i <_{all} o'_{i+1} \leq_{all} o_{i+1}$. Let $o'_i = (i_1,i_2)$, $o_i = (j_1,j_2)$, and $o_{i+1} = (k_1,k_2)$. We assume that $o'_i \leq_{all} o_j$. We show that o'_i and o_{i+1} are not duplicate. If o'_i and o_{i+1} are duplicate, then there are two indices τ and τ' (τ, $\tau' = 1,2$) such that $i_\tau = k_{\tau'}$. Since $o'_i \leq_{all} o_i$, we have $i_\tau \leq j_\tau$. In addition, since o_i and o_{i+1} are not duplicate, we have $j_\tau < k_\tau$. Finally, we have $i_\tau = k_{\tau'} \leq j_\tau < k_\tau$ and $\tau' = 1$, $\tau = 2$. Moreover, the first and second events of π' are the same.

Since o_i and o_{i+1} are not duplicate O, $k_1 < j_2$. Since O is obtained from $\mathrm{Occ}^{\mathrm{FCFS}}{}_S(\pi)$, (j_1,k_1) must be in O instead of (j_1,j_2). Therefore, we conclude that o'_i and o_{i+1} are not duplicate. Since $o'_i <_{all} o_{i+1}$, at least o_{i+1} or an occurrence smaller than o_{i+1} must be chosen as the $(i + 1)$-th element of $\mathrm{Occ}^{\mathrm{FCFS}}{}_S(\pi')$ by Procedure FCFS-MOS (Fig. 1).

Thus, we prove this lemma. (Q.E.D.)

From Lemma 2, we obtain the next theorem. This can be proved in a way similar to Theorem 1.

Theorem 2. The APRIORI-FCFS-MOS algorithm correctly maintains an ε-deficient synopsis for $k \leq 3$.

5. EXPERIMENTAL RESULTS USING INTERNET LOG DATA

In this section, we present the experimental evaluations of our algorithms using real data. As real-world stream data, we used the internet access log data (DNS log data) obtained from an anonymous domain network server. The experiments were run on the following computer environment. CPU: Xeon E5620 (2.4GHz, 12MB Cache) × 2, Memory: 24GB, OS and C compiler: Red Hat Linux, GCC 4.4.6. For $k = 3$, $N =$ 3,000, $T = 30$, and $\varepsilon = 0.01$, the APRIORI-FCFS-MOS algorithm finished computation within 1 s of CPU time, whereas the ROUND_ROBIN-FCFS-MOS algorithm consumed 9,584 s of CPU time. If a frequency distribution follows Zipf's law, the Apriori-like method can save considerable CPU time by skipping events that occur only once in each bucket. The experimental results of the APRIORI-FCFS-MOS algorithm are discussed below.

1. CPU time vs. the length of time sequence patterns k: We applied the APRIORI-FCFS-MOS algorithm to DNS log data with $N = 100{,}000$, and set $T = 25$, $\varepsilon = 0.0001$, and $\gamma = 0.00011$. The results are shown in Table 1. The maximum (resp. average) memory consumption is the maximum (resp. average) memory size for synopsis D and the *Used* data structure in every bucket processing step. We observe that as k increases, the CPU time increases rapidly. As stated before, the APRIORI-FCFS-MOS algorithm does not maintain an ε-deficient synopsis for $k = 4$. Thus, the result in the case of $k = 4$ might show erroneous values.
2. CPU time vs. the error ratio ε and time interval T: We set the other parameters as $k = 3$, $N = 100{,}000$, and $\gamma = 0.00051$. No (k,T)-time sequence pattern was found in any experiments. As ε decreases or T increases, in order to construct (k,T)-time sequence patterns, we must combine many $(k\text{-}1,T)$-time sequence patterns and 1-time sequence patterns. Therefore, as the number of combinations increases, the CPU time and memory consumption increase.
3. Scalability: We set the parameters as $k = 3$, $T = 36$, $\varepsilon = 0.00005$, and $\gamma = \varepsilon + 1 / N$. In Table 3, the CPU time in each column is always smaller than the DNS log recording time. The memory consumptions increase as ε or T increases in Table 2; however, it does not increase greatly as N increases. This is because the number of frequent time sequence patterns may reach the maximum. Then, we can conclude that the APRIORI-FCFS-MOS algorithm can process a stream data in real time.

Table 1. CPU Time vs. the Length of Time Sequence Patterns k

K	2	3	4
CPU time (s)	28	48	315
Maximum memory consumption (KB)	59,043	214,566	768,393
Average memory consumption (KB)	36,416	118,261	402,274
Number of patterns found	50	6	0

Table 2. CPU Time vs. Error Ratio ε and Time Interval T

ε	0.0005			0.0002			0.0001		
T	10	20	30	10	20	30	10	20	30
CPU time (s)	2	3	7	7	12	28	14	29	89
Maximum memory consumption (KB)	13,378	30,839	63,205	26,617	69,215	143,119	49,748	147,186	318,675
Average memory consumption (KB)	5,249	10,532	18,369	14,570	32,989	61,704	32,343	82,056	162,757

Table 3. Scalability on N

N	500,000	1,000,000	1,500,000	2,000,000
DNS log recording time (hh:mm:ss)	1:49:38	4:10:41	6:57:54	8:47:43
CPU time (hh:mm:ss)	0:59:17	2:39:24	2:58:28	4:13:17
Maximum memory consumption (KB)	1,011,152	1,302,228	1,302,228	1,302,228
Average memory consumption (KB)	573,959	589,269	538,044	505,508
Number of patterns found	70	89	85	82

6. CONCLUSION

We proposed a round-robin and an Apriori-like lossy counting algorithm for finding all frequent time sequence patterns with respect to the FCFS-maximal frequency. The Apriori-like algorithm maintains an ε-deficient synopsis for $k \leq 3$. We experimentally showed that the APRIORI-FCFS-MOS algorithm could process a stream data in real time. Currently, we are developing a streaming algorithm that maintains an ε-deficient synopsis, for finding all frequent k-time sequence patterns for $k \geq 4$.

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AN AVATAR-MEDIATED SPEECH-DRIVEN EMBODIED COMMUNICATION SYSTEM WITH AN EYEBALL MOVEMENT MODEL

Yoshihiro Sejima[1], Tomio Watanabe[2] and Mitsuru Jindai[2]
[1]*Graduate School of Science and Engineering, Yamaguchi University, 2-16-1, Tokiwadai, Ube, Yamaguchi, 755-8611, Japan*
[2]*Department of Systems Engineering, Okayama Prefectural University, 111, Kuboki, Soja, Okayama, 719-1197, Japan*

ABSTRACT

We have already analyzed human eyeball movement through avatars using an embodied virtual communication system with a line-of-sight measurement device. We proposed an eyeball movement model consisting of an eyeball delay movement model and a gaze withdrawal model. In this paper, we develop an advanced avatar-mediated communication system in which the proposed eyeball movement model is applied to speech-driven embodied entrainment characters called InterActors. The communication system generates eyeball movement on the basis of the developed model, and also generates the entrained head and body motions of InterActors using only speech input. The effectiveness of the proposed eyeball movement model and communication system is demonstrated by means of sensory evaluations.

KEYWORDS

Human Interaction, Nonverbal Communication, Avatar-Mediated Communication, Line-of-sight, Eyeball Movement

1. INTRODUCTION

As information technology progresses, it is now becoming possible for humans to use computer-generated (CG) characters called avatars to communicate in 3D virtual space over a network (Matsuda, 2003; Dilley, 2008). Because the avatars express nonverbal behavior based on keyboard commands, current systems do not simulate embodied sharing using synchrony of embodied rhythms, such as the nodding and body movements in human face-to-face communication. In such communication, not only verbal messages but also nonverbal behavior such as nodding, body movement, gaze and facial expression are rhythmically related and mutually synchronized between talkers (Condon & Sander, 1974; Watanabe, 2003). This synchrony of embodied rhythms in communication is called entrainment, and it generates the sharing of embodiment in human interaction.

Focusing on the entrainment of embodied communication in our previous work, we analyzed the entrainment between a speaker's speech and a listener's nodding motion in face-to-face communication, and developed iRT (InterRobot Technology), which generates a variety of communicative actions and movements such as nodding and body movements using speech input (Watanabe, Okubo, Nakashige, & Danbara, 2004). In addition, we developed an interactive CG character called "InterActor", and demonstrated that InterActor can effectively support human interaction and communication.

Body movements as well as line-of-sight information such as eye contact and gaze duration play an important role in smooth human face-to-face communication (Kendon, 1967; Argyle & Dean, 1965; Matsuo, 1999). Moreover, it is reported that smooth communication via avatars is realized by expressing the avatar's line-of-sight. For example, Vertegaal developed a system that conveys the line-of-sight between talkers in remote communication by transmitting the talker's measured eyeball movement to the avatar (Vertegaal, 1999). Lee et al. demonstrated that "familiarity" and "vividness" are increased by an avatar that models human line-of-sight behavior in face-to-face communication (Lee, Badler, & Badler, 2002). In addition, Ishii et al. developed a communication system that controls an avatar's gaze based on an estimated line-of-sight model and demonstrated that utterance is facilitated between talkers using this model in an avatar-mediated

communication (Ishii, Miyajima, & Fujita, 2008). These systems generate the avatar's eyeball movement by a statistical model based on face-to-face communication characteristics. However, it is difficult for these systems to enhance embodied interaction because the characteristics of human line-of-sight in avatar-mediated communication have not yet been investigated. In our previous research, we analyzed human eyeball movement through avatars by using an embodied virtual communication system with a line-of-sight measurement device (Sejima, Watanabe, & Jindai, 2010). On the basis of this analysis, we proposed an eyeball movement model, consisting of an eyeball delay movement model and a gaze withdrawal model.

In this paper, we develop an advanced avatar-mediated communication system by applying the proposed eyeball movement model to InterActors. This communication system generates communicative movements and actions, as well as eyeball movement, on the basis of the proposed model by using only speech input. The effectiveness of the proposed eyeball movement model and communication system is demonstrated by means of sensory evaluations in an avatar-mediated communication system.

2. EMBODIED COMMUNICATION SYSTEM WITH AN EYEBALL MOVEMENT MODEL

2.1 InterActor

In order to support human interaction and communication, we developed a speech-driven embodied entrainment character called InterActor, which has the functions of both speaker and listener. The configuration of InterActor is shown in Figure 1. The listener's interaction model includes a nodding reaction model which estimates the nodding timing from a speech ON–OFF pattern and a body reaction model linked to the nodding reaction model (Watanabe, Okubo, Nakashige, & Danbara, 2004). The timing of nodding is predicted using a hierarchy model consisting of two stages - macro and micro (Figure 2). The macro stage estimates whether a nodding response exists or not in a duration unit which consists of a talkspurt episode $T(i)$ and the following silence episode $S(i)$ with a hangover value of 4/30 second. The estimator $Mu(i)$ is a moving-average (MA) model, expressed as the weighted sum of unit speech activity $R(i)$ in Equations 1 and 2. When $Mu(i)$ exceeds a threshold value, nodding $M(i)$ is also a MA model, estimated as the weighted sum of the binary speech signal $V(i)$ in Equation 3. The body movements are related to the speech input in that the neck and one of the wrists, elbows, arms, or waist are operated when the body threshold is exceeded. The threshold is set lower than that of the nodding prediction of the MA model, which is expressed as the weighted sum of the binary speech signal to nodding. In other words, when InterActor functions as a listener for generating body movements, the relationship between nodding and other movements is dependent on the threshold values of the nodding estimation.

$$M_u(i) = \sum_{j=1}^{J} a(j)R(i-j) + u(i) \qquad (1)$$

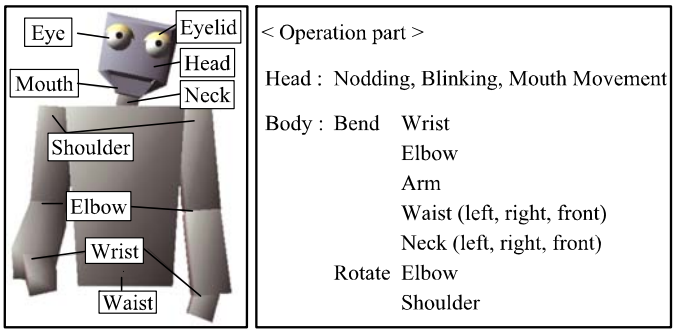

Figure 1. InterActor

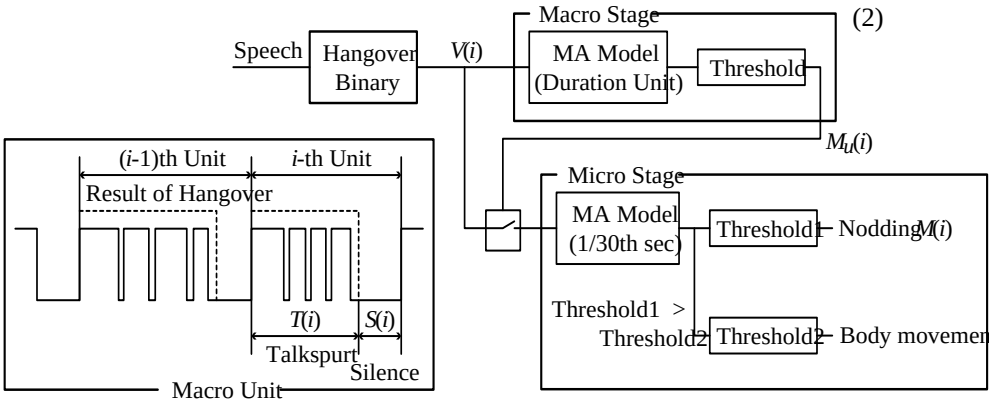

Figure 2. Interaction Model

$$R(i) = \frac{T(i)}{T(i) + S(i)}$$

$a(j)$: linear prediction coefficient
$T(i)$: talkspurt duration in the i th duration unit
$S(i)$: silence duration in the i th duration unit
$u(i)$: noise

$$M(i) = \sum_{j=1}^{K} b(j)V(i-j) + w(i) \qquad (3)$$

$b(j)$: linear prediction coefficient
$V(i)$: voice
$w(i)$: noise

The body movements as a speaker are also related to the speech input by operating both the neck and one of the other body actions at the timing over the threshold, which is estimated by the speaker's interaction model as its own MA model of the burst-pause of speech to the entire body motion. Because speech and arm movements are related at a relatively high threshold value, one of the arm actions in the preset multiple patterns is selected for operation when the power of speech is over the threshold.

2.2 Eyeball Movement Model

We proposed an eyeball movement model that generates an avatar's eyeball movement for enhancing embodied communication based on the characteristics of the analysis of human eyeball movement (Sejima, Watanabe, & Jindai, 2010). The proposed model consists of an eyeball delay movement model and a gaze withdrawal model.

2.2.1 Eyeball Delay Movement Model

The eyeball delay movement model consists of a delay of 0.13 s with respect to the avatar's head movement. First, the angle of the avatar's gaze direction for the viewpoint in virtual space is calculated using Equation 4 (Figure 3). Then, the avatar's gaze is generated by adding the angle of the avatar's head movement to the angle of the avatar's gaze direction in the fourth previous frame at a frame rate of 30 fps (Equation 5). Figure

4 shows an example of the eyeball delay movement model in an avatar. If the avatar's head moves, the eyeball moves with a delay of 0.13 s with respect to the head movement in the opposite direction.

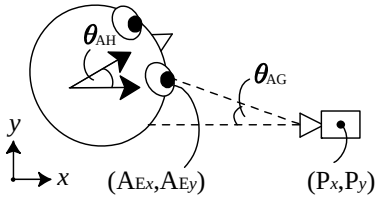

Figure 3. Rotation angle of gaze direction.

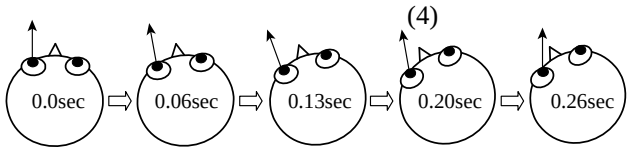

Figure 4. Example of the eyeball delay movement model for InterActor.

$$\theta_{AG} = \tan^{-1}\frac{A_{Ex} - P_x}{A_{Ey} - P_y}$$

θ_{AG} : Rotation angle of gaze direction

A_{Ex}, A_{Ey} : eyeball postion of InterActor

P_x, P_y : position of view point in virtual space

$$\theta_G(i) = \theta_{AH}(i) + \theta_{AG}(i-4) \quad (5)$$

$\theta_G(i)$: Rotation angle of eyeball movement

$\theta_{AH}(i)$: Rotation angle of InterActor's head movement

i : number of frame

2.2.2 Gaze Withdrawal Model

The analysis of the human eyeball indicates that direct gaze is limited to about 80% of total conversation time. Therefore, the gaze withdrawal model in this study stochastically generates eyeball movement for other gazes such as gaze withdrawal and blinking with an exponential distribution based on this analysis. The avatar's eyeball is moved downward by 5°, and the effectiveness of this movement was confirmed in a previous research (Ishii, Miyajima, & Fujita, 2008). We believe that an avatar's gaze should be modulated such that staring is prevented and impressions of the conversation such as vividness are enhanced (Iso, Kimura, Sakuragi, & Daibo, 2004).

2.3 System Configuration

We developed an advanced communication system in which the proposed model was used with InterActors (Figure 5). The virtual space was generated by Microsoft DirectX 9.0 SDK and a Windows XP workstation (HP workstation xw4200: CPU: Pentium 4 2.8 GHz, Memory: 1 GB, Graphics: NVIDIA Quadro FX3400). Voices were sampled using 16 bits at 44 kHz via a headset (SONY DR-260DP). InterActors were represented at a frame rate of 30 fps.

When Talker1 speaks to InterActor2, InterActor2 responds to Talker1's utterance with appropriate timing through its entire body motions, including nodding, blinking, and actions, in a manner similar to the body motions of a listener. In addition, InterActor2 generates an eyeball movement based on the proposed model. In this manner, two remote talkers can enjoy a conversation via InterActors within a communication environment in which the sense of unity is shared by embodied entrainment.

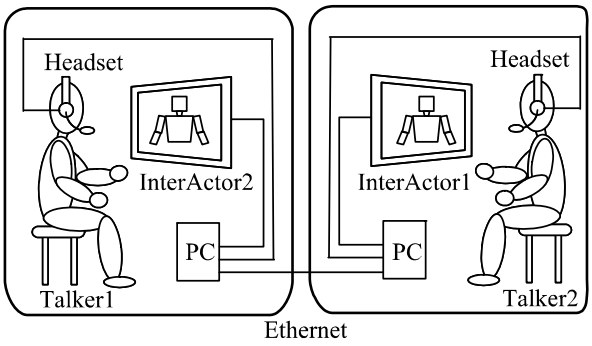

Figure 5. System setup.

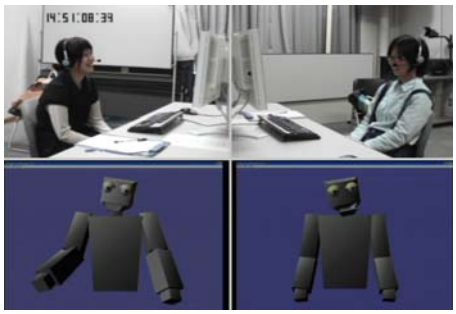

Figure 6. Example of a communication scene using the system.

3. COMMUNICATION EXPERIMENT

In this research, our eyeball movement model consists of an eyeball delay movement model and a gaze withdrawal model. Therefore, we first evaluated only the eyeball delay movement model, and then evaluated the combination of the eyeball delay movement model and gaze withdrawal model.

3.1 Evaluation of Eyeball Delay Movement Model

3.1.1 Experimental Method

The experiment was performed on talkers engaged in a free conversation. In this experiment, the following four modes were compared: in mode (a), the eyeball does not exhibit any movement; in mode (b), the eyeball moves with no delay; in mode (c), the eyeball moves with a delay of 0.13 s; and in mode (d), the eyeball moves with a delay of 0.26 s. We recorded the communication experiment using two video cameras and screens as shown in Figure 6. Each pair of talkers belonged to the same sex (16 males and 14 females).

The experimental procedure is described as follows. First, the subjects used the system for around 3 min. Next, they were instructed to perform a paired comparison of modes in which, based on their preferences, they selected the better mode. Finally, they were urged to talk in a free conversation for 3 min in each mode. The questionnaire used a seven-point bipolar rating scale from –3 (not at all) to 3 (extremely), where a score of 0 denotes "moderately." The conversational topics were not specified in both experiments. Each pair of talkers was presented with the two modes in a random order.

3.1.2 Result

The results of the paired comparison are summarized in Table 1. In this table, the number of winner is shown. For example, the number of mode (a)'s winner is seven for mode (b), and the number of total winner is twelve. Figure 7 shows the calculated results of the evaluation provided in Table 1 based on the Bradley-Terry model given in Equations 6 and 7 (Luce, 1959; Takeuchi, 1978).

$$p_{ij} = \frac{\pi_i}{\pi_i + \pi_j} \tag{6}$$

$$\sum_i \pi_i = const.(=100) \tag{7}$$

π_i : Intensity of i

p_{ij} : probability of judgment that i is better than j

Table 1. Result of paired comparison.

	(a)	(b)	(c)	(d)	Total
(a)		7	4	1	12
(b)	23		5	16	44
(c)	26	25		27	78
(d)	29	14	3		46

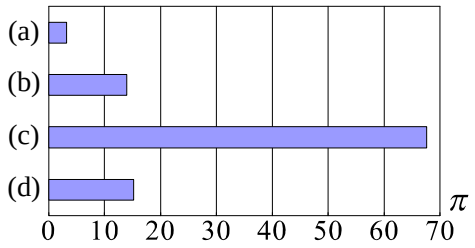

Figure 7. Comparison of π_i.

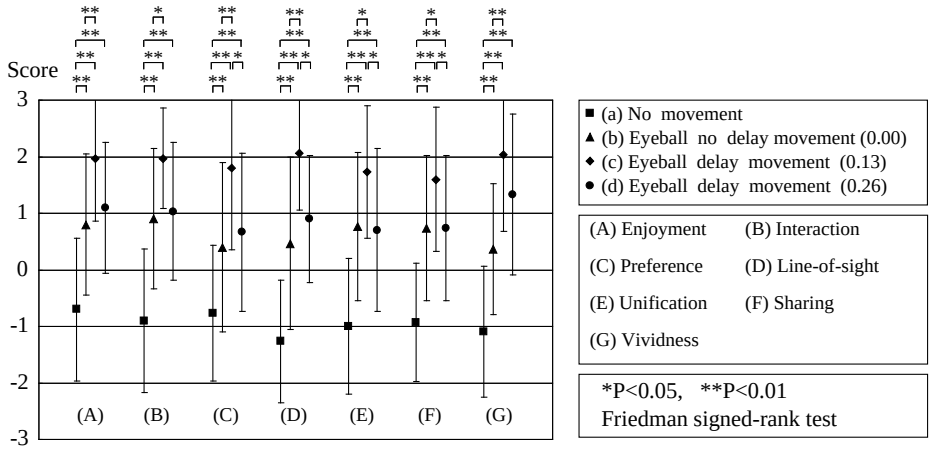

Figure 8. Seven-points bipolar rating.

The consistency of mode matching was confirmed by performing a goodness of fit test and a likelihood ratio test. The proposed mode (c), with a 0.13 s delay, was evaluated as the best; followed by mode (d), a 0.26 s delay; mode (b), no delay; and mode (a), no movement.

The questionnaire results are shown in Figure 8. From the results of the Friedman signed-rank test, all categories showed a significance level of 1% among modes (a), (b), (c), and (d). In addition, "Preference," "Line-of-sight," "Unification," and "Sharing" were at 5% among modes (c), (b), and (d).

In both experiments, mode (c) of the proposed eyeball delay movement model was evaluated as the best for avatar-mediated communication. These results indicate the effectiveness of the proposed eyeball delay movement model.

3.2 Evaluation of Eyeball Movement Model

3.2.1 Experimental Method

In this experiment, the following three modes were compared: mode (a) with no eyeball movement, mode (b) with eyeball delay movement only, and mode (c) with combined eyeball delay movement and gaze withdrawal. The experimental procedure was the same as detailed in Section 3.1.1. The subjects included 15 pairs of talkers (16 males and 14 females).

3.2.2 Result

The results of the paired comparison are summarized in Table 2. Figure 9 shows the calculated results of the evaluation provided in Table 2 using the Bradley-Terry model. The consistency of mode matching was confirmed by performing a goodness of fit test and a likelihood ratio test. The proposed mode (c) with combined movement was evaluated as the best, followed by mode (b) with eyeball delay movement only and mode (a) with no movement.

Table 2. Result of paired comparison.

	(a)	(b)	(c)	Total
(a)		3	3	6
(b)	27		11	38
(c)	27	19		46

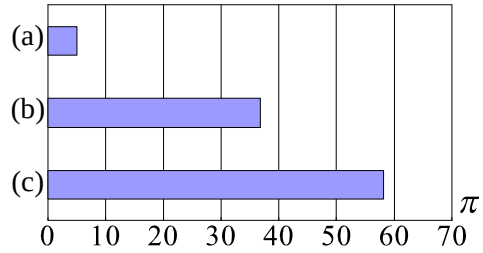

Figure 9. Comparison of π_i.

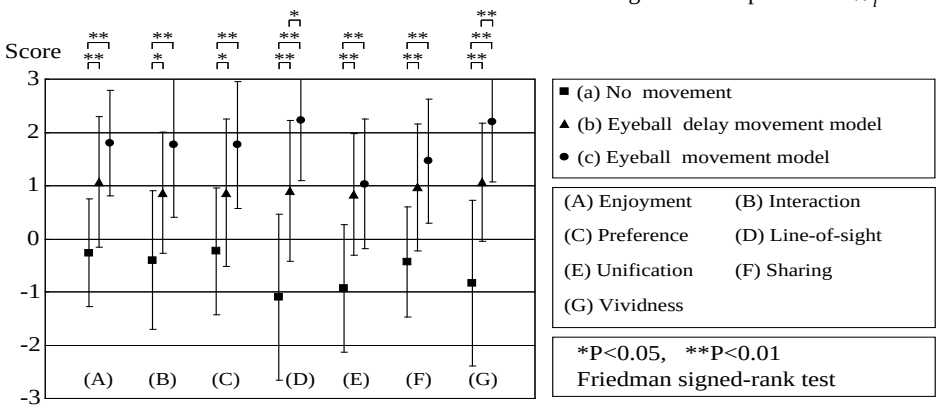

Figure 10. Seven-points bipolar rating.

The questionnaire results are shown in Figure 10. From the results of the Friedman signed-rank test, all categories showed a significance level of 1% among modes (a), (b), and (c). In addition, “Vividness” was at a significance level of 1%, and “Line-of-sight” was at 5% between modes (c) and (b).

These results demonstrate that the combined model is effective.

4. CONCLUSION

In this paper, we developed an advanced avatar-mediated communication system in which our proposed eyeball movement model is used by speech-driven embodied entrainment characters called InterActors. The proposed model consists of an eyeball delay movement model and a gaze withdrawal model. The communication system generates eyeball movement based on this model by generating the entrained head and body motions of InterActors using only speech input. Sensory evaluations in an avatar-mediated communication system showed the effectiveness of the proposed eyeball movement model and communication system.

ACKNOWLEDGEMENT

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USABILITY EVALUATION OF PRODUCTS AND SERVICES: A SYSTEMATIC REVIEW

Ana Martins[1], Alexandra Queirós[2] and Nelson Pacheco da Rocha[3]
[1]*Institute of Electronics and Telematics Engineering of Aveiro*
[2]*School of Health Sciences, University of Aveiro*
[3]*Health Sciences Department, University of Aveiro*
Campus Universitário de Santiago, 3810-193 Aveiro, Portugal

ABSTRACT

The paper intends to identify, analyse and classify the methods described in the literature for the usability evaluation of products and services based on information and communication technologies. For these purposes a systematic review of the literature on usability evaluation methods was performed. The retrieved studies were classified into one of three methods (inspection, inquiry or test). Then they were sub classified accordingly the specific techniques being described. A total of 116 papers were classified. Test methods were the most frequent in this review, followed by inquiry methods and, finally, inspection methods. The combination of methods is relatively frequent specially the combination of test and inquiry methods. This may happen because the conjunction of these two methods allows gathering complementary objective and subjective data.

KEYWORDS

Usability Evaluation, Test Methods, Systematic Review

1. INTRODUCTION

Digital technology is an increasingly global phenomenon. The information systems are everywhere and turn our lives easier and more functional (Best and Smyth 2011). With this spread of technology comes the growing importance and need that it should be user friendly. The use and acceptance of technologies and technical devices depend on various factors such as adequate design, financial resources, housing situation, functions included in the technologies according to user's skills and competences. In this area, a very important aspect is the evaluation of the usability.

The concept of usability was originally articulated naively in the slogan "easy to learn, easy to use". This term was often used to refer to the capability of a product to be easily used. This corresponds with the definition of usability as a software quality in ISO/IEC 9126-11: "a set of attributes of software which bear on the effort needed for use and on the individual assessment of such use by a stated or implied set of users" (Carrol 2009; ISO 1999).

During the 1990s, more sophisticated understandings of usability shifted from an all-or-nothing binary property to a continuum spanning different extents of usability. Usability turned to be about supporting users in achieving their goal, and not only a characteristic of the user interface (Cockton 2012).

Around the turn of the century, the rise of networked digital media (*e.g.* web, mobile, interactive TV or public installations) added novel emotional concerns for of Human Computer Interaction (HCI), giving rise to yet another term: user experience (Cockton 2012). According to the new definition of usability by ISO 9241-11 usability is the extent to which a service or product may be used by specific users in a given context of use, to achieve specific goals with efficiency and effectiveness, while promoting feelings of pleasure (Nielsen 2003; ISO 1999). The word usability also refers to methods for improving ease-of-use during the design process (Nielsen 2003) .

Within the field of HCI the usability has been reconstructed continually and has become increasingly rich and problematic. Usability now often subsumes qualities like fun, well-being, collective efficacy, aesthetic tension, enhanced creativity, support for human development, and many others. Current understandings of

usability are thus different from those from the early days of HCI in the 1980s. Since then, ease of use has improved though both attention to interaction design and improved levels of literacy related with information and communication technologies across much of the population in advanced economies. Familiarity with basic computer operations is now widespread, as evidenced by terms such as "digital natives" and "digital exclusion", which would have had little traction in the 1980s. Usability is no longer automatically the dominant concern in interaction design. Research on usability has since the late 1990s been superseded by research on user experience. User experience is a broader concept than usability, and moves beyond efficiency, task quality and vague user satisfaction to a wide consideration of cognitive, affective, social and physical aspects of interaction.

Usability is now one aspect of user experience. Even so, usability remains important. The value of the recent widening focus to user experience is that it places usability work in context. Usability work is no longer expected to establish its value in isolation, but is instead one of several complementary contributors to design quality (Cockton 2012).

These recent focus on quality in use and user experience makes it clear that the design of interactive systems cannot just focus on features and attributes of the systems. Instead, we must focus on the interaction of users and software in specific settings. We cannot reason solely in terms of whether software is inherently usable or not, but instead have to consider what does or will happen when systems are used, whether successfully, unsuccessfully, or some mix of both. Once we focus on interaction, a wider view is inevitable, favouring a broad range of concerns over a narrow focus on software and hardware features (Cockton 2012).

A very recent approach about usability, referred as PET design, which stands for Persuasion, Emotion and Trust, has its basis in a deep understanding of customers' subtle emotional triggers and employs a rigorous set of new research-based methods and techniques (Schaffer 2009). This approach is being applied in web design and is based on the assumptions that user engagement rather than classic usability is what sets effective web design apart. Once a customer has entered a web site, we must create a sense of trust, persuasive design is fundamentally more qualitative, deep, and subtle than usability, since the thinking processes that guide our commercial choices are complex and emotional, not logical and linear (Schaffer 2009).

The good usability have several benefits, such as (Bevan 1998; Bevan, Claridge et al. 2005): increased efficiency and productivity, reduced error rate and training requirements and improved acceptance. Furthermore, good usability has impact in disadvantaged costumers and users with special needs. In this respect, user centred design provides a framework for achieving accessibility and Design for All. The Design for All philosophy emphasizes the need to provide access to information systems for the broadest possible range of users, mainly the young and elderly, and people with impaired physical and visual capabilities.

Despite of all the benefits described above, there are also barriers to usability. Designing successfully for large organizations require technical and cultural changes and strategic commitment: usability must be an objective of systems development, but until recently there has been no way to accurately specify usability.

The usability evaluation is an important part of the overall design of the user interface, which consist of interactive cycles of design, prototyping and validation (Ivory and Hearst 2001). The vast majority of development processes focus entirely on adherence to technical and process specifications. This is one of the main reasons why systems are either partially used, misused, abused, not used at all or have failed to gain broad acceptance (Bevan, Claridge et al. 2005). The introducing of user centred methods ensures that "real products can be used by real people to achieve their tasks in real world" (Bevan 1998).

The emerging concept of Living Labs represents a user-centric research methodology for sensing, prototyping, validating and refining complex solutions in multiple and evolving real life contexts. The purpose of such Living Lab concept in a wider use is to enhance innovation, inclusion, usefulness and usability of information and communication technologies and its applications in the society (Eriksson, Niitamo et al. 2005). A central idea of the Living Lab concept is a strong and active involvement of users in all the phases of development, since the conceptual design and, later, the prototypes. However, this is not the only focus of Living Lab approach; it also strives to facilitate the interaction between other stakeholders such as organizations (Feurstein, Hesmer et al. 2008).

The importance of usability has been recognized several decades ago and it has been addressed in a vast list of academic literature, field guides, case studies and best practices (Best and Smyth 2011). Organizations are increasingly aware to the issue of usability, but the guidance about how to do usability tends to be technique-centred, concentrating on specific approaches for designing or evaluating systems (Bevan and Curson 1999).

The objective of the paper is to identify, analyse and classify the methods described in the literature for the usability evaluation. To achieve these aims, the authors had performed a systematic literature review.

The paper, in addition to this introduction, has four more sections. The available evaluation methods are described in the section Usability Evaluation Methods. On the other hand, the sections Systematic Review and Results present, respectively the design of the systematic review and its results. Finally, some conclusions are presented in the section Discussion of the Results.

2. USABILITY EVALUATION METHODS

There are a variety of usability evaluation methods. Certain methods use data from users, while others rely on usability experts. Test and inquiry methods use real users to obtain data and inspection method rely on usability experts. There are usability evaluation methods for all stages of design and development, from the specification to final design adjustments (Hanington and Martin 2012).

Evaluation methods can be analytical (based on examination of an interactive system and/or potential interactions with it) or empirical (based on actual usage data).

Inspection methods involve the participation of experts to assess the various aspects of user interaction in a given system. The inspection methods may include (Hanington and Martin 2012, Nielsen 2012): cognitive walkthrough, usability inspection, consistency inspection, automatic test methods and heuristic evaluation.

Inquiry methods involve collecting qualitative data from users. Although the data collected is subjective, it provides valuable information on what the user wants. There are various methods that can be considered (Bevan and Burval 2003): task analysis, focus groups, interviews, diary studies and questionnaires or surveys.

Test methods are techniques that involve observing users while they perform tasks with a specific product or service (Nielsen 1994). The usability evaluation method consists of collecting mostly quantitative data from subjects. Usability evaluation focuses on people and their tasks, and seeks empirical evidence about how to improve the usability of an interface. This method includes several techniques, such as (Bernsen and Dybkjaer 2009, Hanington and Martin 2012, Bevan and Burval 2003, Castillo 1997, Brinkman, Haakma et al. 2008): rapid prototyping (mock ups), hallway testing, rapid iterative testing and evaluation, performance evaluation, observation, think-aloud, Wizard of Oz, remote usability testing, component-based usability test, subjects-in-tandem or co-discovery, personas and scenarios.

3. SYSTEMATIC REVIEW

A systematic review of usability evaluation literature published after 2006 was undertaken. The method and techniques of usability evaluation, the product or service tested and the objective of each study were registered and analysed. The methodology used to conduct this systematic review is detailed in the following sub sections.

A. Research Questions

In order to examine the usability evaluation of products and services, we formulated the following research questions:

RQ1: Which are the methods that are being applied in the usability evaluation of products and services?

After having identified these methods, we have two additional research questions:

RQ1.2: Which kinds of product or services are being tested in terms of usability?

RQ2: Which test methods are used in Living Lab environments?

RQ3: What is the evolution trend for each method over the years?

B. Search Process

The search process began with the identification of the terms used in this field. This was done to minimize the effect of different terminologies. The following search terms were used: "usability evaluation" or "usability test" and "Living Lab" and "user centred". To limit the number of references, the search was performed just in the title. Studies were sought using Web of Science Databases, because it has indexed over 12,000 of the highest impact journals worldwide, including important journals in the field such as ACM Digital Library and IEEE journals.

C. Study Selection

The inclusion criteria for a study to be included in this review were the reference of a usability evaluation of a product or service.

The database searches resulted in 225 references, of which 2 were duplicates, 32 did not had abstract and 75 did not meet the inclusion criteria and, therefore, were excluded. Thus, a total of 116 references were included in this review (Figure 1). Some papers had the aim of comparing usability evaluation methods and, in this case, just the ones that actually performed a usability evaluation itself were considered. All the ones that had a conceptual basis (*e.g.* legal and ethical aspects of usability evaluation, market studies, review papers and editorial material) were excluded.

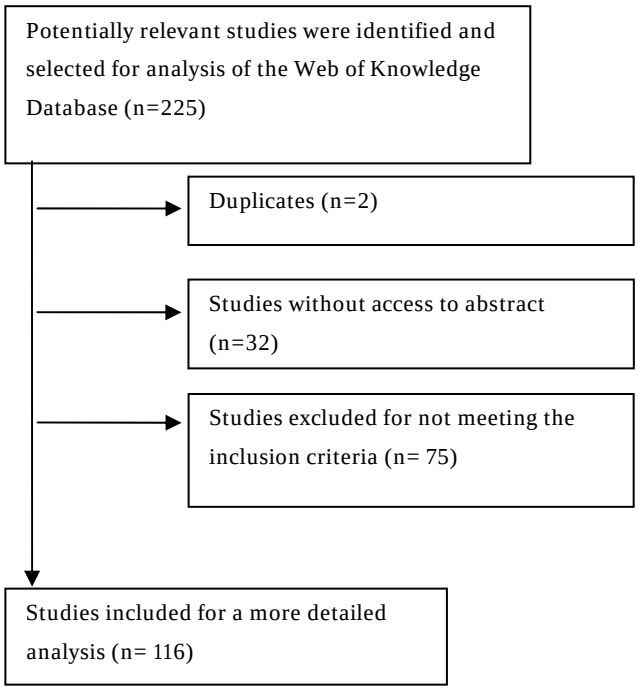


Figure 1. Flow chart of the systematic review

We started by excluding all duplicates and studies without abstract. The initial idea consisted in a first screening analysis of the abstracts, however, in the vast majority of the studies included in this systematic review, the information we were looking for was not described in the abstracts, so we had to extend the analysis to the full paper in order to identify the usability evaluation methods being used.

After the screening, studies were divided into methods and techniques. Whenever that information was present, for each study we marked the methods and techniques used in the usability evaluation process. This categorization is in accordance with the terms presented above, in the section Usability Evaluation Methods.

We designed a data extraction form to collect all the information needed to address the review questions and data synthesis. This form included: publication year, authors, publication title, main objective, what kind of products and/or systems were tested, and what kind of evaluation methods and techniques were used in the evaluation. Data analysis was performed using the statistical tool Microsoft Excel 2010.

4. RESULTS

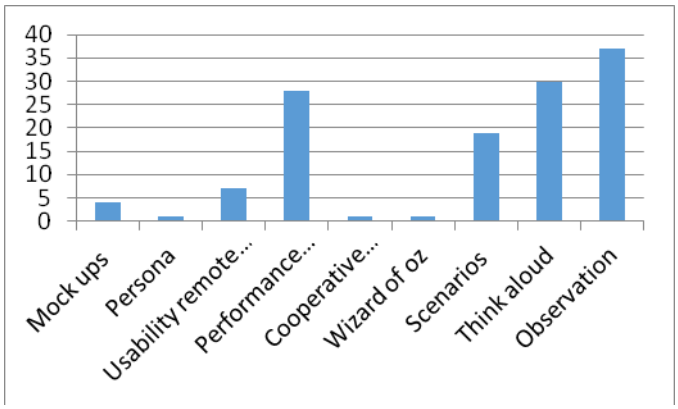
In this section we present the descriptive evaluation of the assessed literature in relation to the research questions.

This literature review included 116 studies. Of those, 98 studies performed evaluations involving users (84.5%), and only 18 studies performed evaluations involving experts (16.38%). In 13 studies, we did not

have any information about the methods used in the usability evaluation (11.2%). Note that several studies included more than one method or technique.

Regarding the evaluations involving users, 79 studies used test methods and 66 studies used inquiry methods.

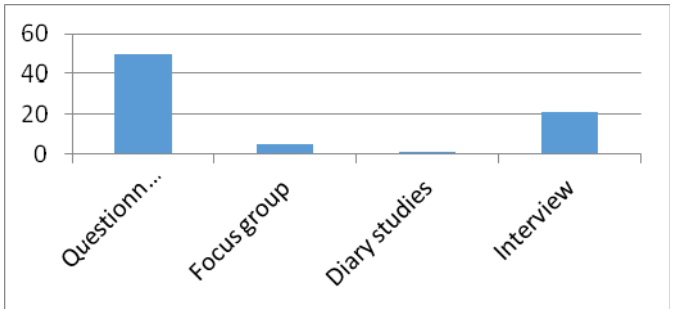
The most frequent test method technique was observation (37) followed by think-aloud (30) and performance evaluation (28). The less frequent techniques in this review with just one study was persona, cooperative usability test and Wizard of Oz. Graph 1 details the number of studies using each test method technique.



Graph 1. Number of studies using test method techniques

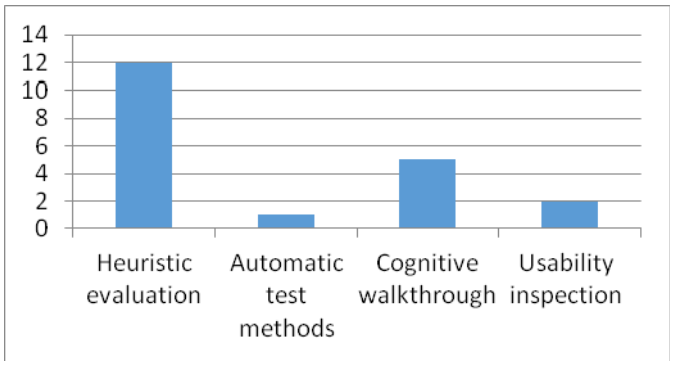
The most frequent inquiry method technique was questionnaire or survey with 50 studies, followed by interview with 21 studies, and the less frequent technique was diary studies with just one study.

Graph 2 details the number of studies using inquiry method techniques.



Graph 2. Number of studies using inquiry method techniques

Regarding the evaluation supported by experts, the inspection method was used in 18 studies. The most frequent inspection method technique was heuristic evaluation with 12 studies, and the less frequent technique was automatic test methods with just one. Graph 3 details the number of studies using inspection method techniques.



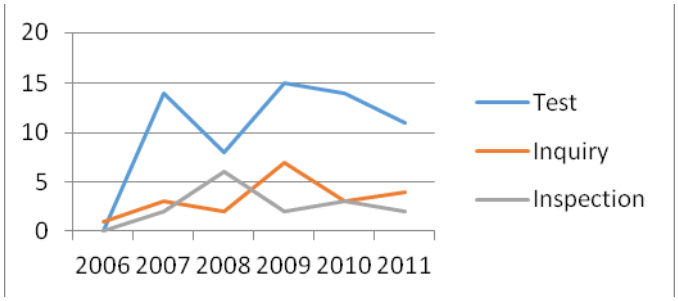
Graph 3. Number of studies using inspection method techniques

In this literature review, we found that 49 studies combined inquiry and test methods, 1 study combined inspection and inquiry and 4 studies combined not just two, but three evaluation method: test, inquiry and inspection.

By analysing the studies publication over the years, it is possible to identify an increasing trend in the usability evaluation based on test methods, from 0 studies in 2006 to a maximum of 15 studies in 2009, and with a little decrease in 2010 e 2011 with 14 and 11 studies respectively. In 2008 test methods have been applied only in 8 studies.

The inquiry methods grew gradually from 1 study in 2006 to 7 studies in 2009 and then slightly decreased to 4 studies in 2011. The inquiry methods revealed, although in a smaller magnitude, the same increasing and decreasing trend as the test method. Regarding to the inspection methods, there was a slight increase until 2008 with 6 studies, and slightly decreased thereafter. Contrary to what happened in the test and inquiry methods, the inspection methods showed an opposite trend of increasing and decreasing when compared with the other evaluation methods.

The year 2012 was removed from the analysis, as it is likely that further studies would be published by the end of the year. The Graph 4 presents graphically this trend.



Graph 4. Evolution trend of usability methods over the years

In this systematic review, the usability evaluation described in the majority of the studies was related to services (82 studies), such as websites, e-learning platforms and applications. Some examples of services are a health information systems (Croll 2010), a library web site (Fry and Rich 2011), an e-learning platform (Granic and Cukusic 2011) and a health website (Lachance, Erby et al. 2010).

34 studies described the usability evaluation of products, such as health support devices and mobile devices. Some examples of products are a mobile robot (Boissy, Briere et al. 2011), home cholesterol test kits (Surabattulaa, Harvey et al. 2009), new pen device for the administration of growth hormone therapy (Fuchs, Mikkelsen et al. 2009) and a digital talking book (Kwak and Bae 2009).

5. DISCUSSION OF THE RESULTS

This systematic review allowed the construction of an overview about the usability evaluation methods and techniques that have been used in the last six years. This overview enables us to identify trends and insights about the evolution in this field and the type of products and services that are being usability tested. The vast majority of evaluation methods listed during the literature review and described in the section Usability Evaluation Methods were also identified in the studies included in this systematic review. A few methods, however, were not identified in any of the studies, probably because the studies number was not large enough to embrace all techniques. If the research had used the key words in abstract or full paper, instead of just in the title, the number of references potentially relevant for the study would be much larger, and probably would include all techniques available.

One of the research questions that this study intended to address, was the identification of the evaluation methods used in a Living Lab approach. In this sample of studies no evaluation method was implemented in the scope of a Living Lab approach. This is a very important finding that suggests that the usability evaluation is still being made according to a traditional perspective of products and services development. Følstad (2008) defends that the Living Lab is still a new and upcoming approach, and many aspects still have to be explored and understood, and there is a need for research about methods and approaches suitable and supportive of Living Lab activities, and this may be a reason for the absence of studies based on this approach (Følstad 2008).

One of the finding of this literature review was that the test methods are largely used when compared with other methods such as inquiry or inspection. This seems to denounce recognition of the end-users role in the usability evaluation. Since real users seem to be closer to real needs, who better to evaluate a product or service then the one who will use it? This is in line with the Living Lab approach, and may suggest that this approach has the potential to be considered in future usability evaluations.

A great number of products and services were evaluated in terms of usability using a combination of different methods. The evaluation of products and services is a complex task and the utilization of just one method may not be comprehensive and complete enough to perform an exhaustive evaluation of the usability issues of a certain product or service. In the other hand, a combination of methods enables a complementary evaluation, which contributes to a complete evaluation of the several features of a product or service. The most frequent method combination found in this review was test and inquiry methods, what may happen due to the fact that the test method is more objective, resulting normally in quantitative data, and the inquiry method in more subjective resulting normally in qualitative data. In this sense, these methods seem to be complementary and the combination of both results in a more complete evaluation. This trend is also in line with the Living Lab concept, as this approach is very comprehensive, and may require the utilization of several methods and techniques for the development and evaluation of products and services.

In this systematic review, the usability evaluation described in the majority of the studies was related to services and only a small minority refers to the evaluation of products. Tendentiously the usability is associated with the HCI, which may explain the greater incidence of services evaluation, considering that in this study we considered websites, applications and platforms as services.

By analysing the studies publication over the years, it is possible to identify an increasing trend in the usability evaluation based on test methods, with a slightly decrease in the last two years. The inquiry methods show a similar trend, although in a smaller magnitude. This may happen because, as referenced before, these two methods seem to be used simultaneously in a vast number of studies, combining the complementary methods of objective and subjective data. Curiously, the inspection method has a boom in 2008, which coincides with the lower number of studies of the other two methods (test and inquiry). After a research about this intriguing fact, we found that an hypothesis of explanation is the fact that an online heuristic evaluation competition was hosted on the World Usability Day website in the end of 2007, and this may have captured the attention of products and services developers to inspection methods (Kirmani 2008).

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A SURVEY ABOUT SYSTEMS THAT SUPPORT NEGOTIATIONS

Sergio Assis Rodrigues[1], Ekaterina Tskhakaya[2], Jano Moreira de Souza[1]
[1] *Federal University Of Rio de Janeiro, Computer Science Department – COPPE/UFRJ, Rio de Janeiro, Brazil*
[2]*University of York, Heslington, York, UK*

ABSTRACT

In the world of modern business negotiation process is becoming even more complicated – more than two parties are being involved, negotiation costs vary, as does the distance between negotiators. To solve these problems and to support successful negotiations, individuals are more frequently using negotiation support systems. Such systems help to solve misunderstanding between negotiators that occurs due to language differences, assist in decision making process and evaluate offers, making it easier for negotiators to communicate. A comparison of several negotiation support systems outlines the diverse nature of such systems and their appropriateness to a separate case. Also, it helps understand the advantages and the drawbacks of each system separately, and help users decide (using the analysis of outlined characteristics) which system will be more suitable for them. Because some of the systems were created to serve specific purposes it may be more beneficial to choose the one which is closer to the required area.

KEYWORDS

Negotiation, negotiation support systems, software tools.

1. INTRODUCTION

Negotiation Support Systems (NSS) are tools that are considered to be increasingly useful in the business environment. Since many of the negotiators are spread around the globe but still need to communicate fast with each other, NSS are becoming very widespread. These systems not only act as a type of communication, but also offer a variety of options that negotiators find useful, such as decision trees and tables, forecasts of events, comparison mechanisms, tools building contract versions, storage of the history of negotiations and many other functions.

This article represents a comparison of a variety of NSS by introducing and characterizing all of them separately and by contrasting their functions. The table presented for the purpose of this paper includes a comparison of nine NSS. An analysis of the table`s results gives an insight to the regarded systems and gives a better understanding of their purposes and allows choose the most appropriate one for each negotiator.

2. TYPES OF NEGOTIATION SUPPORT SYSTEMS

NSS make it possible to ease the negotiation process on any stage of its development including the preparation step which is regarded to be very important. Authors (Kersten and Lo 2001) name three types of methods that assist in negotiations: decision science methods (decision trees, decision tables), statistical methods (forecast of events, regression) and game theory.

Hence, the NSS assists negotiators in activities varying from the preparation stage to the mediation process (Rangaswamy and Shell 1997). According to the authors (Lax and Sebenius 1986; Raiffa, 1998) there are two basic parts that lay the foundation of NSS: negotiation analysis and decision. Negotiation analysis combines the benefits of the qualitative methods and “normative models of bargaining” (Kersten and Lo 2001).

Accordingly to Rangaswamy and Shell (1997), NSS are classified as ones for preparation and evaluation and NSS for the support of the process. The first type is used before the negotiation starts, hence they assist

each individual separately to prepare for the negotiations and to assess the costs, benefits and strengths. The second type of NSS is activated during the negotiation process itself, i.e. "at the bargaining table" (Shakun, 1996).

In comparison with the above classification, authors (Pommeranz, 2009) outline two contexts of NSS: preparation and training and real-time usage. Here the authors (Broekens et al, 2010) argue that preparation category does not involve a real-time contact with the negotiating party and the tools of such NSS are used to find alternatives and structure preferences. On the other hand, real-time category already involves a direct contact, but notably face-to-face contact is not necessary. Authors claim that NSS can play the roles of the negotiators and the role of the mediators (Rangaswamy and Shell 1997; Broekens et al, 2010).

A different classification of NSS is given by Kersten and Lai (2007), where the authors develop specific stages:

"1. Passive involvement – the negotiators are physically located in various places. The tools of system assists in calculation for the decision making process. What is more, the process can be transparent with the help of visualization methods.

2. Active involvement – this stage is a mediation phase that aids the participants of the negotiations to create offers. With the advices for messages formulation it helps reach agreement.

3. Pro-active involvement – the objectives of this stage are similar to the previous one but it makes the proactive mediation possible. Here the NSS disposes of "artificial intelligence" and it controls the negotiation process. Moreover, on this stage NSS is able to contribute to the negotiation with situation analysis and advice. And here lies the main difference between the second and the third stages – the negotiator is capable of asking the active systems for the advice."

NSS have two main advantages to be frequently used for negotiations: firstly, computers help to keep the negotiation process in order, secondly, because nowadays a number of companies conduct negotiations online, hence they need specific software to support negotiations (Rangaswamy and Shell, 1997).

NSS can be also classified as simple ones like online chat tools or complex ones like ISPIRE, for instance. Authors (De Moor and Weigand, 2004) argue that in order to conduct negotiations successfully one should not be using only one system, because it is difficult to find a NSS that supports perfectly every stage of the negotiation process. They also advise to choose an appropriate tool that matches better to each separate stage of the negotiations.

Table 1 gives a classification of NSS with examples and definitions (Starke and Rangaswamy, 1999).

Table 1. Classification of Negotiation Support Systems (Starke and Rangaswamy, 1999)

NSS Category	**Preparation and Evaluation Systems**	**Process Support Systems**		
NSS Type	DSS	Full NSS (DSS + Electronic Communication)	NSS as Non-cooperative GDSS	Cooperative GDSS
Bargaining situation	Interpersonal or collective bargaining	Interpersonal bargaining	Collective bargaining	Problem solving
Network type and number of parties supported	Stand-alone DSS support for a single user	Computer links and supports two or more individuals, or parties with members having common interests.	Computer links and supports several individuals or parties with members having common interests.	Computer links and supports a "single" party consisting of several individuals.
Conflict	N/A	Conflict of interests	Conflict of interests	Cognitive conflict
Preference order	Individual	Differs by party	Differ by party	Group utility
Consensus sought on	Contract	Contract	Contract	Evaluation criteria and weights
Example NSS	NEGOTEX	Negotiation Assistant	Nego	Mediator

2.1 INSPIRE

The first system to be characterized is INSPIRE – InterNeg Support Program for Intercultural Research). INSPIRE represents a phase-model of negotiation. There are four stages of negotiations: climate setting, presenting, mid-point bargaining and closing. (De Moor and Weigand, 2004)

INSPIRE enables its users to collect information on the negotiations and facilitate negotiation process. Negotiators exchange emails and interact with each other through a utility graph function, what is more, parties can compare their original preferences with the package (Bellucci and Zeleznikow, 1998).

According to Kersten and Lo (2001), INSPIRE has several major functions: "preference elicitation, quantitative evaluation of offers, retention of the negotiation history and construction of the utility function". In Figure 1 three stages of negotiation process have been characterized (Kersten and Lo, 2001).

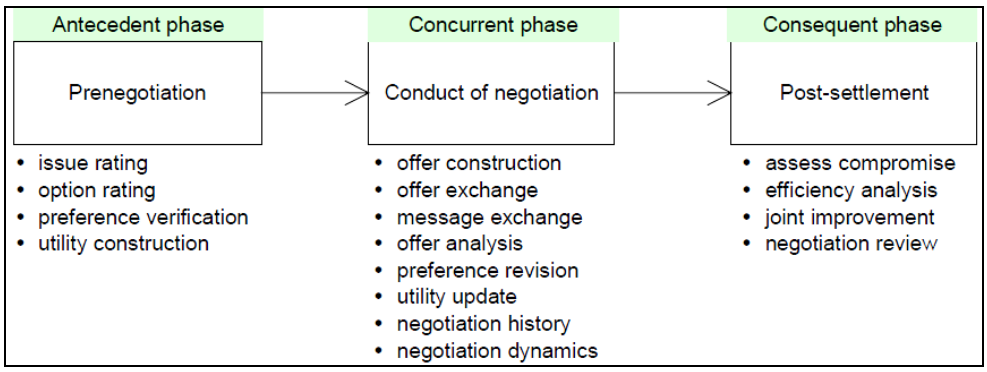

Figure 1. Negotiation Phases and Activities Supported Within INSPIRE (Kersten and Lo, 2001)

INSPIRE can start with an opening offer construction. Every offer has an option chosen by the user for each of the negotiation issues. Free-text messages that could follow the offers will enable users to communicate. One of the advantages of this NSS is that INSPIRE rates by numbers all the sent and received offers according to their quality. It has a history of negotiations which enables negotiators compare the ratings and a graph that shows the dynamic of the negotiation (Kersten and Lo, 2001).

2.2 Split-Up

Another effective NSS is called Split-Up and is "a rule-based neural network system that provides advice on property distribution upon divorce in Australia" (Bellucci and Zeleznikow, 1998). A set of rules create a "common pool" that later on defines a value of split between two individuals. To operate this, the system uses a neural network that determines from the weights of the litigants, of the needs of the litigants and "the level of wealth of the marriage". Split-Up has a hierarchy with a structure that can be used to analyze and organize the task of foreseeing the outcome into thirty-five sub-tasks.

2.3 Negoisst

Negoisst supports complex negotiations and regards: decision-theoretic view, document and communication views. Negoisst is a web-based system that enables parties to interact through semi-structured messages. The system functions through text messages that are divided into four types (Searle, 1969):

"1. Assertives representing facts (message type information in Negoisst),

2. Commissives representing a speaker`s desire to implement certain activity (message type offer and counter-offer in Negoisst),

3. Directives that represent the intention of a speaker to make the listener act as described in the message (message types request and clarification in Negoisst),

4. Declaratives that represent the desire and the ability of the speaker to declare new facts (message types accept and reject in Negoisst).

During negotiations there is always a problem when a misunderstanding takes place because of the barriers that occur with language. In order to solve this problem negotiators comment their messages using a list of terms which can be extended at any time (LaRocco, 2004). This tool can be seen in Figure 2.

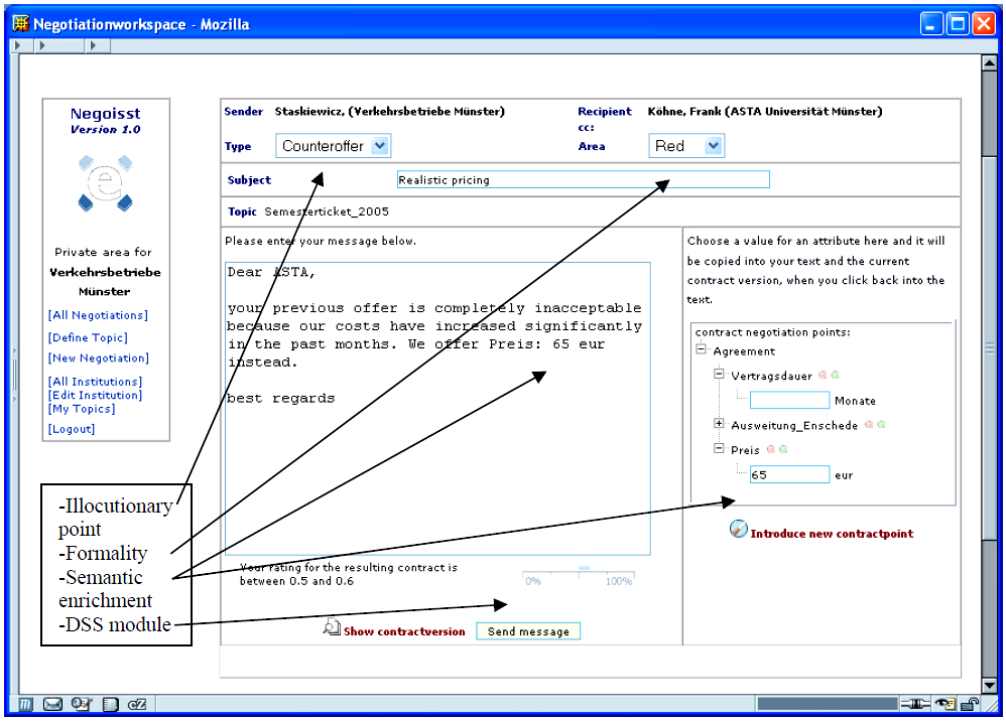

Figure 2. Message exchange in Negoisst (Kohne, Schoop & Staskiewicz, 2005)

One of the most interesting additional features of this system is that it provides a specific area for informal questions where negotiators can communicate without any commitments.

Obviously, the outcome of negotiations might be best reflected in the contract signed. And the contract version is being changed every time a new message appears. Negoisst derives a right version of the contract depending on the messages sent, on the types of negotiators and the roles they play. (Kohne et al, 2005)

Negoisst uses the same model as a previously regarded NSS INSPIRE – a hybrid conjoint method (Green, 1984) for generation of “additive utility functions” that cover categorical attributes. This enables the user to evaluate the offer and visualize concessions.

2.4 WebNS

The fourth NSS introduced for the purpose of the article is WebNS. It is a web-based system that assists negotiation process in Web environment (Yuan, 2003). According to Yuan (2003), WebNS possesses the following objectives:

1. Negotiators could be separated geographically and still interact as they use the web to communicate.
2. Communication of negotiation parties in real-time through different tools, such as public or private messaging, for instance.
3. “Multimedia communication”. Negotiating parties must be able to use video, audio and text tools in order to communicate.
4. Structuration of negotiation process to keep it in order.
5. Privacy and security. Data transmitted during the negotiation process must be authorized.

WebNS is a system written in java that can be installed on Web server and be used from a personal client computer. To every client the system downloads his data part to start the negotiation (Yuan, 2003). After, a Hot Line dialogue window appears to facilitate communication between negotiators and mediator. It serves for delivering short messages from one party to the other. WebNS offers “Final agreement window” for allocation of proposals and counterproposals and for the fixation of final agreement. Another peculiarity of this system is that all the data concerning negotiations of the client is stored on the server, hence, if the negotiation is interrupted due to connection failure, the data is not lost.

An example of the WebNS environment can be seen on Figure 3 (Yuan, 2003).

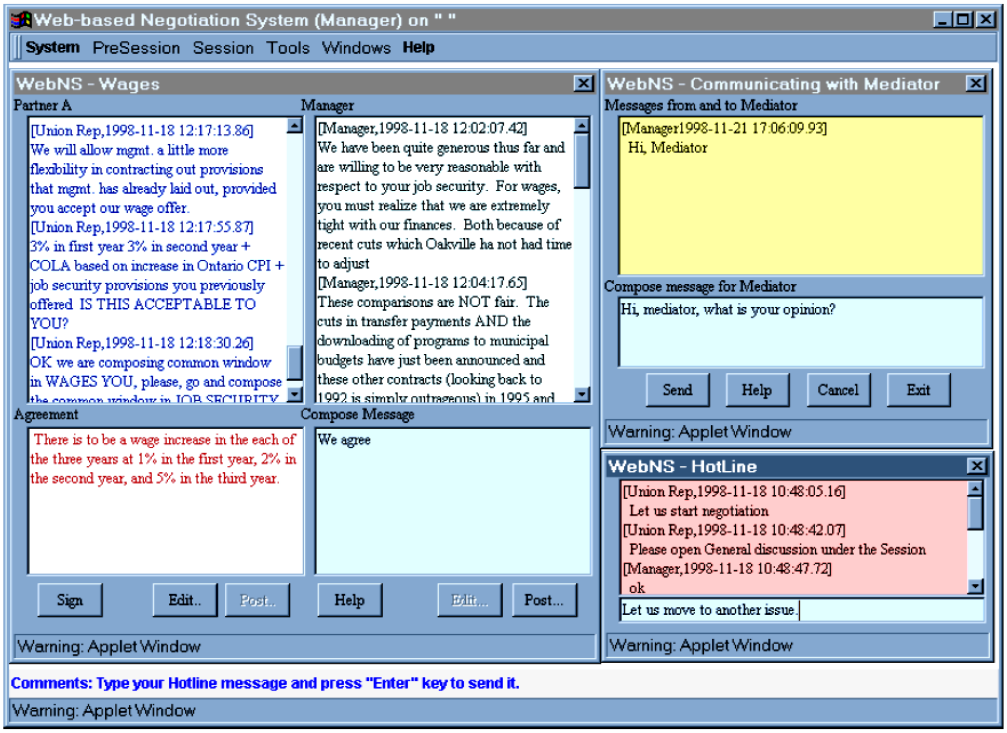

Figure 3. Issue Discussion and Mediation (Yuan, 2003)

2.5 SimpleNS

SimpleNS is a passive NSS in comparison to INSPIRE as it serves as a “sophisticated messenger”, not as a facilitating agent (Kersten et al, 2004). The main difference of these two systems is that SimpleNS does not oblige its users to formulate complete offers, neither it performs such functions as attribution of negotiators’ preferences or construction of utility functions or graphs. However, this NSS is not a simple messenger as it divides the messages from the offers and transforms the negotiation history into a more convenient format, making it more accessible and placing it chronologically on a single page.

In total, there are three pages shown in SimpeNS: “case description page, data input page and negotiation history page”. In Figure 4 the data input page may be viewed (Kersten et al 2004).

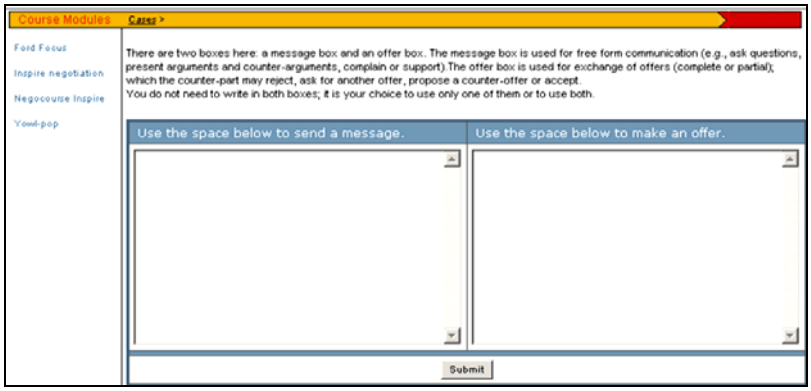

Figure 4. Data input page in SimpleNS (Kersten et al 2004)

It is possible to see in Figure 4 that two boxes (message box and offer box) are placed on the same page in order to make the comparison more convenient. The disadvantage of the system is that negotiation issues and their options are not displayed. What is more, the system does not provide its users with analytical tools and has a limit of storage, organization and display of information.

It should be mentioned that SimpleNS was elaborated for teaching purposes and for comparison of the usefulness of different systems (Kim et al., 2005).

2.6 Smartsettle

Smartsettle aims to reduce time, cost and stress of negotiators in their deals. (Smartsettle, 2012a) Using qualitative and quantitative methods, Smartsettle eases negotiation process making the tradeoff clearer. As Smartsettle disposes of the internet network that helps connect negotiators scattered around the world, still keeping the information secure and confidential. (Smartsettle, 2012a) The main objective of this NSS is to facilitate the decision-making process and resolving a conflict. One of the distinguishing attributes that Smartsettle has is that it may be applied individually when a person needs to compare alternative options and choose the most efficient one. This may be an interesting characteristic for this NSS with other similar systems. Smartsettle can manage any number of negotiators serving for the benefit of each of them individually. (Smartsettle, 2012a) Data inserted by the users is protected by a security code like in any other system.

The mediator function of Smartsettle is performed when the system has enough information from the parties, so that it can suggest beneficial conflict resolving options not previously regarded by the parties. (Smartsettle, 2012a). In addition, human mediator is applicable upon user`s preference. However, mediator does not necessarily have access to private data of negotiators. An interface of Smartsettle can be seen on Figure 5 (Smartsettle, 2012b).

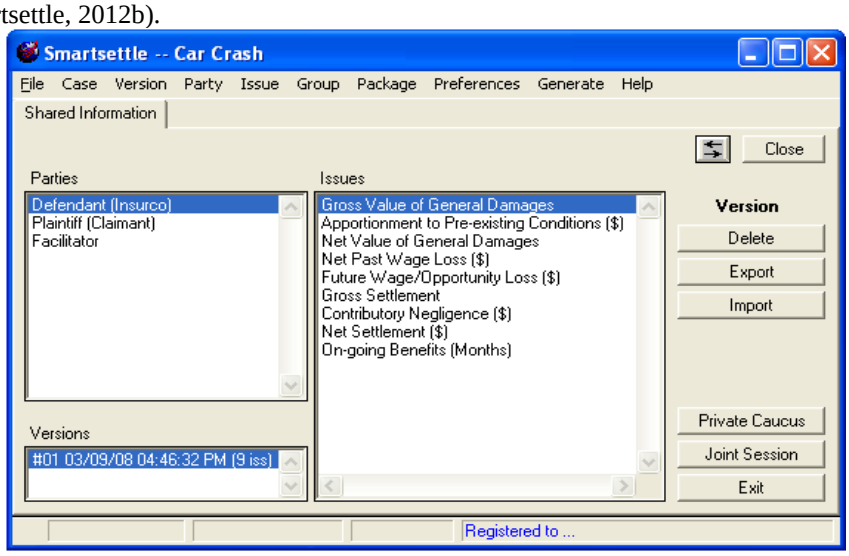

Figure 5. Shared Information in SmartSettle (Smartsettle, 2012b)

In Figure 5 it is possible to see that only a certain amount of data is shared among all negotiators. And the mediator is considered to be a neutral party (Shared Information in SmartSettle).

2.7 PERSUADER

PERSUADER is an intelligent system that uses internal knowledge and negotiators` input in order to produce solutions. What is more, it provides certain support to negotiations and resolves the existing problems. PERSUADER has been used for modeling US “industrial disputes with the help of hybrid case and rule-based methodology” (Bellucci and Zeleznikow, 2005). PERSUADER includes three agents: Union, Company and Mediator (Sycara, 1998).

The system was inspired by human negotiations and has been elaborated mainly for labor negotiations. One of the other applications spheres of PERSUADER was in concurrent engineering (Lewis and Sycara, 1993).

PERSUADER lets the users exchange proposals and counterproposals in order to reach the mutual agreement. Negotiation process includes such characteristics as wages, pensions and subcontracts (Sycara,

1998). Each negotiator has a specific “multidimensional utility” model and it cannot be accessible to other parties.

2.8 Family_Winner

Family_Winner is a NSS that utilizes game theory and heuristics to implement its functions (Bellucci and Zeleznikow, 2001). It gives negotiators a possibility to attribute values of importance to indicate the level of their preference of an offer. Family_Winner also uses this type of information to create trade-off rules.

There are three basic assumptions for its usage:

“1. The dispute can be modeled using Principled Negotiation,

2. Weights can be assigned to each of the issues in dispute,

3. Sufficient issues are in contention to allow each side to be compensated for losing an issue.” (Bellucci and Zeleznikow, 2003)

When using Family_Winner, each negotiator introduces an issue and shows the relevance of issues one to another. The analysis of inserted data is represented in graphs and trade-off maps. Maps are helpful for illustration of relevant issues and for seeing the degree of importance of each issue (Bellucci and Zeleznikow, 2003).

The system asks negotiators to add sub-issues which are stored in a decompositions hierarchy. The more the number of the issues in a dispute is, the easier it is to allocate them since the opportunity of trade-off grows (Bellucci and Zeleznikow, 2003).

2.9 ENEG

ENEG is a framework which concerns several approaches and technologies: Knowledge and Risk Management, Visualization Methods, Text Mining and Mobile Statements. ENEG focuses on negotiations of software development projects. The environment is available on Portuguese and English languages and its use is free.

The Knowledge Management Module controls negotiation information, such as: contacts, deadlines, negotiators, interests, options, relationships, power, communication, criteria, legitimacy, concessions and there are several forms and wizards to help the users. The Risk Management Module allows users to identify risks and point out negotiation elements that can be impacted by stored risks. Text Mining tools and Visualization Methods are used for mining the data stored and transform data to information through a group of dashboards.

The environment also provides mechanisms to increase IT professionals' negotiation skills. For this purpose, e-learning tools focused on the IT context have been developed, e.g., trading games, quizzes and psychological tests. The environment is available at http://www.negociacao.net and its architecture is depicted in Figure 6.

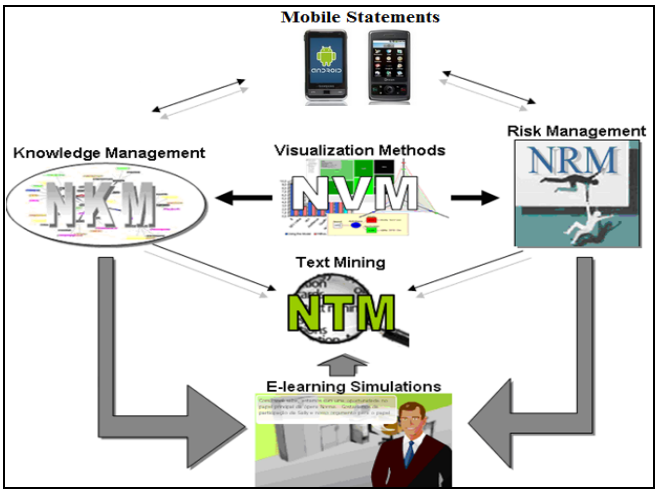

Figure 6. ENEG (Rodrigues et al, 2011)

ENEG has also sophisticated platforms to support experienced negotiators, such as a mobile approach, that lets users to manage data registered in the negotiation. This mechanism is integrated into Knowledge Management and Risk Management Modules.

3. NSS COMPARISON

Hereby we may see that all the regarded NSS vary according to their functions and environments. A comparison table of the NSS provides clear distinction among their differences.

Table 2. Comparison of Negotiation Support Systems

System/ Criteria	Web System	Free	Case based support	Possibility of usage of negotiation models	Supply of learning environment (eg. e-learning)	Supply of definitions and tests in negotiation models based on Fuzzy Cognitive Maps	Supply of risk management for negotiations
Negoisst	Yes	Yes	Yes	Yes	No	No	No
WebNS	Yes	Yes	Yes	Yes	No	No	No
INSPIRE	Yes	Yes	Yes	Yes	Yes	No	No
Split-Up	No	Yes	No	Yes	No	No	No
SimpleNS	Yes	Yes	No	Yes	No	No	Yes
PERSUADER	No	No	Yes	Yes	No	No	No
Smartsettle	No	No	Yes	Yes	Yes	No	No
Family_Winner	No	No	Yes	Yes	No	No	No
ENEG	Yes	Yes	Yes	Yes	Yes	Yes	Yes

In general, some of the systems have considerable advantages. For instance, WebNS has a very convenient interface and provides security of information as it stalled in the server and it is practically impossible to lose it occasionally. Another important function is Hot Line which was characterized earlier and that makes negotiation process faster. However, INSPIRE has also some certain advantages as it offers negotiations history that may be presented in graph and a rating of offers which helps parties evaluate their existing position in the negotiation table. Smartsettle may be used both by a single individual for personal decisions when alternatives are needed to be compared and by a number of negotiators when making a deal. Family_Winner allows evaluation of options by assigning weights to each of the options so that decision making process becomes less complicated. Taking into the account the characteristics of the table, ENEG has advantages in comparison to other systems it is the only one that has all the functions presented in the table.

4. CONCLUSION

Negotiation Support Systems play an important role in the process of managing negotiations and conflicts resolution that may occur in any negotiation table. Modern technologies permit individuals communicate globally and do not interrupt the negotiation process because of differences in geographical location and that is what NSS were created for. Having regarded different types of systems it is possible to conclude that every each of them is suitable for a certain type of negotiations and can be applied in different ways. What is more, every system has its own set of advantages that make it more suitable for certain negotiators, although ENEG has the largest set of characteristics than other systems.

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TOPIC-BASED BROWSING OF TENDENCIES IN TWITTER CONVERSATIONS BY USING SOCIAL GLOCAL INFORMATION EXTRACTION

Takafumi Nakanishi, Kiyotaka Uchimoto and Yutaka Kidawara
National Institute of Information and Communications Technology
3-5 Hikaridai, Seika-cho, Soraku-gun, Kyoto, 619-0288, Japan

ABSTRACT

In this paper, we present a topic-based browsing method of the tendencies in micro-blog conversations. Micro-blogs such as twitter are used by various users for not only communication with friends but also extraction of important news in local areas, serving in effect as human sensors. We can see situations in more detail than with conventional media such as TV and radio. Recently, some researchers have been working on extraction methods of feature words or trajectories of focused words in the spatiotemporal axis. Twitter itself also provides a "Trend" service that identifies hot topic words. Using these services, it might be possible to find topics of focus on Twitter. However, there is no way to tell why certain words attract attention, or what becomes hot due to the words used, by simply extracting feature words and word trajectories. We are working on a new word-extraction method for social media: Social Glocal Information Extraction (sGIE). sGIE extracts important elements by comparing a global set with a local set, and it discovers the tendencies extracted from tweets, including the focal topic word. By using our method applying sGIE, we can see the tendencies in our society. In other words, sGIE provides perspectives on the social events extracted from Twitter. Accordingly, sGIE dynamically gives a schema for the focused topic after it is posted. In addition, we present a new browsing method for Twitter: Topic-Based Browsing of Conversation Tendencies in Twitter. We also demonstrate implementation of this method and show examples of browsing.

KEYWORDS

Topic-Based Browsing, Content Analysis, Social Glocal Information Extraction (sGIE), Micro-blog, Twitter, Tendency of Conversation Topic.

1. INTRODUCTION

Many people, through their participation in them, are playing a major role in the dynamics of online systems. Their attention can suddenly concentrate on web application such as Twitter, YouTube, and Facebook. Sometimes these are called consumer-generated media (CGM). We can see detailed and realistic views of the news by these media rather than TV, radio, or newspapers. CGMs are killing the traditional media and are establishing themselves as new media for evaluating tendencies. We computer science researchers play an important role in creating new systems that provide organized information for users' understanding, decision-making, and next action. Twitter, in particular, is a good media for knowing the current situation. For example, when the Great East Japan Earthquake devastated east Japan, people could use Twitter to easily communicate about conditions, information, requests, etc. At that time, Japanese TV only continued to broadcast a lot of not-so-useful information and frames of shocking scenes again and again. They did not extend their broadcasting of news beyond disaster victims to reports from rescue parties and volunteers as well. We could communicate directly with disaster victims and provide them help as soon as possible. We were not directly affected by the disaster; however, we were shocked by it and dismayed at our inability to do anything as information science researchers. These days, one of the most important challenges is to provide an up-to-date big-picture view of important topics by using massive data. This is the same issue as the Big Data era.

We will understand nothing and only become tired from simply looking at the timeline on Twitter. Although Twitter's "Trend" service provides words indicating hot topics, these topic keywords are not so

informative to us because there is no way to know why the words attract attention or what is really getting hot based on the words, simply by following the extraction of feature words and word trajectories. Therefore, we have to provide not only key topics but also words or evaluations that indicate why the topics are hot.

We are developing a new extraction method of important words by comparing a global set containing, for example, the entire web's documents with a local set of items such as an aggregated tweet set: Social Glocal Information Extraction (sGIE). When we aggregate tweets about a topic, sGIE dynamically extracts appropriate words from the aggregated document set. In this case, extracted words have to satisfy two items. One is that the words represent features of an aggregated document set. The other is that the words converge to aggregated results. sGIE extracts the words satisfying these requirements. That is, we can see how the hot topics are expressed by utilizing sGIE. The features of sGIE are as follows:

1. sGIE can *apply to various languages* if there are spaces between words. sGIE does not have language dependency.
2. sGIE can discover topic words from an aggregated tweet set by *measuring* relative word distributions of a Web document set (global document set) and an aggregated document set (local document set).
3. sGIE does *not need any ontology, thesaurus, or concept dictionary*. sGIE dynamically extracts appropriate words depending on the aggregated tweets as a context.

In this paper, we present a discovery method of the conversation tendencies in topics from Twitter by extracting words that represent the contents of the conversation topics. Furthermore, we add the information of the extracted words. We can find how the extracted words are represented by how they are used in the tweets by using sentiment classification technology (Nakagawa et al., 2010). By implementing our method, we can see not only hot topics but also the reputation of the hot topics. One only needs to access our system when trying to find the tendencies of conversation topics.

Our method is applied to see a trend, check the reactions of the world to the news that concerns the user, check the trends of the interests of followers, etc. Twitter data are massive data. We cannot see every conversation. However, if the system shows hot topics, the words used in the topics and the tweet's sentiments can give a quick overview of the current state of real-time public opinion.

This paper is organized as follows. In Section 2, we survey the related works of our proposed method. In Section 3, we introduce our method of "Glocal Information Extraction" for social media, which we call Social Glocal Information Extraction Model (sGIE). In Section 4, we propose our discovery method of the tendencies in conversation topics from Twitter by extracting words that represent the contents of the conversation topics. We present an example of a developed system and give a discussion in Section 5. Finally, we conclude our paper in Section 6.

2. RELATED WORKS

An average of 140 million tweets are posted every day, according to finding from March 2011 (Twitter, 2011). Consequently, many people are creating massive amounts of fragmental data. Interactive topic browsers such as tweet (Mor et al, 2010) have been developed. Topic-based browsing approaches have seen success in information-oriented tasks within a search (Dumais, 2001; Käki, 2005), document exploration (Hearst, 2006; Kammerer et al., 2009) and blog interfaces (Baumer & Fisher, 2008). Many researchers have addressed such data and have developed rich interfaces and algorithms for filtering tweets, such as topic-based browsers like Twahpic (Ramage et al., 2010) and Eddi (Bernstein et al., 2010).

Twahpic (Ramage et al., 2010) presents views consisting of topic words and their characterizations (Substance, Status, Style, Social, and Other) by extracting from Latent Dirichlet Allocation (LDA) (Blei, 2003). We note that the data structure used in this research is based on extracted words with characterization.

Eddi (Bernstein et al., 2010) presents views consisting of tag cloud, timeline, topic dashboard, and navigation list. The tag cloud describes the major topical themes in the user's Twitter stream. The timeline draws attention to temporal events in the feed. The topic dashboard shows up to five tweets chosen from the top ten topic categories. The types of categories are preliminarily defined by each user. In Eddi, we can share the categories. The navigation list contains a complete list of topics in the feed, sorted by popularity, and provides the same brushing tooltip as the tag cloud. We note that Eddi targets particular Twitter users, topics or feeds.

On the other hand, our topic-based browsing method consists of representations of hot topic words extracted from the entire real-time Twittersphere, feature words and their sentiments for a selected hot topic word, and examples of actual tweets. The browsing data structure of our method is shown in Figure 1. In these views, we can see the detailed structure of a tweet and its sentiment, while also seeing an overall view of hot topics throughout the Twittersphere in real time.

In addition, we use our new information-extraction technology—Social Glocal Information Extraction—for feature word extraction. Twahpic (Ramage et al., 2010) and Eddi (Bernstein et al., 2010) use LDA (Blei, 2003), TF, or IDF. We make sure that the LDA tends to extract words of a superordinate concept. Therefore, the LDA might be suitable for hot topic words from the entire real-time Twittersphere. However, it is not suitable for feature words that represent the contents of topic words. Therefore, we use our Social Glocal Information Extraction for feature word extraction.

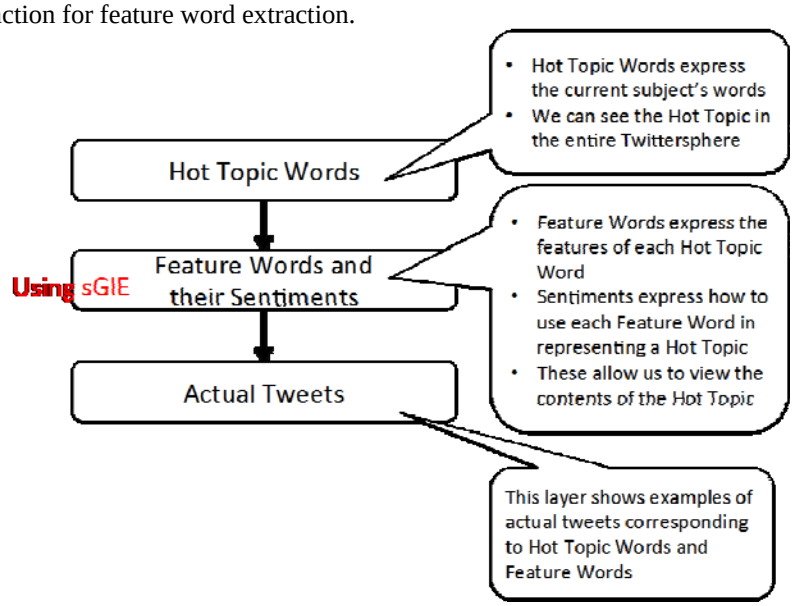


Figure 1. Browsing data structure of proposed method. First, our system represents "Hot Topic Words." These express the current subject's topic in Twitter. Next, our system represents "Feature Words and their Sentiments." Feature Words express the characteristics of each "Hot Topic Word." Sentiments express how to use each Feature Word for representing hot topic representation. Consequently, we can view the contents of the hot topic. With these tools, we can access the actual tweets related to "Hot Topic Words" and "Feature Words."

3. SOCIAL GLOCAL INFORMATION EXTRACTION (SGIE)

The data of social media are different from other document data, news data, etc. In particular, we focus on micro-blogs like Twitter. Twitter data consist of a massive number of tweets, which are basically fragmental short documents. Furthermore, these are sometimes meaningless. It is important to build a system that presents a quick overview of the current state of real-time public opinion from Twitter data.

In this section, we propose Social Glocal Information Extraction (sGIE), which is glocal information extraction specialized to Twitter data. First, we state assumptions for introducing sGIE in section 3.1. After that, we give the formulation of Social Glocal Information Extraction (sGIE).

3.1 Assumptions for Twitter Data

Figure 1 overviews the assumptions made for Social Global Information Extraction (sGIE). First, we assume that each word appearing in a tweet set clustered for a certain purpose has certain relations. That is, we retrieve tweets from the entire Twittersphere by each hot topic word. Such clustered tweets relate to the same purpose. The author of each tweet is expected to use similar or the same words for this purpose. Actually, we often use the co-occurrence relations (Xu et al., 1996) of each word. The co-occurrence relation is applied in a

tweet, but we can define that each word appearing in a tweet set of the same cluster has relations if it can extend to the tweet set clustered for a certain purpose.

As shown above, it is important to compare the document frequency (DF) of each word in a tweet set on the entire web (or the whole tweet set) and that in a document set clustered for a certain purpose. When the DF of a certain word in a document set on the entire web (or whole tweet set) is larger than in a tweet set clustered for a certain purpose, the words do not actually represent the characteristics of a tweet set clustered for a certain purpose. This is also the case when this rate is the same. When the DF of a certain word in a document set on the entire web (or whole tweet set) is smaller than in a tweet set clustered for a certain purpose, the word represents the characteristics of a tweet set clustered for a certain purpose. We define a document set on the entire web (or whole tweet set) as the "global set" and a tweet set clustered for a certain purpose as the "local set."

Assumption 1: (Glocal comparison) The word is important for representing the hot topic characteristics of the tweet set when the DF of the word in the local set is larger than in the global set.

Among the tweets retrieved by hot topic words, there are a variety of tweets, and many meaningless tweets exist in the set. Our method sometimes involves noise, since these tweets fail to express anything. We assume that the tweets having sentiment representation are good sources for representing the characteristics of hot topic words; conversely, our analysis has no need for the meaningless tweets.

Assumption 2: (Local target sources) The feature words that represent the characteristics of hot topic words are extracted for clearly expressing the sentiment of the tweets.

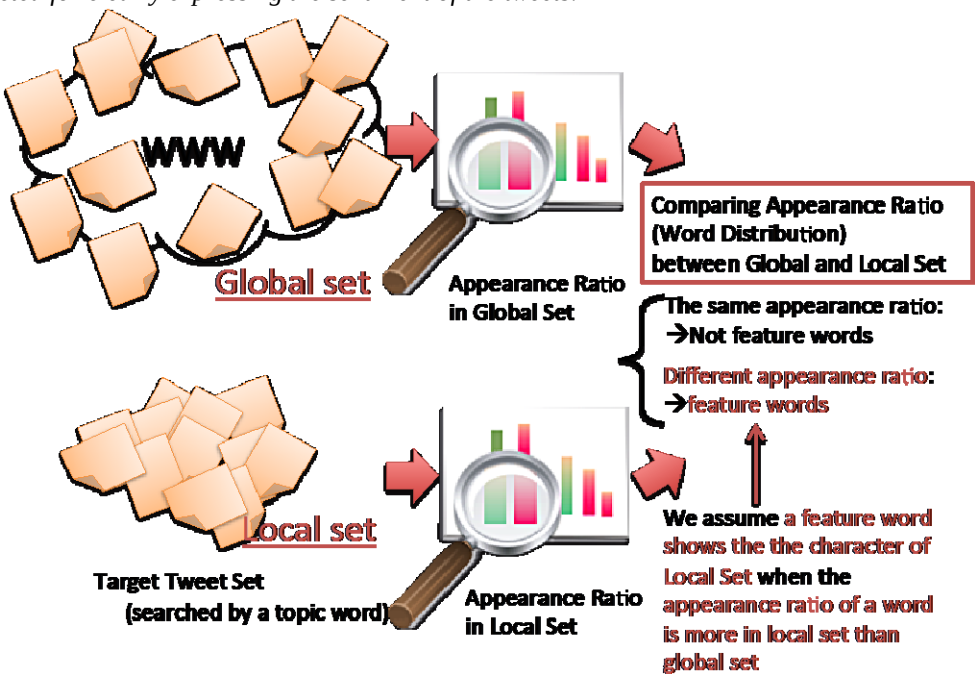


Figure 2. Intuitive representation of Assumption 1. The important point is the comparison of word appearance frequency between the Global and Local sets. We assume that a word shows the characteristics of Local Set when the appearance frequency of a word is more in the local set than in the global set.

3.2 Formulation for Social Glocal Information Extraction (sGIE)

In this section, we construct our Social Glocal Information Extraction (sGIE) based on the assumptions shown in section 3.1.

In the web, there are large amounts of document data, so it is good to use tweets from the entire Twittersphere. These data are represented in the global set GD:

$$GD = \{gd_1, gd_2, \ldots, gd_N\},$$

where gd_i signifies each data item in the global set GD. A user tries to input hot topic words he/she can think of to a search engine (in this case, a user inputs them to the Twitter API). The search engine outputs data depending on the user's query from the global set GD. These data are represented in the local set LD:

$$LD = \{ld_1, ld_2, \ldots, ld_M\},\ LD \subset GD,$$

where ld_j signifies each tweet's data in the local set *LD*. Each data item in the local set ld_j has words. The document frequency value (DF) of *L* words in the local set represents a local-df vector **ldf** as follows:

$$\mathbf{ldf} = (ldf_1, ldf_2, \ldots, ldf_L)^T.$$

The DF of *L* words in the global set represent a global-df vector **gdf** as follows:

$$\mathbf{gdf} = (gdf_1, gdf_2, \ldots, gdf_L)^T.$$

We can obtain *L* words from local set *LD*. Therefore, we focus on the *L* words. Here, in accordance with *Assumption 1*, the ratios of the elements of **gdf** and **ldf** are compared. For example, the *k*-th word is extracted if

$$\frac{gdf_k}{N} < \frac{ldf_k}{M}$$

is satisfied, where *N* is the number of documents in the global set and *M* is the number of documents in the local set.

However, it is difficult to get value *N*. All variables in the above inequality are always more than zero. We can develop inequality as follows:

$$\frac{ldf_k}{gdf_k} > \frac{M}{N} = \varepsilon.$$

Therefore, the threshold ε is set up and the *k*-th word is extracted as the appropriate word for representing the characteristics of the local set when ldf_k/gdf_k is more than ε. That is, the *k*-th word is extracted as a feature word for representation of hot topic words. We note that we do not need threshold ε close to M/N. The threshold is set up by a pre-experiment calculation, or if it is also good for the ldf_k/gdf_k value to extract words on a large scale.

The most important feature of this filter is that information extraction is achieved by measuring and comparing the ratio of each element of **gdf** and **ldf**. These variables are only based on word distribution in the global set and local set. The information extraction is achieved by only making comparative calculations without using any ontology, concept dictionary, or inference involving probability distribution. The technique using probability distributions is based on the premise that the distribution of words is in agreement with the probability distributions. Is it possible to ensure that the probability distributions you use correspond to the distribution of words in the target document set? This is, in fact, impossible. Although the scales completely differ, it is reasonable to compare the local and the global items— the local one is the document set applying a certain method, and the global one is all of the documents on the web. Thus, we call this system a Glocal Filter.

Now, we have to consider the case of assumption 2. Some researchers have proposed many classification methods of sentiment by machine learning, among other approaches. (Choi & Cardie, 2008; Moilanen & Pulman, 2007; Jia et al., 2009; Wilson et al., 2005; Ikeda et al., 2008; Morency et al., 2007; Sun et al., 2008). In this paper, we use the sentiment classification tool (Nakagawa et al., 2010). This tool extracts sentiment from a certain sentence. The types of sentiments are "emotion (+/-)," "review (+/-)," "merit (+/-)," "adoption (+/-)," "event (+/-)," "advice (+/-/0)," and "request (+/-/0)." Accordingly, our method targets the tweets that can be classified using the categories of this tool. By classifying and representing feature words by sentiments as a local set, what kind of sentiment feature words are used in the hot topic can be shown.

4. TOPIC-BASED BROWSING OF CONVERSATION TENDENCIES IN TWITTER

In this section, we explain our method – topic-based browsing of conversation tendencies in twitter. An overview of our method is shown in Figure 3. In this section, we describe each function in detail.

4.1 Hot Topic Word Extraction and Organization Function

A number of researchers have been working on hot topic extraction for micro-blogs, including Twitter. Actually, there already is a trend word extraction API – "Trend" in Twitter. In this paper, we use a "Hot Topic word bot" – "@benymd_bot" bot tweets. This bot tweets hot topic words every hour in Japan. We can obtain hot topics without any hard coding.

4.2 Tweet Extraction Function

We can search tweets for usable keywords by Twitter Search API. In this paper, our system retrieves 100 tweets by Twitter Search API using each hot topic word as a keyword. Actually, it is better to aggregate all tweets including the hot topic word and then to relate them. It is necessary to know the tendencies of a conversation. Even if we do not get all tweets related to each hot topic word, we will be able to know these tendencies. That is, the numbers of retrieved tweets are determined by the computational power available for supporting this system.

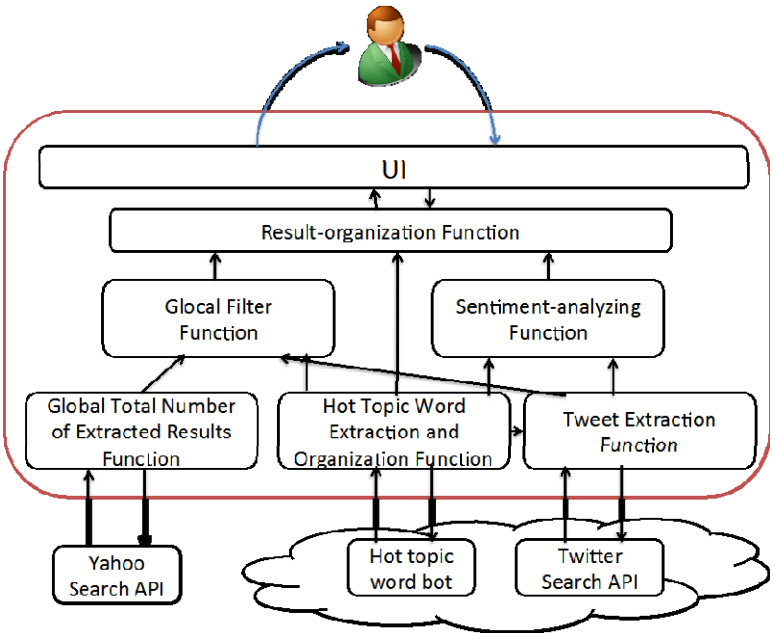


Figure 3. Overview of proposed method – Topic-Based Browsing of Conversation Tendencies in Twitter. It consists of a UI, result-organization function, glocal filter function, sentiment-analyzing function, global total number of extracted results function, hot topic word extraction and organization function, and tweet extraction function.

4.3 Global Total Number of Extracted Results Function

In order to calculate "Global Filter" values, we have to get the number of total results in each feature word. Therefore, this function performs Japanese-language morphological analysis and inputs each word to Yahoo Search API. Twitter Search API is not a representation of the total number of results, so we only use Yahoo Search API. If it is possible to obtain the total number of results from Twitter, it might be better to use it.

4.4 Glocal Filter Function

This function calculates the global filter as described in section 3.2 by using the results of the global total number of extracted results function in each word. It judges whether each word is suitable as a feature word, as explained in section 3.2.

4.5 Sentiment-analyzing Function

This function analyzes the sentiment of the targeted tweets. In this paper, we use the sentiment classification tool (Nakagawa et al., 2010). This tool extracts sentiment from a certain sentence. The types of sentiments are "emotion (+/-)," "review (+/-)," "merit (+/-)," "adoption (+/-)," "event (+/-)," "advice (+/-/0)," and "request (+/-/0)." Therefore, our method targets tweets that can be classified using the categories of this tool.

4.6 Result-organization Function

This function organizes the results of the global filter function and sentiment-analyzing function. In addition, it constructs the data structure, such as that depicted in Figure 1.

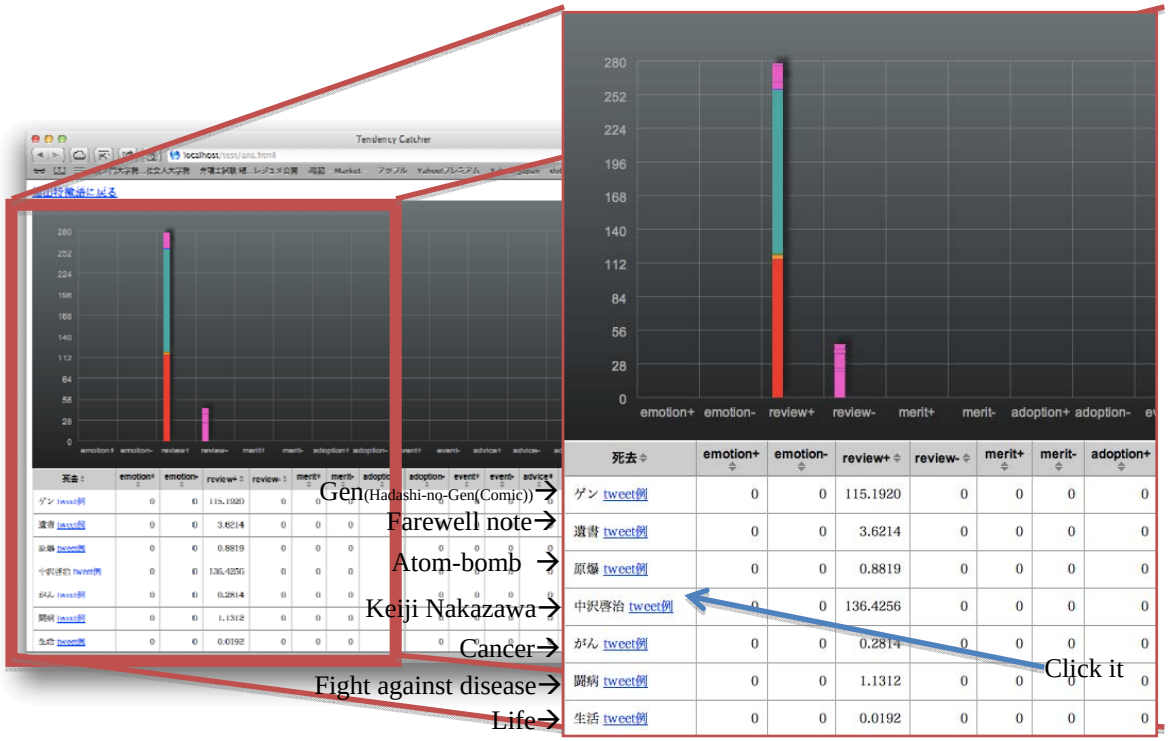
5. IMPLEMENTATION

Here, we show an example from December 25, 2012, at 14:17. When you access our system, you can see your twitter timeline and hot topic words (Figure 4). We can see "Christmas," "Present," etc. as hot topic words. We can also see "New Year's card." In Japan, if we post a New Year's card on December 25, the post office guarantees sending it to the destination on January 1. Therefore, many Japanese would be writing New Year's cards at this time.



Figure 4. Opening screen of Topic-Based Browsing of Conversation Tendencies in Twitter, from a screenshot taken when accessing our system on December 25, 2012. We can see “Christmas,” “Present,” etc. as hot topic words; on the other hand, we can also see “demise.” Only this latter word is meaningless; in addition, we feel uneasy about this word.

On other hands, we can see “demise.” Only this word appears to be meaningless. In addition, we feel uneasy about this word. Therefore, we click this word to view the system’s next screen (Figure 5). This screen presents feature words and their sentiments related to “demise.” That is, this screen shows what kind of feeling is expressed about the topic by what kind of feature words. We can also see “Hadashi-no-Gen” (comic book about the atomic bomb dropped on Hiroshima), Atomic Bomb, Keiji Nakazawa, etc. We could guess that Mr. Keiji Nakazawa has died. Mr. Nakazawa is a well-known comic author in Japan, and “Hadashi-no-Gen” is a particularly famous work of his. The system next presents the screen shown in Figure 6. This is a list of tweets related to “demise” and “Keiji Nakazawa.” There are many tweets like “May his soul rest in peace,” “Hadashi-no-Gen” and “peace.”



死去	emotion+	emotion-	review+	review-	merit+	merit-	adoption+
ゲン tweet例	0	0	115.1920	0	0	0	0
遺書 tweet例	0	0	3.6214	0	0	0	0
原爆 tweet例	0	0	0.8819	0	0	0	0
中沢啓治 tweet例	0	0	136.4256	0	0	0	0
がん tweet例	0	0	0.2814	0	0	0	0
闘病 tweet例	0	0	1.1312	0	0	0	0
生活 tweet例	0	0	0.0192	0	0	0	0

Figure 5. Second screen of Topic-Based Browsing of Conversation Tendencies in Twitter. This screenshot was taken while accessing our system on December 25, 2012, and it shows the result of clicking “demise” on the first screen. This screenshot shows what kind of feeling is expressed about the topic (“demise”) for what kind of feature words. We can also see “Gen,” “Atom-Bomb,” “Keiji Nakazawa,” etc.

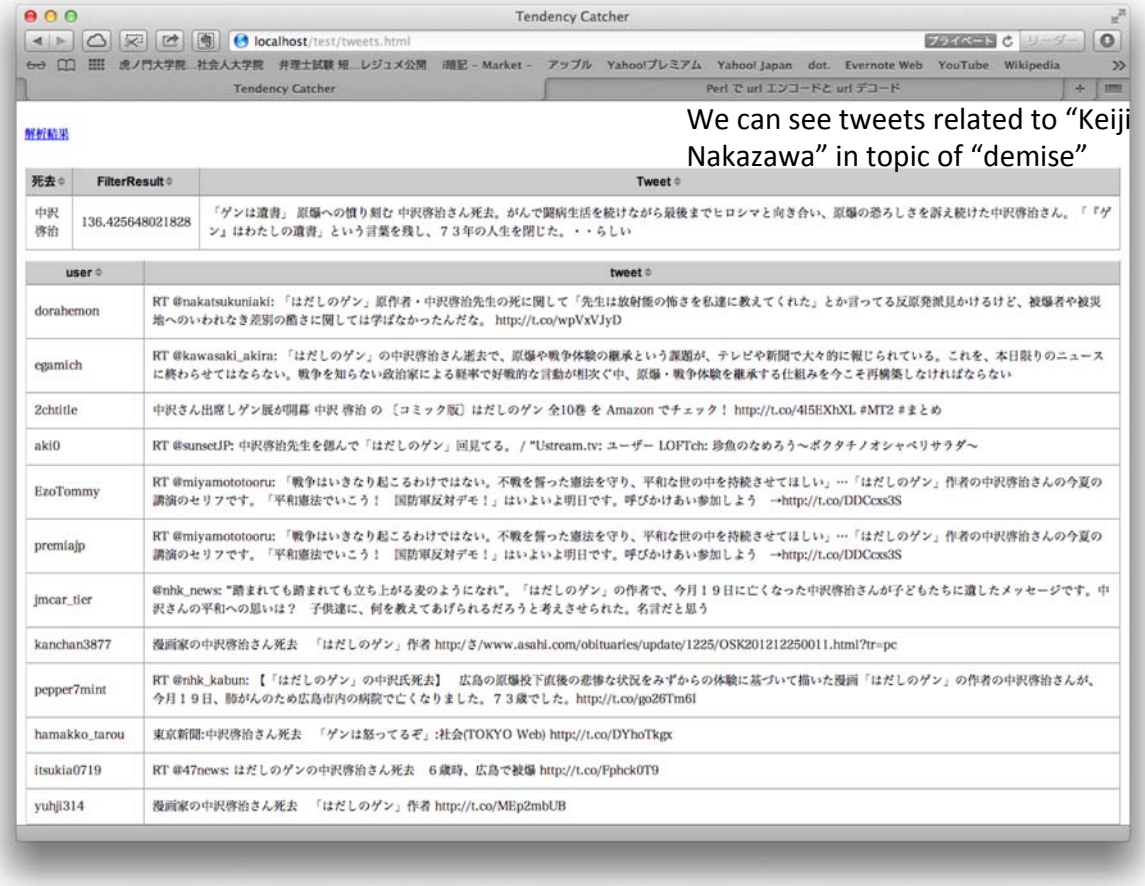


Figure 6. Third screen of Topic-Based Browsing of Conversation Tendencies in Twitter. This screenshot was taken while accessing our system on December 25, 2012. This is the result of clicking “Keiji Nakazawa” on the second screen. It shows actual tweets related to “demise” and “Keiji Nakazawa.” There are many tweets like “May his soul rest in peace,” “Hadashi-no-Gen” and “peace.”

6. CONCLUSION

In this paper, we presented a topic-based browsing method of the conversation tendencies in micro-blogs. Micro-blogs such as twitter are used by various users for not only communication with the user’s friends but also extraction of important news in local areas as human sensors.

Our proposed method, Social Glocal Information Extraction (sGIE), extracts important elements by comparing a global set with a local set. sGIE discovers the tendencies extracted from tweets, including the topic word in focus. By implementing our sGIE method, we can observe the tendencies in our society. In other words, sGIE presents viewpoints on extracted social events from Twitter. That is, sGIE dynamically gives a schema for the focused topic after it is presented.

In addition, we showed a new browsing method for Twitter: Topic-Based Browsing of Conversation Tendencies in Twitter. We also presented an implementation of this method and an example of browsing with it.

As described above, our browsing method can view the contents of the Twitter topic by organizing them into layers of hot topic words, feature words, and actual tweets. In many cases, the user cannot gain a clear understanding of the situation by only extracting the hot topics of Twitter. We should consider the development of a new browsing method for not only Twitter but also other social media in this Big Data era.

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Short Papers

ANALYSIS AND COMPARISON OF EXISTING MATURITY MODELS FOR BUSINESS PROCESSES

Lisa Hamann[1,a], Prof. Dr. Gerrit Tamm[2,b] and Sascha Kämpfer[1,b]
[1]*T-Systems Multimedia Solutions GmbH, Winterfeldtstraße 21, 10781 Berlin*
[2]*SRH University Berlin, Ernst-Reuter-Platz 10, 10587 Berlin*
[a]*Author*
[b]*Co-author*

ABSTRACT

The continuous optimization of business processes is becoming an increasingly important factor for a company's long-term success. Maturity models for business processes aim at maintaining a distinct quality of processes and help to determine the maturity level of the processes and the company's maturity. Previous research has shown the lack of transparency and standardization for maturity models. In particular, existing maturity models were not scientifically compared and evaluated among themselves. Uncertainty and unawareness in selection and application of adequate maturity models can be observed in applied science and practice.
The aim of the scientific work was to evaluate existing business process maturity models in terms of strengths and weaknesses in order to provide a comprehensive and reliable knowledge-based on specific evaluation criteria setting. The conclusions have been used to take advantage of one of the pre-chosen models to measure the maturity of a business process. The examined models were CMMI, BPMM-OMG, PEMM and EDEN. The applied methodology consists of literature research, empirical findings and practical application. The empirical findings comprise a purpose-made questionnaire and an outcome weighted in terms of importance and / or appliance. A particular challenge of the research was to compare the different maturity models based on their criteria, scales and general scope.

KEYWORDS

Business Process Management (BPM); Business Process Maturity Model (BPMM); Capability Maturity Model Integration (CMMI); Successful, Continuous, Efficient and Sustainable (EDEN); European Foundation for Quality Management (EFQM); Process and Enterprise Maturity Model (PEMM).

1. INTRODUCTION

The continuous optimization of business processes within companies is becoming an increasingly important indicator for the long-term success of an operation. An applied BPM in the enterprise creates transparency and helps, by constantly adapting and optimizing core business processes, to support the sustainable development of the competitive position. But the fact that BPM is deployed and modeled does not mean that the business process is anyhow successful. The implementation of a process controlling supports companies in the determination of process efficiency and effectiveness [BPM Maturity model eden e. V.]. In order to measure the performance concerning the quality of individual processes in the business process as well as to identify potential for improvements, a performance measurement seems reasonable; the so-called maturity models provide a great support for doing process assessments. The assessment identifies processes strength and weaknesses and measures the results with the best practice. The variety of maturity models has a more or less close connection to process management, with focusing on the entire company, on specific processes or on specific industries. Maturity models measure the status quo and the target state of an organizations process; they provide recommendations which can be used for further action.

Business process related maturity models are prospering at the moment; there is a proliferation which makes it challenging for organizations to keep track of the market. Due to the large number of different maturity models on the market today, it is hard for a layman to distinguish the different models, since many of those seem to be similar. Existing maturity models run over 200 [BPM Focus]. They differ from each other if focusing on the criteria to measure the maturity level as well as in the field of application [Schmelzer,

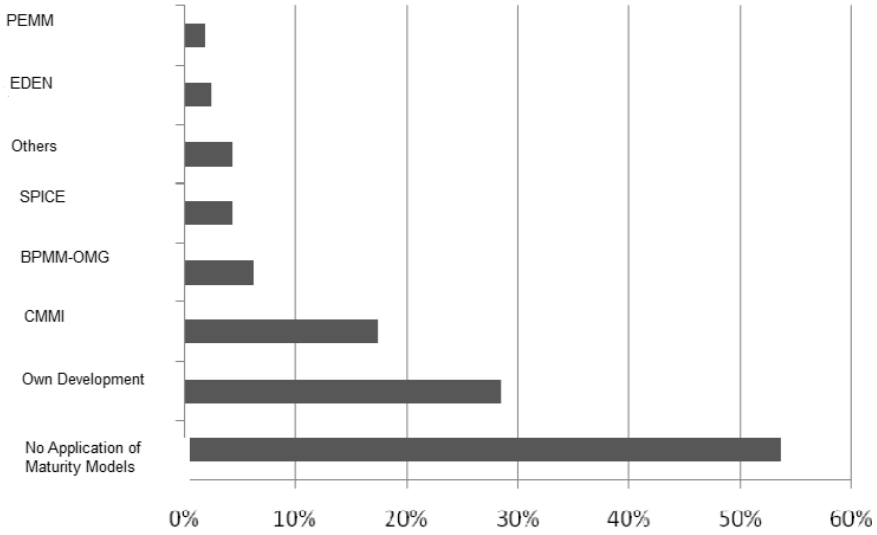
J., Sesselmann, W.]. According to Roseman and vom Brocke "the number of maturity models related to the BPM field is such high that practitioners and scholars run the risk of losing track" [Röglinger, M. et al.; Rosemann, M., vom Brocke, J.]. There is a high uncertainty as there "a systematic in depth analysis is lacking" [Röglinger, M. et al], in terms of BPM maturity models. According to Kwak and Ibbs "a high degree of uncertainty regarding the selection and application of these models can be observed in practice" [Ahlemann, F., Teuteburg, F.; Ibbs, C. W., Kwak, Y.-H.].

Although there are descriptions of the different models free available, they are very heavy on theory and sparse. "Adopters from practice are frequently forced to speculate about appropriate measures with only having the textual descriptions of generic target states as a basis" [Röglinger, M. et al]. The BPM&O survey indicated that maturity models are not widely adapted in practice. There is only a little or no advice concerning the application – especially when considering independent sources [BPM&O GmbH]. The purpose of the paper is to make the selection of an appropriate maturity model transparent and comprehensible.

2. MATURITY MODELS FOR BUSINESS PROCESSES

Maturity models for business processes assist companies in measuring the quality of their processes, show weaknesses and identify potential for improvement. Due to the weak transparency among the models, the authors aim was to clearly distinguish and compare several aspects regarding the selected four models. For this reason, the requirements of an expert group has been evaluated and compared with the most commonly applied maturity models [see Table 1: BPM&O GmbH (2011]. The basis for this was the survey conducted by BPM&O in collaboration with the University of Applied Science Bonn-Rein-Sieg and the EBS University. 211 companies from various industries and different number of employees participated.

Table 1. Application of Maturity Models



PEMM, EDEN, BPMM-OMG and CMMI were chosen as SPICE did not fit to the authors requirements on maturity.

2.1 Procedure

In order to pre-select maturity models, the consultants of the T-Systems Multimedia Solutions GmbH (MMS) have been declared as experts on that subject. It will therefore be subject to define the requirements of the MMS to a process maturity model and to define precisely. For this purpose existing methodology has been used. Using this qualitative method, a non-standardized approach is used. An open questionnaire is in this

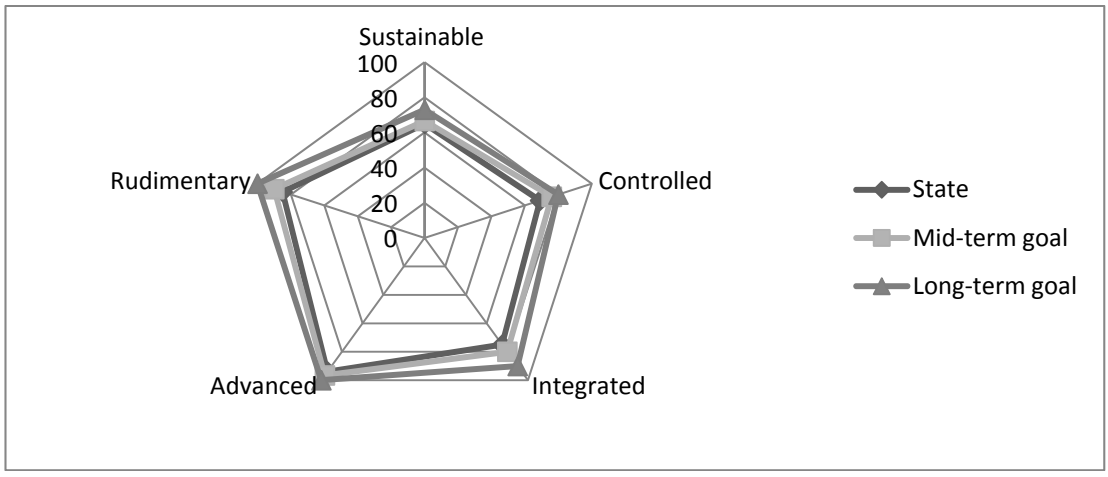
case necessary to identify the knowledge of the experts. Based on a quantitative questionnaire, the expert knowledge of those that deal with the operational processes will be used to validate the factors. The answers will be weighted according to a specific method to provide an average answer for the consultants. A model will be chosen and applied to measure a business process.

In order to define, delineate and highlight the requirements of a group of 14 experts, an anonymous questionnaire has been developed. According to the opinion of the specialists, business processes in general are conducted as an important topic regarding a company's success. These people see a missing transparency among the models as well as the importance of sustainability in terms of business processes. Requirements include the application in independent industrial processes, possibility of independent performers, possibility of self-assessment and the focus on core processes. The mentioned requests come along with the challenges of acquiring and transferring knowledge, mapping of processes and their measurement. The pre-chosen four maturity models were subsequently evaluated according to the identified requirements coming from the results of the questionnaire. The maturity models have been compared based on following evaluation criteria: general field of application, number of maturity level, level description, average time to reach the next level, application in theory, complexity, lead appraiser, purpose, scope and audience

2.2 Application

In the direct comparison of BPMM-OMG, CMMI, EDEN and PEMM, significant differences in maturity models became visible to each other. As EDEN met the requirements best, the model has been selected to measure a business process of an enterprise. The information on EDEN and the conduction of the self-assessment are sparse without deciding for a consultation of EDEN. Therefore the carried out assessment is based on the casebooks RGP-model of Schmelzer and Sesselmann. A business process has been measured by using the RGP-checklist and rate from 1 to 100, whereby the EFQM-model was used for the evaluation. The business process level has been weighted according to the authors own estimation. The maximum weight of each level represents the maximum points the valuation of each level can achieve. The results are visualized in the maturity measurement and converted in percentage [see Table 2: EDEN e. V. (2010)]. The five stages of EDEN's maturity are visualized in the table below.

Table 2. Measurement of Business Process Maturity



Additionally a current position matrix as well the process position could be visualized to show the position of the maturity levels. The results can subsequently be used to provide recommendations and to clarify the question of how to make the process more mature. Potential for improvement will then be highlighted; gaps will be recognized. The required scope of action will be the outcome, emerging from the analysis of the maturity level [BPM Maturity model eden e. V. (2009)]. Improvement suggestions and recommendations can be provided after the analysis.

3. CONCLUSION

The main challenge of this research is the not existing comprehensive standard overview concerning several maturity models; individual models are mainly found in today's literature. Out of that reason, potential users are of the opinion that there is a lack of transparency in the direct comparison of the maturity models. As the author is taking advantage of several studies and surveys which were already confirmed and indicated, BPM will play a future role in terms of company's success and is out of that reason becoming increasingly important.

Assessments in the automotive industry are performed nowadays in terms of evaluation and qualification of electronics suppliers. Automotive manufacturers are nowadays increasingly demanding their electronic engineering suppliers to perform at least at CMMI level 3 [Schmelzer, J., Sesselmann, W.]. The demand for the provision of certain standards will increase in future. The maturity assessment of individual business processes provides transparency between prospective business partners. The maturity level of competitors can be used to get an understanding of the rival's portfolio and therefore puts one into the position to effectively compete. Staff satisfaction is an additional benefit of process improvement as the removal of manual workflows facilitates an efficient operation. Outcomes are increased, number of satisfied employees as well as an increased productivity [Capgemini]. The process assessment results in derived measures to enhance the company's success sustainable. Besides the outcome analysis as the scope of action, the observed maturity model EDEN needed a supportive model to conduct the maturity analysis. The use of the RGP-Model was not challenging but the non-standardized models, the lack of transparency, the sparse recommendations and the difficult reflection were. The lessons learnt from that research is the need for qualitative surveys regarding model selection as existing surveys are highlighting the importance of business processes. The lacking application and certain limitations are influencing maturity models negatively.

The requirements on a maturity model were met best by EDEN. The model has been selected and implemented in practice. EDEN represents the three dimensions: the current state, the medium term and the long-term desired state. This method is applicable for deriving certain measurements which are of an additional customer benefits; this results in necessary recommendations for the company to reach the next maturity level.

The resulting derived measures contribute to enhance the company's success sustainable.

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INITIAL EVALUATION OF A CLINICAL SIMULATION APPLICATION FOR NURSING EDUCATION

Daniel Cliburn[1], Xinxin Li[1], Christopher Trondsen[1], Shawn Kerns[1] and Kristin Lee[2]
[1]*University of the Pacific, Stockton, California, USA*
[2]*University of Missouri - Kansas City, Kansas City, Missouri, USA*

ABSTRACT

In this paper we discuss a software application that simulates a medical-surgical nursing unit of a virtual hospital. The purpose of the application is to allow nursing students to practice responding to clinical situations they may face during their careers. The advantages of such an application include that it can be used whenever and wherever students have access to a computer, and scenarios can be customized to meet the educational objectives of specific courses. Initial evaluation of the software suggests that it has the potential to be a useful tool for nursing education.

KEYWORDS

Nursing education, virtual worlds, simulation

1. INTRODUCTION

This paper describes a 3D game-like software package that simulates a medical-surgical nursing unit of a virtual hospital. The software is intended to help nursing students practice assessing a patient's condition and forming an appropriate treatment plan. Nursing education is broadening the application of alternative adjuncts to clinical education. More emphasis is being given to shift from the traditional format of class and clinical education, to include other alternatives to facilitate clinical education, including human patient simulators. Human patient simulators are computerized manikins that imitate human anatomy and can be programmed to simulate vital signs as well as other physiological functioning. A decrease in the availability of hospital clinical sites, and other issues, is causing schools of nursing to incorporate other clinical education components that can provide the learning opportunities traditional hospital clinical courses can provide. Simulation has been viewed as a vital component to the nursing curriculum as an adjunct to clinical education (Nehrig, 2008; Harder, 2012) and human patient simulators have proven to be effective tools for nursing education (Beyea and Kobokovich, 2004; Hravnak et al, 2007).

The initial motivation for our project was to improve the problem solving and psychomotor skills of nursing students by providing an alternative training method resembling the experience provided by a physical human patient simulator. Teaching problem solving and psychomotor skills requires educators to expose students to various scenarios to help bridge the gap between theory and practice. Simulation provides students the opportunity to apply principles learned to a realistic situation in a safe environment. With the use of human patient simulators, evaluation methods can not only address the development of psychomotor, affective, and cognitive skills, but also their ability to communicate and work effectively in teams (Cannon and Boswell, 2012). While the incorporation of training experiences with human patient simulators has no doubt improved the ability to evaluate student learning in undergraduate nursing education, there are drawbacks with the use of simulation. These drawbacks include that access to the simulators is restricted to a single location and, due to time constraints, many times students must work in large groups, limiting the students' ability to fully participate in all aspects of the scenario. Ideally, students need the opportunity to individually problem-solve a scenario to improve clinical reasoning skills. However, the realities of the simulation laboratory logistics, as previously described, make individual assessment unrealistic for most schools of nursing. In contrast, a 3D virtual environment can be accessed anytime that a student has access to a computer. Our software is designed to provide nursing students with an opportunity to individually problem-solve scenarios to increase their clinical reasoning skills and improve their clinical judgment.

2. BACKGROUND

Traditional nursing education is comprised of two distinct components. The first component consists of the study of theory and takes places in the traditional didactic setting. Thereafter, education moves to the clinical setting for practical application of theory. Many approaches are used in nursing education to allow students opportunities to practice applying what they have learned during their education, prior to real clinical experience. In addition to the human patient simulators discussed earlier, these approaches can include written case study, role playing, and standardized patients. While these can all be useful training methods and can help facilitate the development of problem-solving skills, each also has limitations. For example, with case studies, students frequently do not receive feedback on their choices (Grupe and Jay, 2000) and case studies might not be as stimulating to visual and kinesthetic learners. Also, it can be difficult for an educator to assess students' level of comprehension just by watching them role-play various scenarios (Chan, 2012). Finally, since standardized patients are actors that act as if they have some affliction or respond to a script, they can be difficult to schedule, prepare, and standardize across nursing curricula (Nehrig, 2008).

Virtual worlds can be useful educational tools as they have the potential to provide a training simulation that connects knowledge with experience. Virtual worlds are capable of providing an environment that engages the visual and auditory senses, and can develop conceptualized, procedural and experiential knowledge (Stieglitz, et al, 2010). Virtual worlds have been used widely in medical education and yield encouraging results. Some examples include the use of virtual reality for training and pretreatment planning of radiotherapy (Boejen and Grau, 2011) and a virtual simulation for laparoscopic surgery (Larsen et al, 2009). Nursing educators from Glasgow Caledonian University have used Second Life to enhance and evaluate nursing students' decision-making skills (McCallum et al, 2011). Mili et al (2008) describe a 3D game for training nurses called VI-MED. Their game features two components: a "gaming component" that simulates a virtual hospital with dynamically modeled patients whose conditions evolve over time and that properly respond to students' actions, and an "assessment component" that updates students' profiles and adjusts the game appropriately. The goal (and what we see as the major contribution) of our project is to develop an application that can be easily customized by nurse educators to align with the learning objectives of their courses. Our intention is not to replace practices that currently play an important role in undergraduate nursing education. Rather, what we envision is to augment those activities with virtual training experiences designed by the instructor that students can complete at a time that is convenient for them.

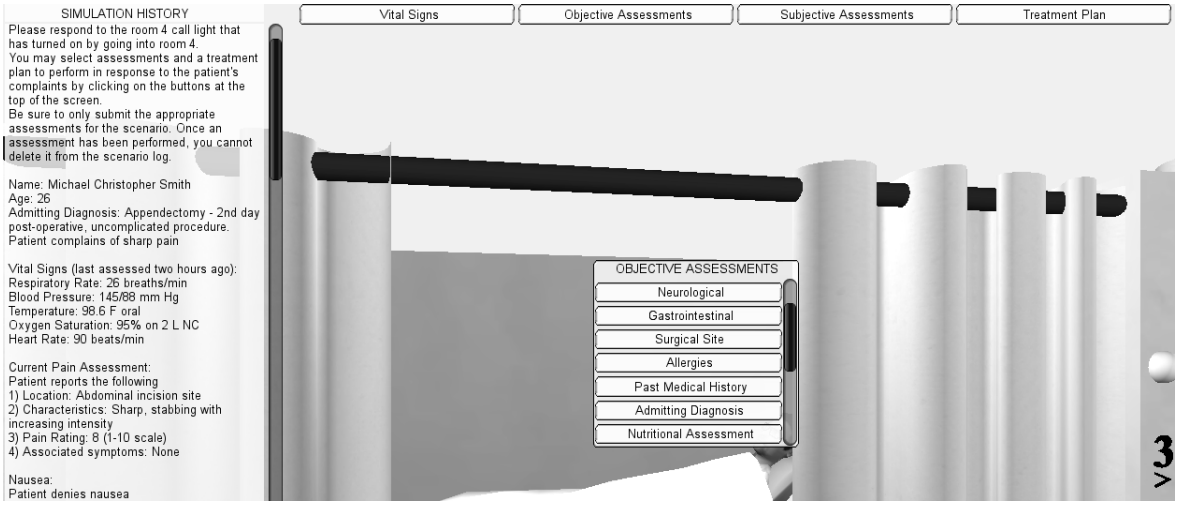

Figure 1. The Interface of the Virtual Medical-Surgical Nursing Unit

3. THE VIRTUAL MEDICAL-SURGICAL NURSING UNIT

The current version of our software was developed using the Unity game engine (unity3d.com). The application begins by displaying to the user basic instructions in the simulation history window to the left of the screen (shown in Figure 1). After a few seconds, a beep sounds and a call light starts blinking to alert the user that a patient has requested attention. Additional information then appears in the simulation history instructing the user to navigate to the patient's room. Once the user arrives, the scenario (with the patient's name, medical history, and complaint) is shown in the simulation history. Scenarios can present the user with a symptom or ailment the patient is experiencing. The user must then attempt to diagnose the situation by performing the appropriate assessments available through action buttons and subsequent menus (the selection of "Objective Assessments" is shown in Figure 1). Possible actions include checking vital signs, performing objective assessments such as checking lung sounds and looking up past medical history, and performing subjective assessments such as asking the patient if he or she is experiencing nausea or abdominal pain.

The simulation ends when the user develops and submits a treatment plan. The treatment plan involves selecting an appropriate type and amount of medication (if any), selecting appropriate non-pharmacological interventions (if any), and a time at which the patient's condition should be reassessed. The simulation summary (shown in Figure 2) is provided immediately after the simulation ends as if an instructor were present. The summary's purpose is to increase student comprehension of each operation through its use in the scenarios, thereby increasing student confidence in performing assessments and developing treatment plans.



Figure 2. The Simulation Summary Window

4. PRELIMINARY EVALUATION

Interviews were arranged with four nurse educators unaffiliated with the project. Institutional Review Board (IRB) approval was obtained to conduct these interviews. First, the educators were asked to "talk out loud" as they used the software. The educators were then asked if they felt it would be helpful for students to work through scenarios such as the one shown in our application, and whether or not the application could be helpful for increasing students' comfort and competence in patient care. The interviewer then talked with the educators about additional features that could be added to the software. The notes from these interviews were analyzed for general themes. Our findings are as follows.

While our intention was not to spend a great deal of time with the nurse educators on usability issues, a number of issues with the software were identified that needed to be corrected. Some of the more serious issues included that the scenario's directions were not obvious and that navigating through the virtual environment (using the arrow keys) may not be intuitive for some users. Another issue was that the software needed to make it clearer what treatment options had been selected in the treatment plan window. One educator suggested that, in addition to showing information about the performed assessments in the history window, the application should display assessment information in a separate pop-up window so that users do not have to look at a different area of the screen for the result of their actions.

The educators indicated that it would be helpful for many nursing students to work through scenarios such as the one we showed them. They also suggested that the program could be useful to increase students' comfort and competence in patient care. Some of the educators cited that the additional practice and repetition provided by the application would be helpful for students to increase their confidence. One educator did indicate that there could be at least some students for which this type of activity may not be helpful. However, another educator suggested that the application could be most useful for those students who are having difficulty assimilating and applying previously learned material.

The educators also had a number of suggestions for features to add to the program. For example, while the immediate feedback provided in the summary report could be useful to students, some of the educators felt that we needed to make it possible for instructors to provide more feedback to students as to why some assessments were required for a particular scenario and others were not. Another suggestion made by multiple educators was to allow students to write free text responses as part of the treatment plan, or as a concluding activity after they see the summary window. Free text responses as part of the treatment plan would allow students to describe other treatments they would want to perform that were not supported by the application. Students could also be asked to explain why they chose to perform the actions they did. In the summary window, free text responses could allow the students to answer questions that have been proposed by the instructor that encourage students to further analyze and reflect on the scenario.

5. CONCLUSION

As we discussed, our application allows users to practice diagnosing a patient's condition and developing a treatment plan. The application's purpose is to provide nursing students, in a safe and convenient environment, an opportunity to increase their clinical reasoning skills and improve their clinical judgment. Initial evaluation of the software has been encouraging. However, the application still needs to be assessed by nursing students. Our future plans include modifying the software in accordance with the suggestions made by the educators, and then evaluating the software in the context of an actual course.

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PROGRESS ON DIGITAL INCLUSION THROUGH THE CYBER-EDUCATIVES IN SOUTHERN PATAGONIA

Alexandra Lizana[1], Victoria Marín[1], Jesús Salinas[1] and Iñaki Salinas[2]
[1]*Universitat de les Illes Balears*
[2]*Universidad Nacional de la Patagonia Austral*

ABSTRACT

The paper focuses on the description of the progress of a cooperative ICT project for inclusion into the Information and Knowledge Society. This project is the result of the efforts of two universities as distant as the National University of Southern Patagonia and the University of the Balearic Islands, to empower Southern Patagonia communities to access quality education using ICT and take part in social and educational activities related to the empowerment through ICTs. The Cyber-Educatives' and its facilitators' role are emphasized as the main elements of the project to fulfil the objectives posed.

KEYWORDS

Digital inclusion, distance learning, educational programs, Southern Patagonia, resource centers.

1. INTRODUCTION

This paper describes the progress made by the international cooperation project entitled the Southern Patagonia Digital Network (REd de VINculación DIgital de la Patagonia Austral - ReVinDiPA). This project is centred on designing, organizing and launching education services for isolated communities through integrated efforts by different institutions, especially the National University of Southern Patagonia (UNPA-Argentina) and the University of the Balearic Islands (UIB-Spain). It is being supported by the National Argentinean Science and Technology Agency, the Santa Cruz Regional Government and towns in the region through the PICTO 31150 and the AECID (A1/035996/11, D/023508/09 and D/017590/08, PCI Latin America) Projects, as well as the Balearic Government (the UIB's Office for Cooperation in Development and Solidarity), since 2006.

Some of its main objectives are (Salinas et al, 2009):

- Offer minority groups and those in isolated communities or marginal circumstances the chance for socio-economic integration, communication and learning.
- Make access possible to higher education, specifically to the UNPA's institutional virtual learning environment, through an effective online distance learning system.
- Explore innovative new ways for community access to ICTs to optimize the convergence of technology, training and local and regional development, according to each community's cultural traits.

2. CYBER-EDUCATIVES AS LEARNING PLACES

Cyber-Educatives derive from this project as multimedia resources centers that support teaching and learning activities in order to foster digital inclusion in Southern Patagonia (Salinas and Márquez, 2008). Cyber-Educatives' users are provided with the support and aid from the facilitators in order to take part in different learning and social activities, access to information and, of course, access to higher education. Therefore, Cyber-Educatives are the cornerstone to achieve the goals set by the project.

Cyber-Educatives establish an inter-institutional regional integration network in the different communities of the region, which build local nodes to empower people to access information and education through ICTs. This is very helpful for Southern Patagonia's citizens since their region is characterized by the isolation due to large distances. Furthermore, this isolation is related to the low investment in ICT infrastructure and the poor connectivity to Internet (Bain et al, 2007). In this sense, since its beginnings, the UNPA has been a benchmark higher education institution on promoting the use of technologies for education in the region. With this purpose in mind, it designed an online educational system, so that all the people from the province could access, with quality and sustainability, to its offer of higher education.

3. PROJECT RESULTS

In terms of numbers, there are sixteen Cyber-Educatives currently active. Their staff vary from only one facilitator in some of them, to teams of eight facilitators. The amount of users differ depending on the Cyber-Educative as well. Not only does the town population (from 1.000 to 15.000 people) influence the quantity of its users but also the activity of the Cyber-Educative itself. Most of their users are college students with family, work or some dependence that makes complicated for them to move into another town in order to continue their studies.

Although we are still carrying out the project, we would like to draw up some of the project's relevant results concerning to the posed objectives and, specifically, the role of the Cyber-Educatives as spaces for empowering communities to access quality education.

3.1 Training of the Cyber-Educatives' Facilitators

Cyber-Educatives' facilitators go on different training courses to develop: basic skills, academic-oriented skills, facilitator's role skills and project-oriented skills.

Basic skills training consists on two intensive days of a face-to-face course. It is centred on explaining the facilitator its role in the Cyber-Educative, what Cyber-Educatives are intended to be, what the Revindipa net is and how to connect in it and in the UNPA, and also basic use of the computer and its software. This training is essential, since facilitators usually begin working in the Cyber-Educative with little knowledge about computers, the UNPA and the functioning of places that work as telecentres (Villatoro and Silva, 2005), similar to how Cyber-Educative works. However, this face-to-face training is quite costly in terms of time and money, owing to the long distance to travel along for each training, which occurs every time a new facilitator joins Revindipa.

The academic-oriented training consists of online courses and workshops to increase facilitators' knowledge and skills on some important issues for their role. These are, for instance, how the UNPA is structured and how it works, what its academic offer is, to whom contact for one or another kind of request or how the virtual learning environment works. In addition, specific workshops are also conducted in some concrete periods, for example, to learn about the process of students enrollment to the UNPA's courses.

Nevertheless, working in a Cyber-Educative requires more competences than basic skills and academic knowledge about the UNPA in order to assist people other than students. For six years, the UNPA and the UIB have been training facilitators through an online course run by lecturers from both universities with some face-to-face classes at its end. It is formed by five modules of 15 hours each one, with the objective of providing facilitators with the necessary skills - among which are facilitator's role skills and project-oriented skills - to run properly the Cyber-Educative. The course modules are: the pedagogical module, the social module, the technical module, the organizational module and the communicative module.

Finally, there are also other courses addressed to facilitators, which concern the implementation of certain projects, depending on its needs: the use of wikis, how to work with old people, collaborative working software and other tools, methods or specific knowledge.

Currently, we are working in the elaboration of self-study materials in order to avoid long distance travelling and embrace the non-training initial period for recent joined facilitators to Revindipa. These educational materials are being designed according to the learning paths methodology (de Benito, Darder and Salinas, 2012) to encourage self-autonomy and motivation in their own formation.

3.2 Educational and Social Programs using ICT

One of the most important outputs of the project are the educational and social programs using ICTs promoted from the Cyber-Educatives and led by its facilitators.

Some of them can be recalled (Mollenhauer et al, 2012):

- Elder Internauts (Grandes Internautas). An initiative oriented to the elderly with the objective of approaching the use of new technologies to them. Thus they would be able to communicate through email, chat or videoconferencing calls with family, write a blog, search information on the Internet, and so forth.
- Territorial Organisation "Chew Mapu Selk". It is a participation space through a web portal for aboriginal communities living in Southern Patagonia - mainly Tehuelche and Mapuche people. This way, these communities have their own voice on the Internet and make other people get to know their culture.
- Virtual Net for Local Development (Red Virtual para el Desarrollo Local). Its objective is to originate a network of people using ICTs for collaborative working to foster the development of new entrepreneurships according to the regional characteristics and to empower the provincial social-productive sector as well.
- Santa Cruz Producers (Productores de Santa Cruz). A project that created a website to ease artisans, manufacturers and small producers to publish their goods and other information they want to share publicly, increasing their businesses' presence through the Internet.
- UNPA Network. As it was mentioned before, one of the objectives of Revindipa is to foster access to higher education through the technologies. This program makes sense in that context (Ramos et al, 2010). It supports the UNPA with helping students to solve their doubts and problems related to access the university services and to improve their educational use of ICTs.
- Fostering 2.0 Citizenship from School (Promoviendo la Ciudadanía 2.0 desde la Escuela). This project is aimed at collaborating between secondary school teachers, Cyber-Educatives' facilitators and volunteers from different areas of Santa Cruz Province in order to enhance the subject of Ethics and Citizenship with the use of ICT tools, such as concept maps, forums and wikis (Lizana et al, 2012). This project is directly related to the Argentinean initiative "Conectar Igualdad", along with the development of other 1-to-1 programs in Latin America (Lagos and Silva, 2011; Marés et al, 2012), which supplies children and teachers from the secondary school with laptops for educational use.

3.3 The Observatory of Technologies in Education in Patagonia

The Observatory of Technologies in Education in Patagonia (OTEP) emerges as an associated service to the Southern Patagonia Digital Network. Its main objectives are (González et al, 2010):

- Promote and strengthen networks and bonds amongst different social institutions.
- Become a space of trustworthy information in order to design educational policies with the aim of contributing to progress on digital inclusion.
- Provide data and information to the academic and research community.

The OTEP works with a collection of indicators - elaborated from internationally-recognized recommendations - which make possible identify and evaluate the changes in access, use and impact of ICTs in formal and informal education in Patagonia (González et al, in press). One of the main sources to collect information from informal education is the Cyber-Educative. Nowadays, facilitators are the local agents for data collection; in other words, they provide the requested information about its town. The evaluation of the use of ICTs through automatic data collection and processing is an issue to address by the OTEP.

4. CONCLUSION

Some of the reflections about the on-going project, though we cannot draw any final conclusions, are the following:

1 The educational and social programs promoted through the Cyber-Educatives have empowered the participating users to the appropriation of the technology. In addition, these actions have led strategically to the integration of economic, social and education issues through digital inclusion in the region, for which reason today all the Cyber-Educatives are successfully running. This success has had impact on the expansion of the network of Cyber-Educatives in other different areas in

Southern Patagonia. Indeed, this arises the need for more and better quality services that enable digital inclusion and maintenance, thus being able to reach the entire population.

2 Training for facilitators' Cyber-Educatives has been always a challenge in the project due to the characteristics of this collective. Furthermore, there is frequent staff turnover and new facilitators join at different moments in the year. As it was mentioned earlier, we are heading towards a shift on the way of working with them to improve the training effectiveness and foster self-autonomy in designing educational and social programs using ICT and assisting communities by facilitators.

3 Although still it is in its beginnings, the OTEP's role will be quite relevant to involve stakeholders in enhancing digital inclusion in Southern Patagonia. They will have a better approach to ICTs and they can propose improvements in their community. This observatory works as a point of information for all those interested people who want to develop innovative projects in their community.

4 Concerning to the main objectives of the project, we feel that the three of them are being suitably tackled, especially through the Cyber-Educatives. These places are effectively making access possible to higher education for people who had poor access before, and are offering real opportunities for socio-economic integration, communication and learning to their local communities and minority groups, often in the form of innovative ways, such educational and social programs using ICTs.

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GERONTECHNOLOGY VERSUS SOCIAL ACCELERATION: AN ETHICAL CHALLENGE

Lionel Ben-Ahmed, Juliette Sablier, Bertrand Boudin and Vincent Rialle
AGIM Laboratory Grenoble Faculty of Médecine
UF ATMISS CHU Grenoble
38700 La tronche

ABSTRACT

The use of technology and the development of new tools are part and parcel of a technical acceleration. However, the possibility to carry out more tasks in a shorter time hasn't brought about a liberation from constraints, or wider segments of free time to be enjoyed. On the contrary, we now have to face an acceleration in the pace of our lives and a real time-starvation in late modernity.
Yet gerontology takes up the opposite bet by offering new tools for deceleration and a better life, tools meant for taking one's time with and for older persons, in accordance with the values of *care***.**
Far from being a utopia, the bet of gerontechnology is indeed an ethical demand opposed to the risk of having our norms imposed upon us by the social acceleration, and consequently lose our autonomy.

KEYWORDS

Gerontechnology, social acceleration, ethic, care, value

1. HIGHT-SPEED SOCIETY

1.1 Technical Acceleration as an Enemy of the Free-Time

Since the eighteenth century, communication has increased its speed by 107 %, our means of conveyance by 102 %, data processing by 1010 %[1].

The use of technology goes together with the acceleration of a major part of our activity – here we mean the number of tasks, or the output a person can achieve within a certain time. Actually, while our forefathers wrote ten letters in a few hours' time, we, during the same lapse of time, have to write 20, 30, or 40 by e-mail, in order to keep up with the competition.That phenomenon is called "Technical Acceleration" by Hartmut Rosa[2].

When you come to look at it, since technology enables us to carry out more tasks in a shorter time, it should have presented us with vast periods of free time : "We had always expected one of the advantages of economic wealth (generated by technical progress) would be to bring up a quiet, harmonious way of life, a life in Arcadia."[3]

Paradoxically, the "saved" time hasn't turned out into "free" time, as in our present day societies we can observe a real "Time Famine"[4] - a shortage of time which is not due to longer periods for leisure or idleness : the time saved by technical acceleration has been reinvested into work, and the demands of economic growth.[5]

The combined effect of acceleration and growth has led to faster exchange; we then have to follow the dynamics of acceleration, and this has consequences over the whole of our time.

That is a distinctive feature of modernity : "The characteristic of modernity is the acceleration of time."[6]

The direct consequence to be observed is the ever-increasing amount of work, and reduction of our free time. Using technology then means an increase in activity, leaving less and less respite to the actors of our society.

1.2 The Extravagant Wager of Gerontechnology

Such observations make us think that, remarkably, gerontechnology seems to take up the opposite bet, by asserting that the new technologies will save time for us not in terms of work, but in terms of human contact and happy ageing.

The time gerontechnology allegedly saves is truly a time of deceleration, when home helpers can have enough time to listen to the older adults, and have their ears, too.

A genuine code of Ethics is here at stake : deceleration would in fact enable the next of kin or the social worker to have more time for the person and for themselves. Taking time would allow the values of gerontechnology[7] to expend a lot more, at one with the values of *care* as formulated by Joan Tronto :

- Paying attention to other people and their needs (*caring about* phase)
- Being responsible for fulfilling a need after determining the appropriate means (*taking care of* phase)
- Being competent in order to achieve the medical treatment efficiently (*care giving* phase)
- Being able to come up to the needs of the provider and the needs of the person who receives medical care in a balanced way. (*care receiving* phase)[8]

Paying attention to the needs of the individual, as well as to the feedback we get after giving care, the values of gerontechnology demand time : time must be given to and for the person, the people around them and the various participants giving medical care and helping keep senior citizens in their own homes. All that requires an investment in time which is harder and harder to find because of acceleration.

Is the prospect of deceleration – defended by gerontechnology – a mere utopia, or can it become a reality, and if so, under what conditions ?

We will see in this paper the effects of technical acceleration in the field of gerontechnology. This effects will show the negative results of acceleration in gerontechnology. An ethical dilemma appear : on the one hand we wants tools able to helps us for the care of elderly; on the other hand, we know that these tools will be more used for the social acceleration. However, the values of gerontechnology must keep on, because we cannot to eschew at the care.

2. ACCELERATION IN THE FIELD OF GERONTECHNOLOGY

As a matter of fact, gerontechnology, as indeed all technologies, do promise some time-saving, but also a lightening of tasks, which then seems to be paradoxical, since technical acceleration implies a growth in the output of the personnel and the acceleration of our social time. The technologies used for independence and home support are by definition tools which aim at helping people with tasks they cannot carry out any longer. Such technologies also strive after various goals, according to the tools : for instance, they can alleviate the care burden of the person in charge, they can facilitate communication between the family and the medical staff or the social services, etc…[1]

As regards tele-assistance technologies, for instance, from the point of view of the senior citizen, they allow him/her to stay at home and carry on with the chores and activities of daily living that can be done on their own. The next of kin and the home care services, on the other hand, may see those technologies as a prerequisite before the aged patient is allowed back home after a stay in hospital.[9] Such a provision of facilities is reassuring for the relatives : they no longer need to worry as they would if the elderly person had to leave home.

Those tools cannot be separated from the accompanying services[10]. The tele-assistance box is useless without the duty staff and the call back included in the subscription. The use of technology linked with service workers implies a technical acceleration of all the activities of the home care services.

The stand-by duty staff will have to react to the alarm as quickly as possible by contacting the family, the physician or the emergency services in case of an accident. As the seniors can be directed to the appropriate services without delay, they in their turn have to react faster, thus creating a snowball effect for all the implied services (SSIAD , SAD = Home nursing care services)

1 Projet Host AAL

At first sight, the acceleration process is a very positive element : there are no problems at all as regards ethics, since a majority of seniors will prefer staying in their own homes[11] - and priority must be given to carrying on with activities in the daily environment. Moreover, the older persons feel more safe because they can quickly and easily ask for help when a problem occurs; it also reassures the next of kin. Speeding up the medical assistance to the elderly, all that is very satisfactory: it is a positive effect of acceleration. However, we mustn't look away from the negative aspects of acceleration over gerontechnology.

2.1 The Negatives Results of the Acceleration in Gerontechnology

As far as Ethics is concerned, acceleration also rises some questions: homecare is also an economic issue, since supporting older people in their homes is a lesser cost to society than running residential homes, therefore using those technologies is quite economical.

Allowing seniors to live out their days in their homes means developing a battery of homecare and nursing services around the person. For example, home support and home care make use of portable phones and RFID technology in order to work out more rapidly how long the personnel need for their intervention. It is therefore easier to organize and keep the books of the service providers, thus increasing their productivity. The amount of time allowed for service is consequently reduced as much as possible, and staff must achieve as many tasks as they can, as quickly as they can. It is easy to imagine a possible use of the robots that are already available in domotics, so as to increase the number of chores to be done in a shorter and shorter lapse of time. And we can easily imagine, as well, the consequences entailed by the acceleration of the social time as regards the future of gerontechnology.

The acceleration induced by those tools would mean demanding more tasks, more responsibilities for the workers with lower income: helps, home care, home nursing care providers – but in return, no feedback in terms of social or financial recognition.

What would the conclusion be, but an increase in social inequity and injustice?

Apparently, gerontechnology does not seem to be able to escape the phenomenon of acceleration. How could it, since the phenomenon changes our social time and consequently implies a large part of the elements of our societies in its mad rush ?

Does this mean that we cannot help following that acceleration, and that the only way to avoid putting pressure on the weaker professions would be to deny gerontechnology any new developments ?

3. GERONTECHNOLOGY'S ETHICAL DILEMMA

The hypothesis that technologies will enable us to improve the quality of life for the elderly and their helps is quite common; technologies will bring about a better medical follow-up, better working conditions for the care service workers.

Far less common is the demonstration by researchers that gerontechnology and its tools actually enable the various services to do more – and at a lower cost – without any consideration for the quality of life of the protagonists. Consequently, our hypothesis will be that, generally speaking, these technologies must be used keeping in mind the human needs and certainly not the needs of financial markets, in terms of the economy alone.

By "human needs" we mean the longing for social ties, for consideration, a feeling that the persons belong to, and are recognized by, their peers. Eventhough the issue of a business model may be of importance, it must, in our view, come second to the quality of the support services and the needs they meet.

Thus the foundation of gerontechnology is : caring. Its ethical requirement is echoed in its values.

At present, the situation is as follows: on the one hand, we are developing new technologies, services and a business model aiming at a better life, better working conditions, better access to medical treatment and follow-up; on the other hand, we do know that such tools may be used in a logic of acceleration, demanding that people should do more and more things in a minimum time. Such a move would mean weakening even more people who already live precariously, whether they are older citizens or home care workers, and it would run counter to the very foundations of gerontechnology.

We are here facing an ethical risk, as acceleration implies that those technologies work against our fundamental hypothesis on gerontechnology, and threaten to ruin our ideas on how to use those technologies.

3.1 The Values of Gerontechnology Must Keep On

One among several possible answers would be to reconsider the foundation and the values we have so far taken to be ours, so that they no longer clash with the move of social acceleration.

However, it seems particularly difficult to find out new foundations that would admit acceleration – and yet would not lead our initial values totally astray.

The task is all the more difficult because new foundations can only lead us to a new idea of gerontechnology. In fact, if we admit that only a new gerontechnology based upon new values can coexist with acceleration, do we really have to abandon our values ?

Refusing to abandon such values incompatible with the acceleration of time could be a utopia.

However, we are here facing an ethical issue. Must we reconsider our values in order to conform them to the present evolution in society ? In other words, do we need to think again about what has to be in order to model it on what actually is at this point in time ?

The answer, of course, is no : that would mean renouncing all possible ethics. We have already lost control over the flow of world trade : it has become too fast to be managed by anything but computers. If the starting point is that acceleration beyond our reach, in order to set standards and values, we actually abandon our autonomy, in other words the ability to lay down our own laws[12].

Now our autonomy and ability to give ourselves a code of ethics, is our very essence as human beings.

Rather than think that our foundations are to be changed, hadn't we better think that acceleration itself is to be reconsidered, and by extension the evolution of our society ?

4. CONCLUSION

A fundamental ethical issue is at stake, namely our independence, which is threatened by the phenomenon of acceleration. Gerontechnology warns us against the dangers of modern times and reminds us of the true role of technology. It advises us to think twice about new techniques : their tools should not allow technical and social acceleration only, but but they should be used as tools for the people and their needs. However utopian these values may seem, there is no way we can renounce them without giving up at the same time all hope to conceive, and apply, a code of ethics.

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E-LEARNING PRACTICE-ORIENTED TRAINING IN PHYSICS: THE COMPETENCE ASSESSMENT

Titova O.V. and Kravets A.G.
Volgograd State Technical University,
Volgograd, Russia

ABSTRACT

An insufficient level of schools graduates in physics is identified as the modern problem of the education. It is propose to prepare students to the Unified state examination by means of tasks solution competences formation. The method of competences level automated management is developed for student's competences formation.

KEYWORDS

E-learning, tasks solution, competence level, assessment.

1. INTRODUCTION

Researchers (Sylvia Encheva, 2009; Barbara Scheuner & Lukas Faessler, 2010; Simon Caruana, 2010; Margot McNeill et al, 2010) propose methods of material assessment, strategies and technologies that enable the learner to embark on a learning process.

E-learning platforms are now widely used by educators to enhance the learners' interest in learning, shorten the learning portfolio, and improve the overall learning outcome (Zolttan Balogh & Cyril Klimes, 2010; Silvia Knittl & Hans Pongratz, 2010; Ting-Sheng Weng, 2009).

Individual learning paths may be used and suggested to user in dependence on a given answer of an exercise (Julia Schrock et al, 2010; Stefanie Sieber & Andreas Henric, 2010; Najat Smeda et al, 2010).

However, the question of the organization the e-learning practice-oriented training remains unresolved. This study have show that defining competences from solution tasks process lead to the solve problem.

2. ASSESSMENT OF THE COMPETENCE

2.1 Analysis of Practice-Oriented Training

The Russian government has adopted the program of the socially oriented development of the country. According to this program one of the main objectives is the development of science and technology sectors. For the solution of the posed problem in education the priority is given to technical and natural science disciplines.

The implemented Unified State Exam (the USE) has its goal to select capable school and university graduates. According to the results of the USE 2012 in Physics it has been found out that 26,6% (Ershov A.G. 2012) of all the school graduates got average and high grades and the rest of the school graduates (73,4%) got minimal and low grades. There has been observed a tendency of increasing number of school graduates who have not passed the minimum threshold. The number of such school graduates has increased from 0,4 % in 2011 to 12,1% in 2012. The situation is no better with those who got 100 grades. The number of them decreased from 0,11% in 2011 to 0,02% in 2012. As a result the universities specializing in engineering technology missed out on competitive applicants in 2012.

In accordance with the requirements of the Federal State Education Standard all school graduates must be able to apply their knowledge and skills in familiar, changed and new situations. The formation of the ability

to apply knowledge and skills in a familiar situation can be achieved by doing similar tasks. Application of knowledge and skills in changed and new situations requires some extra abilities. Pure knowledge of the theoretical material is not enough for completing the tasks in part C in the USE in Physics. Teachers of Physics tend to prepare students for the examination by giving them a great number of challenge tasks. Doing such tasks students acquire knowledge, the very knowledge that they apply at the examination. This preparation method is considered ineffective because one needs much time for fulfilling the tasks and nobody can guarantee that students will be able to cope with the task at the exam.

That is the reason why they suggest students being prepared through the formation of task-doing competences. Due to the development of new technologies and new PC hardware in educational institutions the preparatory work should be done through automation of a teaching process.

Accordingly, the development of the automated management method of students' competences level is viewed to be a vital target.

2.2 Representing Objects of the Discipline

Aiming at defining the task-doing competences in Physics there has been carried out an analysis of the task-doing process. As a result of the analysis there have been developed a structural and functional models of the task-doing process in the notation IDEF0 (Titova O.V. & Kravets A.G., 2011). The model of a task-doing process is viewed as a combination of functions. For each of these functions there are form controlling, controlling mechanisms and also in- and out coming data (Kravets A.G. & Titova O.V., 2011a). The obtained functions are now task-doing competences, which are to be formed in students. Control elements of the function are the theoretical material of the Physics course. The theoretical material required by solving the function is included into the ontology of a physical task (Kravets A.G. & Titova O.V., 2011b).

Aiming at the automation of competence level control process there have been set the tasks to control the system of practically oriented teaching in the field of natural science, within the framework of which there has been offered an idea of mathematical controlling the level of students' competences. As a result of solving the problem of the competence level control there has been obtained an optimal teaching mode. It is characterised by gradual increase in the competence level during the study process (Kravets A.G. & Titova O.V., 2012).

Ontology a physical task it is created in the Protege 4.1 software supporting format RDF/OWL. In ontology the classes (concepts) hierarchy of the physical task solution on a theme “Uniform movement of a material point” is presented. Quantities which describe movement of a point in a circle are chosen from the list of physical quantities. In ontology units of measure of physical quantities, a prefix or multiplier, a trajectory, etc. are added. In Figure 1a the hierarchy of classes is shown. The set of the RDF-statements received as a result of a relations establishment, forms oriented graph in which tops are classes and copies, and edges are marked by attitudes.

In Figure 1b the part of physical task ontology with relations is presented.

2.3 Assessment of the Competence

For automated control of the competence level it is suggested that they perform a model of a student as a set of many competences: $M_s = \{ C_1, C_2, \ldots, C_n \}$,

where C_i – i-th the tasks solution competence.

With the help of the worked out method of presenting a range of competences there have been defined certain connections between the competences. It are represented the tasks solution competence in the form of sets: $C_1=\{k_1, k_2\}$; $C_2=\{k_2, k_7, k_8, k_{13}, k_{14}\}$; $C_3=\{k_1, k_5\}$; $C_4=\{k_2, k_3\}$; $C_5=\{k_3, k_{10}\}$; $C_6=\{k_5\}$; $C_7=\{k_4\}$;

$C_8=\{k_6\}$; $C_9=\{k_8, k_9\}$; $C_{10}=\{k_{11}\}$; $C_{11}=\{k_{12}\}$; $C_{12}=\{k_7, k_{14}\}$,

where C_i – competences, k_i.– elements of a theoretical material (packages of knowledge).

For controlling the level of the competences there has been worked out a method of the competence level evaluating and developing an individual teaching strategy. Testing defines a level of the student knowledge. Answers in packages of knowledge under the formula are estimated:

$$lk_i = \frac{kol_prav_i}{kol_vop_i}, \qquad i=1,2,\ldots n_1$$

where kol_prav – quantity of right answers, kol_vop – in all questions in i-th package of knowledge, n_1 – quantity of packages of knowledge (n_1=14).

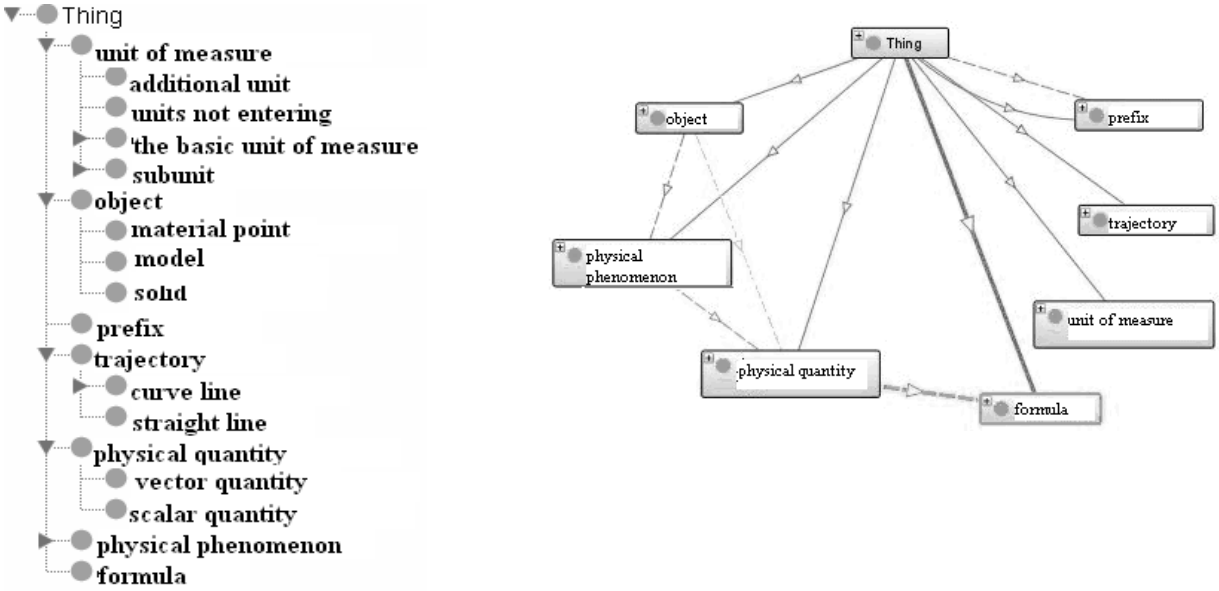

Figure 1. a) Hierarchy of classes; b) the part of physical task ontology with relations

The deviation student competence level from a level of the target competence is entered:

$$\varepsilon_i = \frac{rc_i}{n} - \frac{\sum_{j=1}^{n1} v_{ij} \cdot lk_j}{n \cdot \sum_{j=1}^{n1} v_{ij}}, \quad i=1,2,\ldots n,$$

where rc_i=1 level of the target competence, n –competences quantity (n=12), elements of a matrix are defined by a following rule:

V_{ij}= 1, if i-th competence contains j-th package of knowledge;

0, if i-th competence does not contain j-th package of knowledge.

Deviations ε_i the competence accept various values from 0 up to 1/n. Having ordered them in decreasing order, we receive the order of formation competences of student or an individual learning trajectory. Criterion of the competence inclusion in a learning trajectory - nonzero values of deviations:

$\varepsilon_i \neq 0$, i=1,2,…n

The level of student competences is evaluated with the help of software developed in ASP.NET MVC 3 RTM (Figure 2).

It allows to evaluate the competences level and to build up an individual strategy of the educational process.

2.4 E-learning of Physics Tasks Decision Competences

During last 3 years the pupils and students' e-learning of physics tasks decision competences were performed. The Internet Consulting Center (ICC) was organized in 2004 and the new method was implemented from 2009.

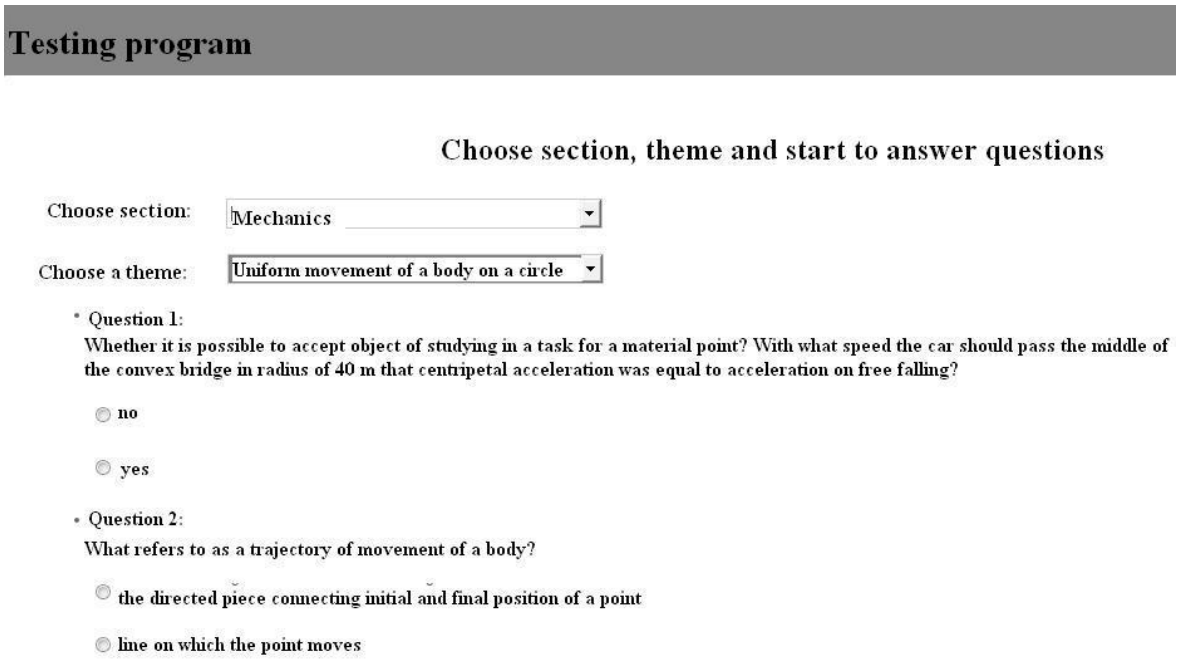

Figure 2. Software For Estimation of the Student Competence Level and Construction of Individual Learning Trajectory

The ICC education is commerce based. Without changing of the payment amount it was reduced the training time by 15% thanks to the implementation of developed methods and programs. We compared the average level of training at the groups with traditional and experimental (with proposed methods) ways of training (Figure 3).

The tests were carried out and the level of training was defined according to the formula (Kravets A.G. & Titova O.V., 2011a): $k = \frac{a \cdot 1 + b \cdot 0{,}64 + c \cdot 0{,}36 + d \cdot 0{,}17}{a+b+c+d} \cdot 100\%$

where a – quantity of marks «5», b – quantity of marks «4», c – quantity of marks «3», d – quantity of marks «2».

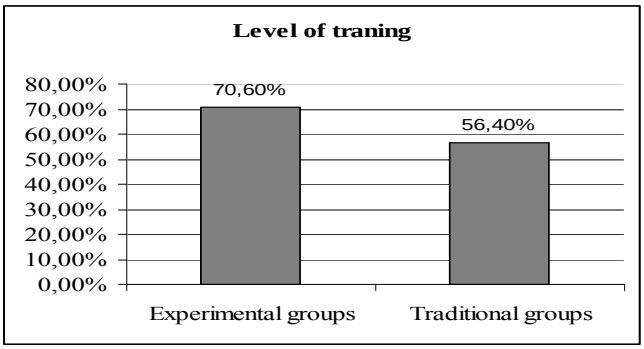

Figure 3. The Diagram of Training Level

The level of training is higher at the experimental groups by 14,2%.

The results of new methods implementation:

For students

1) training quality increased by 14,2%; 2) training time decreased by 15%.

For ICC

1) incomes increased by 17,6%; 2) additional time for courses 15%.

3. CONCLUSION

The designed method of the automated students' competence level control differs from the known methods in:

- The ontological model of a physical task has been the first to be developed. Ontology of a physical task is a field of knowledge, which includes both basic data of the task and the desired quantity. Solution to any task is included into this field of knowledge.
- There has been proposed a new method of the task-doing process formalization. It differs from the known ones due to the carried out the detailed task-doing process and the defined logical conclusion for completing the task from the basic data using ontology and descriptive logic.
- There has been developed a method of performing a variety of competences in doing physical tasks which is unique due to the fact that the task-doing competences in Physics are formed from the solving process model.
- There have been set the tasks to control the system of practically oriented teaching in the field of natural science, within the framework of which there has been proposed an idea of mathematical managing the level of students' competences.

This research proposes the innovative methodology that includes ontology of physics tasks and builds the assessment system to assist teachers to create the e-learning practice-oriented courses. The research is supported by Russian Basic Research Fund grant 12-07-00760-a.

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DO STUDENTS IN A DISTANCE LEARNING PROGRAM USE E-TOOLS AND DIGITAL DEVICES?

Jean Claude Callens
KATHO

ABSTRACT

In this study we research if students (who follow a distance learning program) have digital devices (cf. smartphones, e-readers, tablets), and if they use these digital devices during their study. Secondly, we research if these students use newfangled/modern e-tools (e.g. social media, cf. blogs, Twitter, Facebook,…) during their study and if the degree of self-regulation has impact on the degree of use of these e-tools. An online questionnaire was used. We consider this study as explorative.
The results reveal that participants use in a limited degree digital devices and e-tools during their study. There was no main effect of degree of self-regulation to the extent that students use e-tools. Finally, the results show that participants mainly prefer email in their communication with their lectors.
In conclusion, the finding that participants not often use e-tools and digital devices during their study, does not imply that e-tools and digital devices have no value in a formal learning process, but stresses the importance of well discussed educational choices to integrate e-tools and digital devices in a formal learning process.

KEYWORDS

Digital devices, social media, self-regulation, informal learning, formal learning

1. INTRODUCTION

There is the increased amount of research which focuses on the question how to integrate new-fangled/modern e-tools -e.g. social media, cf. blogs, Twitter and Facebook- in a distance learning program. Learning is a continuous process that takes place throughout life and in many settings Learning includes formal, non-formal and informal learning (‘OECD’, 2008). When not explicit used as element of a formal or non-formal learning process, social media may be considered as sources of informal learning.

The use of social media may increase the opportunity for students to study/learn at any time and wherever they want. This freedom of time and place creates de facto learner control. There is the assumption that effectiveness of learner control is partly determined by characteristics of the learner. Learner control seems intertwined with the degree of self-regulation. Students with low self-regulation function better when they have a lower degree of learner control; and vice versa, students with a higher degree of self-regulation are more capable to make effective use of the opportunities that learner control provides (Eom & Reiser, 2000; Scheiter & Gerjets, 2007).

2. RESEARCH QUESTIONS

In this study we research if participants use digital devices (e.g. tablet, smartphone,…) and e-tools (cf. blogs, Twitter and Facebook) during their study. Furthermore, we focus on the influence of the degree of self-regulation on the use of e-tools. This leads to the following research questions
- Which digital devices have students who follow a distance learning program?
- Which e-tools/digital devices use students (who follow a distance learning program) during their study?
- Is there a main effect of degree of self-regulation on the degree that students use e-tools during their study?

3. METHODOLOGY

This is an explorative study in which we investigate with a survey the perception of students. Könings, Brand-Gruwel and Merriënboer (2005) write that the degree of perception, the interpretation of students on learning matched with the principles of a learning environment, usually will determine also the effectiveness of a learning environment. Also Vermetten, Vermunth, and Lodewijks (2002) write that there is a constant interaction between a learning environment and individual learning, interspersed with the perception of learning about teaching, assessment, course content and structure, etc. Students are considered active, self-regulating participants in the learning process and their perceptions of learning can influence how they learn (Entwistle, 1991). In addition, instructions are always interpreted by students, and this interpretation may influence the effect of the instruction (Struyven, Dochy, Janssens, & Gielen; 2008).

3.1 Participants

A total of 745 students in a distance education program of 1 institution were invited the complete an online questionnaire. Only 298 have completed the questionnaire. This high drop-out is probably due to the fact that participation was no obligation.

The largest group (76.8%) of the participants are female. 44.7% of the participants have already obtained a degree. Almost half of the participants (47.7%, n = 142) has just started their study, 15.8% of the participants (n = 47) expects to graduate in six months.

3.2 Instruments and Procedure

An online questionnaire was used. The use of an online questionnaire seems to be justified this because in general the use of ICT has a positive motivational impact on students (Evers, Sinnaeve, Clarebout, van Braak, & Elen, 2009). The online environment was 'technical' simple, so no specific ICT skills were needed (Evers et al, 2009). After some personal data, participants were asked 1) which digital devices they possess and 2) which digital devices and e-tools they use during their study. When scoring the use of e-tools, a Likert scale was used (from 1-7, where 1 means 'never' and 7 'very much'). When scoring the digital devices they possess, participants could choose from two options: yes / no.

To monitor the workload, a questionnaire with a limited number of questions (=SRQ-L questionnaire; Black & Deci, 2000; Williams & Deci, 1996) was chosen to research the degree of self-regulation. The SRQ-L questionnaire consists of 12 statements. Questions 1, 4, 8, 9, 10, refer to autonomous regulation; questions 2, 3, 5, 6, 7, 11, 12 to controlled regulation. Participants assess (from 1-7, where 1 means 'not' and 7 'very much') how true each statement is for them. Besides the translation, an adaptation of the original questionnaire was done by changing 'chemistry' in ‘course’. In this study, the adapted SRQ-L questionnaire has an alpha reliability for autonomous regulation of .706 and .708 for controlled regulation. This corresponds with an acceptable internal validity (Gliem & Gliem, 2003).

With an e-mail the link to the online questionnaire was sent to the students. Participants had two months to complete the online questionnaire.

3.3 Data-analysis

First a descriptive report was made. Then, the influence of the degree of self-regulation (independent variable) on the use of e-tools (dependent variable) is examined with a one-way ANOVA (with exceedance probability of 0.05).

3.4 Results

Most participants have a computer with internet access (93.3%), 90.9% indicates to use the internet while studying. 31.2% of the participants possess a smartphone with 3G internet connection, but only 7.7% (n = 23) indicates to use a smartphone with 3G internet connection while studying. Furthermore, the results show that only 8.1% (n = 24) owns a tablet with 3G internet connection, 12.4% a tablet without 3G Internet. Only a

limited number of participants uses a tablet while studying: 6.7% uses a tablet without 3G internet, 5% a tablet with 3G internet. The results show that a limited number of participants owns an e-reader (10.1%, n = 30), only 4.4% uses an e-reader as support during their study.

The results reveal that participants use in a limited degree e-tools as support while studying.

Almost half of the participants (48%) says that they never use blogs; 78.9% indicates never to use twitter; 57.4% (n = 171) never uses Facebook; and 56% (n = 167) said never to use podcasts.

Yet, 87.9% (n = 262) indicates to use regularly websites while studying. 7.7% said never to use websites during their study. 75.7% consults online forums of the electronic learning environment (=Toledo, variant of Black-board), 12.8% never. 53.4% of the participants indicates to use regular the institutional digital video archive (made available via iTunes); 60.8% (n = 181) indicates the use regular Youtube in their study.

Respectively 25.5% (n=76) and 28.9% (n=86) mentions never to use Youtube and the institutional digital video archive while studying.

A chi-square reveals that certain tools to communicate with their lectors are significantly more chosen by the participants than others (x^2=474,11; df=4; p=0.00). The results show that the participants prefer email (70.1%) to communicate with their lectors. Only 4.4% prefers to communicate via phone with a lector (see table 1).

Table 1. Preference tool to communicate with a lector

	Count	Percent
phone	13	4,4
e-mail	209	70,1
Skype	20	6,7
online fora in toledo	38	12,8
Q & A in toledo	18	6,0
Total	298	100,0

Finally, the results reveal no main effect of degree of self-regulation (cf. RAI) on the use of e-tools (cf. use of respectively blogs, twitter, Facebook, YouTube, iTunes, podcasts, websites and online forums) in a learning process.

4. CONCLUSION

It is striking that participants make little use of digital devices (cf. smartphones, e-readers, tablets) and e-tools (cf. social media) while studying. The online forums of the electronic learning environment (= Toledo, version of Blackboard) and websites are more used/consulted. It also appears that participants use videos on Youtube and videos made available through the institution specific platform (made available via iTunes) during their study.

The results reveal that participants prefer email to communicate with their lectors. This has probably to do with the profile of the participants. Participants were all students who follow a distance learning program. These students very often have to combine work, family and their studies. Synchronous communication (such as telephone, skype, ...) make them less time independent; and thus it is less obvious with these tools to combine work, family and study. There was no main effect of degree of self-regulation on the degree that the students use e-tools in their study.

In conclusion, the finding that participants not often use e-tools (e.g. social media) and digital devices during their study, does not imply that e-tools and digital devices have no value in a formal learning process, but stresses the importance of well discussed educational choices to integrate e-tools and digital devices in a formal learning process.

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TELEMEDICALLY AUGMENTED PALLIATIVE CARE: EMPOWERNMENT FOR PATIENTS WITH ADVANCED CANCER AND THEIR FAMILY CAREGIVERS

Romina Nemecek[1], Stefanie Weber[1], Barbara Hofer[1], Patrick Huber[1], Herbert Watzke[2] and Michael Binder[1]
[1]*Department of Dermatology, Division of General Dermatology*
[2]*Department of Internal Medicine, Palliative Care Unit*
Medical University of Vienna, Waehringer Guertel 18-20, 1090 Vienna

ABSTRACT

Patients with advanced cancer have a substantial symptom burden, which deteriorates their quality of life (QoL). Palliative care, including symptom management, psychosocial support and assistance in decision-making improves well being of patients and their family caregivers. Special services (palliative care units, hospices, mobile hospice teams) have been established to meet the increasing demand of palliative care in the community. However, these services are expensive and usually not offered in sufficient numbers. By providing new eHealthcare services, unnecessary hospital admissions and costs for the health-care system could be avoided.
We want to evaluate the effects of a telepresence intervention implemented in the homes of patients with advanced cancer. For this purpose, we will develop a user-friendly telemedical system that will enable patients encountering medical problems to send a direct request to a palliative care team. This team will be accessible around the clock with the click of a button. Furthermore, a specially tailored database including up-to date important patient information, which can be fed by both the palliative care team and the patients themselves, will be developed. We hypothesize that our telemedical concept will i) increase QoL of patients and their family caregivers and ii) reduce the number of (unnecessary) hospital visits and admissions.
In order to assess the effects of this intervention we will conduct a controlled feasibility study, randomly assigning 20 patients with advanced non-small cell lung cancer to receive either standard palliative care or the telemedically augmented palliative care. We will compare QoL using standardized validated questionnaires, as well as frequency and duration of hospital visits/admissions with this control group and assess user satisfaction with our telepresence system.

KEYWORDS

Palliative care, oncology, telemedicine, video conferencing, quality of life, family caregivers

1. INTRODUCTION

According to the World Health Organization, cancer causes 20% of deaths in the European Region. With more than 3 million new cases and 1.7 million deaths each year, cancer is the most important cause of death and morbidity in Europe after cardiovascular diseases. In the majority of cases, there is little accessibility to effective treatment for their diseases. The development of palliative care is usually the only feasible alternative to respond to urgent needs of chronically sick people and improve their quality of life (QoL) (Sepulveda et al., 2002). Mobile hospice teams are a well-accepted alternative to provide medical support outside hospitals. Nevertheless, the major problem is that there are far too few mobile hospice teams available. Resources are not sufficient to manage acute medical problems at night. If a patient has medical problems during night, usually the ambulance is called and the patient is admitted to hospital. This means not only additional distress to patients themselves, but also to their family caregivers.

1.1 Patients and Caregivers – One Unit of Care

Previous studies have shown that providing care results often results in experiencing elevated levels of emotional distress, resulting in a deteriorated QoL (Schulz et al., 1990, Song et al., 2011, Kuenzler et al., 2011, Rhee et al., 2008). One of the main stress factors is the amount of given care, which severely affects the lifestyle of family caregivers (Cameron et al., 2002). Interestingly, Fleming et al. (Fleming et al., 2006) demonstrated that patient's mental health and depression scores correlate with those of their family caregivers. These data suggest that terminally ill patients and their family caregivers share similar perceptions and evolve as a "unit of care". This finding is also supported by Northouse et al. (Northouse et al., 2010).

1.2 Telemedicine – White Hope in Augmented Care?

Audio-visual technologies may be useful in home-based palliative care. Morgan et al. (Morgan et al., 2008) observed that videoconferencing for patients with severe congenital heart disease decreased anxiety levels compared with telephone calls, as it was associated with improved clinical information. In a study by Miyazaki et al. (Miyazaki et al., 2003), the use of ISDN video-phones in palliative and antenatal home care was examined. The palliative care patients and their families commented that visual features of their mobile phones enhanced the received care. Visualization of patients also allows a (limited) physical assessment to be undertaken, which can assist with patient management and care (Bensink et al., 2004). Various models of telemonitoring have been proven useful in different situations. Maiolo et al. (Maiolo et al., 2003) showed that homemonitoring of arterial oxygen saturation and heart rate was reliable and decreased the number of hospital admissions and acute home exacerbations during the telemonitoring phase. Scalvini et al. (Scalvini et al., 2002) showed that telecardiology in patients with chest pain showed a very high diagnostic accuracy (86.9 %). Three-fourths of these cases could be solved by the telemedical service.

2. METHODS

The objectives of our project contain three major scopes: (1) Improve patients' and family caregivers' quality of life (QoL) by means of telemedically augmented palliative care, (2) Decrease the number of hospital admissions and emergency room visits, (3) Gain initial data on cost and potential benefit of this approach.

Within the scope of this project, a telemedical device will be used to link oncological patients and their family caregivers to the responsible physician at the Palliative Care Unit, Department of Internal Medicine, General Hospital of Vienna. Technical requirements include immediate availability, convenient handling, connectivity to an already existing Internet connection, and data security. To access the database, a web interface will be used. The database acts as the server component and the web interface as the client component. The web interface should be user friendly. Ideally, the telepresence system will consist of a monitor or tablet with touch-screen function. It should be possible to send an emergency request within very few clicks. An installation should not be necessary. Every request to the palliative care unit should be documented in an audit repository.

The database will include the necessary information concerning participating patients and should be collaborative, meaning that physicians as well as patients and/or family caregivers will be able to add important information to continually update the database. The process of updating should be as easy as possible. Therefore, it should be possible to use the web interface via mobile devices (e.g. tablets). Weight, pulse, blood pressure, oxygen saturation, breathing rate and diet should be documented. Important nursing information (e.g. patient's ideal rest position) should be documented too. Automatic data transmission of oxygen saturation and pulse is desirable. A first draft of such an interface is shown in Figure 1.

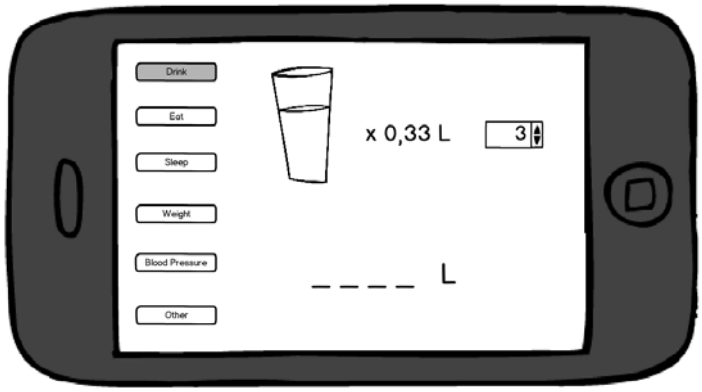

Figure 1. GUI Mockup (tablet)

Essential requirements are data security (encrypted data transmission, password protected login) and usability. The challenge is to support the physician in charge by providing a quick overview of the patient's history and characteristics, thus facilitating decision-making.

Ergonomic aspects for patients with special needs (e.g. mobility problems) will be considered. In order to assess the patients' needs and expectations of such a telemedical system, structured interviews with 10 oncological patients and 10 family caregivers will be performed. This pre-study is a prerequisite of this study. In case of an emerging medical problem, the previously described telemedical service will enable participating patients and their family caregivers to contact a palliative care team that will be available around the clock. Furthermore, the palliative team will be equipped with a specially tailored database (as described above) which provides all important information about the patient in need of help and which will serve the responsible physician as decision support. We assume that most cases will be solved by telemedicine. If the medical request cannot be solved by telemedicine, the patient must be admitted to hospital. Figure 2 pictures the previously described workflow.

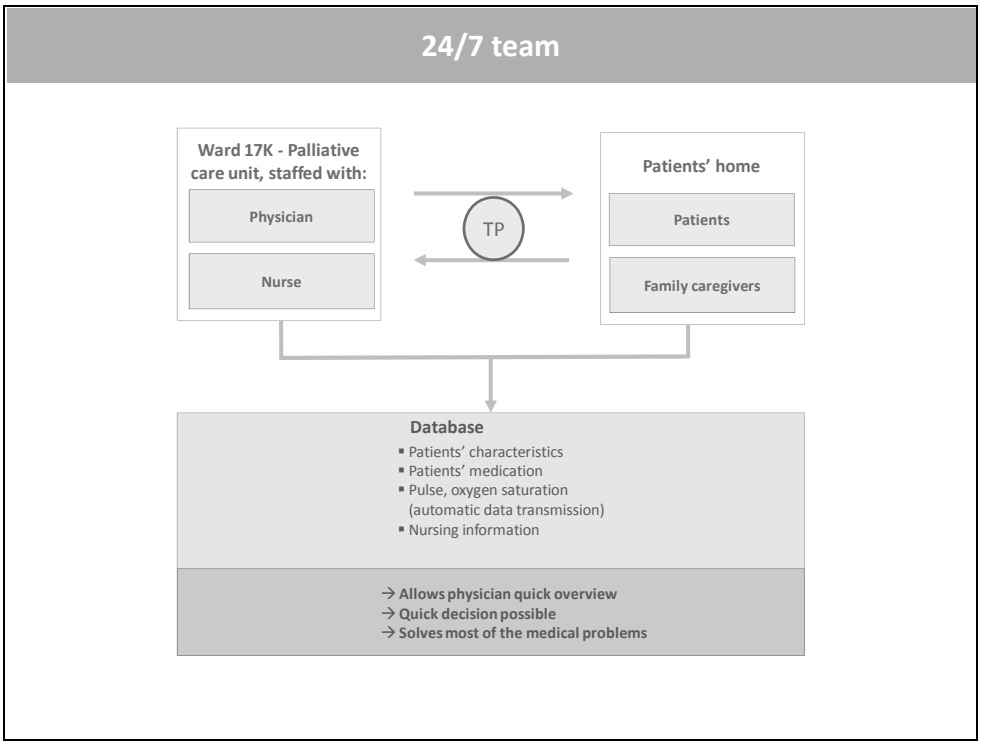

Figure 2. Workflow (TP… Telepresence system)

To assess QoL and mood, the validated questionnaires EORTC QLQ-C15-PAL, Hospital Anxiety and Depression Scale (HADS) and FAMCARE (Caregiver Satisfaction with Advanced Cancer Care) will be used. Questionnaires will be filled in at 3 different points of time. All patients will complete HADS and QLQ-C15-PAL, whereas the family caregivers will complete HADS and FAMCARE. The first survey will be performed at the beginning of this project (baseline), the second survey will be conducted 10 weeks after baseline and the last survey will be conducted 20 weeks after baseline. Additionally, patients and family caregivers of the intervention group, who will be supported by telemedicine, will fill in a questionnaire regarding their experiences with the telemedical service. This structured questionnaire will include the subjective opinion on the doctor-patient-relationship as well as on the quality of care, acceptance and satisfaction with the telepresence system. Technical performance will be assessed by measuring the accessibility of the technical system in general, the frequency of technical failures and the measurement of transmission speed of latency. In addition, the usability of the system will be measured on both sides, the providers of medical care as well as the patients and their relatives. All parameters will be transferred to a database allowing for statistical analysis.

3. CONCLUSION

We expect that by providing a telepresence system to palliative care patients, most problems can be solved by telecommunication, thus sparing the patient and family caregivers additional distress. Furthermore, the possibility to get medical advice at any time may improve symptom management, decrease emergency room visits and enhance support for families and friends who are taking care of patients at home. Thus, QoL of oncological patients and family caregivers will be improved.

The aspect of incorporating QoL outcomes into the evaluation of our telemedically augmented palliative care service is a clear advantage in comparison to most studies in this field (Zimmermann et al., 2008). The specific strength of this approach is its design close to a real-life clinical setting. Specifically patients as well as the individuals from the control group are recruited from clinical setting and are under close supervision during the entire duration of the study. Usability, reliability and data security as well as reasonable data aggregation are key requirements concerning any telepresence system regarding the acceptance of patients, caregivers and physicians. Our study will take into account all these important aspects and will assess their impact on the overall success of this concept of care.

There are a few limitations of our study. First, it will be performed at single care site with a specialized group of palliative care clinicians, thereby limiting generalization of the results to other care settings or patients with other types of cancer. Second, the sample size is modest. Future research should address for broader testing. Once the presented concept of telemedically augmented care is established, multiple medical fields of application can arise. One of the major terms for the broad application of telemedically augmented care will be a clear legal regulation of hardware and software in the medical domain.

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TELE-HEALTH AND NEUROMUSCULAR DISEASES

Esther Lázaro, Imanol Amayra, Juan Francisco López-Paz, Amaia Jometón,
Oscar Martínez and Imanol Pérez
University of Deusto
Avda Universidades, 24 Bilbao-Spain

ABSTRACT

Neuromuscular diseases are a group of pathologies characterized by the progressive loss of muscular strength, atrophy or hypertrophy, fatigue, muscle pain and degeneration of the muscles and the nerves controlling them (The French Muscular Dystrophy Association, 2004). Perceived isolation and health related quality of live are affected in the majority of cases due to the illness chronicity. Internet and the use of chat and videoconferencing programs are alternatives options to mitigate the mentioned variables. Thus, the aim of the study is to assess the effectiveness of teleassistance on reducing isolation and improving health related quality of life in adults with neuromuscular diseases. The sample was composed of 60 participants randomly selected and affected by different neuromuscular diseases (e.g. Myasthenia Gravis, Becker Muscular Dystrophy, Facioescapulohumeral Muscular Dystrophy, etc.). Twenty-four patients were assigned to the experimental group, which participated in the chat and videoconferencing sessions, and twenty-one to the control group, which did not participate. All the patients were recruited from neuromuscular disorders associations and Hospitals of The Basque Country. Effectiveness were assessed by a pre-post design in which questionnaires and interviews were administrated (e.g. Disability Assessment Schedule – WHO-DAS II, Sickness Impact Profile, The MOS Social Support Survey, etc.). The online support entailed different activities developed during three months in once a week sessions: a) Group videoconference sessions with a Psychologist, b) Individual videoconference sessions with a Neurologist, and c) Forum discussion groups about biopsychosocial issues. The psychologist counseling consisted on a psychosocial program about general topics such as illness information, emotional reactions to the disease, the most frequently automatic thoughts, etc. A web site was developed to carry out the intervention: http://neuromusculares.deusto.es/. Preliminary results revealed that health-related quality of life improved after the teleassistance and feelings of isolation were reduced in patients with mobility problems due to teleassistance. High levels of satisfaction are reported by the participants. Teleassistance is an effective alternative way of advising people with neuromuscular disorders.

KEYWORDS

Teleassistance, online support, neuromuscular disease, isolation, quality of life.

1. INTRODUCTION

This paper presents the results from tele-assistance program directed to a group of people with neuromuscular diseases. The aim of the study was to create a website with multidisciplinary information about neuromuscular diseases and to reduce feeling of isolation and finally to improve health-related quality of life levels.

Several authors have researched on how videoconferencing can be used as an effective support for people with different diseases. The results of the studies indicates that tele-assistance may reduce the sense of loneliness and isolation of elderly people, can be as effective as face to face condition with people suffering posttraumatic stress disorder or depression, or can improve health related quality of life of people with neuromuscular disease, like myasthenia or multiple sclerosis (Amayra, Lázaro, López-Paz & De la Cruz, 2008; Germain, Marchand, Bouchard, Drouin & Guay, 2009; García-Lizana & Muñoz-Mayorga, 2010).

The present study was focused on the following neuromuscular diseases: Myasthenia Gravis, Limb-girdle Muscular Dystrophy, Becker Muscular Dystrophy and Facio-scapulo-humeral Muscular Dystrophy.

A neuromuscular disease is a disorder that affects the peripheral nervous system. The peripheral nervous system includes muscles, the nerve-muscle (neuromuscular) junction, peripheral nerves in the limbs, and the motor-nerve cells in the spinal cord. Other spinal cord or brain diseases are not considered “neuromuscular” diseases. Patients with neuromuscular diseases can have weakness, loss of muscle bulk, cramping, numbness,

tingling, and a host of other symptoms (French Muscular Dystrophy Association, 2004). These diseases are considered rare diseases with low prevalence and a high geographic dispersion. Some of the people who suffer them, live in rural areas where health care services are not so accessible. These diseases are chronic, with similar characteristics, such as muscular weakness, mobility difficulties, feeling of isolation or dependence. This chronicity and the lack of cure leads to high health care costs (Chandorkar & Chakraborty, 2000).

2. METHODOLOGY

2.1 Sample

The sample is composed of recruited forty-five participants over fifty years of age from different Hospitals of Biscay and some associations of affected people. The total sample was composed of 29 participants with Myasthenia Gravis and 16 with the other diseases (figure 1).

The patients were assigned to the experimental group, which participated in the chat and videoconferencing sessions, and the other thirty to the control group, which did not participate. The participants were allocated to the experimental or control group depending on their interest of participate actively or passively in the project. In the experimental group there were eleven 11 males and thirteen 13 females, and in the control group twelve 12 males and nine 9 females.

Sample		Total (n=45)	Exp. Gr. (n=24)	Contr. Gr. (n=21)
Gender	Male	23	11	12
	Female	22	13	9
Age	Mean	50.56	45.38	56.48
	Standard Deviation	14.075	11.798	14.379

Figure 1. Characteristics of the Sample

The inclusion criteria for both groups were: medical confirmed diagnosis (CIE-10) of one of the diseases mentioned above, age ≥ 18 years, agreeing to participate in the study by signing an informed consent, and ability to manipulate a computer (just for the experimental group). The exclusion criteria for both groups were to have a psychiatric disorder (DSM-IV-TR), head trauma or severe visual limitations. All the patients were recruited from neuromuscular disorders associations and Hospitals of The Basque Country.

2.2 Instruments

At two time-points in the study, the participants have to complete questionnaires and interviews: prior to beginning treatment and immediately following the final session. Assessment was conducted in person in both conditions: pretest and post-test. The instruments will be applied in the following order: 1) Disability assessment Schedule: WHO-DAS II (Luciano et al., 2010); 2) Health related quality of life: EuroQoL EQ-5D (EuroQoL Group, 1990); SF36 (Alonso et al., 1995); 3) Sickness Impact Profile (Bergner et al., 1976); 4) The State-Trait Anxiety Inventory (STAI-E-R, Spielberger, 1982); 5) The Beck Depression Inventory (BDI, Beck, 1979); 6) The MOS Social Support Survey (Sherbourne, 1991); 7) The Hospital Anxiety and Depression Scale (HAD, Zigmond et al., 1983); 8) The Holmes and Rahe Stress Scale (Holmes & Rahe, 1967); 9)The COPE Inventory (Carver et al., 1989); 10) The Self-efficay Scale (Sanjuan et al., 2000).

2.3 Procedure

This is the home page of our website. The name of the site is neuromusculares.deusto.es (figure 2). It was composed of two areas: on the one hand, the public area, with publications (thesis, articles, books, database), news about neuromuscular diseases and several links. On the other hand, a private area with psychosocial support, medical advice and a forum.



Figure 2. www.neuromuscular.deusto.es

The intervention program had three components: group videoconferences with a psychologist, individual viodeoconferences with a neurologist and a forum about biopsychosocial topics.

The first one, the videoconference with a psychologist, consists on seven group sessions of one hour duration, every two weeks, about several topics. It was carried out with the Skype computer program, in which four or five people participated with the therapist.

Several topics were discussed during the online sessions: Emotional reactions during neuromuscular disease: stress, physical, cognitive and behavioral symptomatology of anxiety, anger to other and to oneself, sadness, fear or hope. During the sessions the participants could share their emotions about the present, diagnosis and the development of the disease. Other topic was the negative automatic thoughts: definition, consequences, negative emotions, adaptation difficulties, detection of negative thoughts and change for alternative ones. The participants also had the opportunity to share and express their automatic thoughts. The members of the chat group help each other to find alternative thoughts. With the guided visualization the participants had access to visualization examples in the website and they could practice it every day. During the next sessions, the experiences and perceived benefits were shared between participants. Finally, the following topics were developed: problems solving skills with practical examples of problem definition and formulation, generation of alternative solutions, decision making process, solution implementation and verification.

The second component of the intervention was the videoconference with a neurologist; there were individual sessions every week. The average duration of each one was around fifteen minutes. These neurologists were specialized in neuromuscular diseases. The main aim of this service was to solve general doubts about participant's disease.

Finally, there was a forum about different topics where participants could leave messages to professionals or to their peers, like medical or psychological issues.

3. RESULTS

In the WHODAS-II of the member of the experimental group, there were statistically significant differences ($p < .05$) in these variables: "Understanding and communicating", related to general cognitive capacities such as memory, attention or concentration; "Getting along with people", including aspects such as dealing with unknown people or making new friends; "Life activities", a variable related to household responsibilities and the difficulties doing them; "Participation in society", for example community activities or barriers and in the total scores of this test. The scores of control group members in the WHODAS-II were not statistically significant except in the domain "Life activities" with an increase in its scores, indicating a worsening.

Variables	Mean Score		Z	P-value
Understanding and communicating	PRE	14.5833	-2.076	.038
	POST	7.5		
Getting along with people	PRE	17.3611	-2.289	.022
	POST	7.9861		
Life activities	PRE	43.3333	-2.844	.004
	POST	34.1667		
Participation in society	PRE	34.7222	-2.052	.040
	POST	26.3889		
Total WHODAS Working	PRE	15.2291	-2.226	.026
	POST	14.6226		
Total WHODAS Not Working	PRE	32.6726	-2.930	.003
	POST	22.3430		

In the Sickness Impact Profile of the experimental group, statistically significant differences were found in the variables shown in this table. There was a decrease in the scores, indicating an improvement in these variables: "Emotional behaviour", related to nervousness, complaints of pain or discomfort; "Social interaction", such as reduction of visits to family and friends, isolation, or irritability; "Alertness behaviour", related to memory, attention or concentration; "Psychosocial Domain" and "Total SIP. The control group did not in statically significant differences.

In the COPE inventory there was a significant decrease in the "escape" score, indicating a slight reduction of cognitive avoidance strategies, being these ones low in the pre-test. And in the eSeF - thirty-six (36) health survey questionnaire there was an improvement in the "General health" score.

The control group did not show significant differences in these two variables but it did in the variable "Self-care" of the EQ-5D, showing a slight worsening bearing in mind the low pre-score.

To assess the satisfaction with the online program we did an interview about the topics reflected in the slide. Up to 60% of participants reported quite a lot satisfaction.

With regard to the reduction of health care costs in the long term, the majority of participants reported that they would not reduce the time of each session with the neurologist, but forty-one percent (41.7%) said that teleassistance could decrease traveling expenses because of a reduced need for face-to-face support. Finally, seventy-five (75%) reported that they would make a high use of online services if mobility difficulties appear in the future.

4. CONCLUSION

Several limitations were found along the whole process are those mentioned here: the sample was not randomized: There were some difficulties obtaining the sample due to diagnosis delay, geographic dispersion or low prevalence. The only participants who benefited were those who had access to a computer and internet. And computer illiterate participants did not benefit because they were included in the control group; People with higher levels of disability demand this type of assistance more than those with lower levels and, lastly, there were some technical problems such as Internet connection, low image quality, having a not updated Skype version or facing troubles in its use, etc.

Finally, we can conclude that the differences found in the health-related domains of the WHODAS-II, SF-thirty-six and SIP, point out that health-related quality of life can be improved with the teleassistance program. Second, feeling of isolation can be reduced in patients with mobility problems due to the creation of social support networks by teleassistance. This reduction can be explained by the improvement of some of the social variables of the WHODAS-II and the SIP. Third, qualitative analysis of the participants' answers showed that health care costs can be reduced in the long term. And fourth, participants reported high levels of satisfaction with the teleassistance program according to the final interview.

This project can be sustainable in the future because the web site and the videoconference are developed; Moreover, they are accessible, simple and useful tools.

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TOWARD A FRAMEWORK FOR DATA QUALITY IN ELECTRONIC HEALTH RECORD

Omar Almutiry, Gary Wills and Richard Crowder
School of Electronics and Computer Science, University of Southampton, Southampton, UK.

ABSTRACT

Electronic Health Record (EHR) refers to the digital form of a patient's medical record. It is defined as a repository of patient data in digital form. This record is stored and exchanged securely and accessible by different levels of authorized users. Its key purpose is to support the continuity of care, and allow the exchange and integration of medical information for a patient. However, this would not be achieved without ensuring the quality of data populated in the EHR as the data quality can have a great impact on the overall effectiveness of EHR. The assurance of the quality of data used in healthcare systems is a pressing need to help the continuity and quality of care. Identification of data quality dimensions is a challenging issue as EHR data quality often focus only on data validation and verification, and overlook, for example, the appropriateness of use. Some research proposed frameworks of the data quality dimensions without taking into consideration the nature of e-healthcare systems. In this paper, we proposed an initial framework that fits the data quality attributes. This framework reflects the main elements of the healthcare systems and the functionality of EHR.

KEYWORDS

Electronic Health Record (EHR), Data Quality (DQ), DQ Dimensions, Information System.

1. INTRODUCTION

EHR refers to the digital form of a patient's medical record. It is defined as a repository of patient data in digital form. This record is stored and exchanged securely and accessible by different levels of authorized users (Häyrinen et al. 2008). One of the most noticeable advantages of adopting EHR systems in healthcare providers is the improved quality of the patient care as the key purpose of digital recording in healthcare services is to improve the quality of health services provided to a patient. Many studies (Thakkar & Davis 2006; Yoon-Flannery 2008) highlighted and emphasized how such systems could enhance the quality of care and support its continuity.

Data quality in information systems with its dimensions have been widely discussed by many researchers (D. P. Ballou & Pazer 1985; Tayi & D. Ballou 1998; Strong et al. 1997; R. Y. Wang et al. 1995; Fox et al. 1994; Anany Levitin & Thomas Redman 1995; Canadian Institute for Health Information 2009; Orfanidis et al. 2004). As a result, many frameworks of Data Quality (DQ) dimensions have been introduced and discussed in order to assure the quality of data populated in any information system. However, these frameworks have missed some important attributes that need to be involved to ensure, for example, the integrity and the origin of information. This is due to the fact that the frameworks are generic, and do not reflect the nature of the domain.

In the area of Health Information System, some issues and challenges have been arise that have an impact on the widespread adoption of EHRs. Data quality assurance is a challenging issue as the key barriers of optimally using data populated in EHRs is the increasing data quantity with poor quality. "Fitness for use" is one of the best definitions of the data quality. This definition takes us even further beyond the traditional concerns with accuracy of data, as it will end up with many other dimensions of data quality. So data quality is a concept with multi-dimensions. The existing frameworks of the dimensions were usually based on literature review, industrial experiences or intuitive understanding. Consequently, there is variety of DQ frameworks, and the definition of a dimension may vary from one framework to another.

We developed an initial framework that concerns DQ in the context of electronic health care systems. This framework is a result of filtering the existing data quality dimensions in many research, and checking their suitability to the nature of e-health systems.

This paper reviewed EHR systems and their functionalities, and data quality. After that, it discussed the proposed framework and its life development. The paper concludes with discussion and future work.

2. EHR AND ITS FUNCTIONALITIES

EHR refers to the digital form of a patient's medical record. It is defined as a repository of patient data in digital form. This record is stored and exchanged securely and accessible by different levels of authorized users (Häyrinen et al. 2008). Regarding its functionalities, the Institute of Medicine (IOM) Committee in the USA (Hoffman & Podgurski 2008) identified the key components of EHR systems and highlighted its functionalities. These core functionalities fall into eight categories, and are briefly discussed below.

- **Health Information and Data**: EHR systems should hold a defined data set that includes, for example, medical and nursing diagnoses, allergies, demographics and laboratory rest results to ensure improved access for some needed information to care stakeholders.
- **Results Management**: It is a feature that manages results of all types such as laboratory test results and radiology procedure results reports. This would prevent the redundant and additional testing, thus improving efficiency of treatment and decreasing cost.
- **Order Entry/Order Management**: Computerised provider order entry (CPOE) for areas like electronic prescribing can improve workflow processes, prevent the occurrence the lost orders and overcome the problem of ambiguities caused by illegible handwriting.
- **Decision Support**: Computerised decision support systems have demonstrated the ability to enhance clinical performance for many aspects of health care through, for instance, drug alert, rule-based alerts and reminders.
- **Electronic Communication and Connectivity**: Effective communication is crucial to the provision of the quality of health care. This can be between health care team members, patients and other partners such as pharmacy, laboratory and radiology. This communication and connectivity include the integrated medical record within the same facility, different facility within the same healthcare system, and among different systems (Thakkar & Davis 2006).
- **Patient Support**: Many forms of patient support have shown significant effectiveness in healthcare in general. These forms include patient and family education and home telemonitoring.
- **Administrative processes**: Electronic scheduling systems for hospital admission, inpatient and outpatient procedures, and visits play an important role not only to enhance the efficiency of healthcare units, but also provide better service to patients.
- **Reporting and Population Health Management**: This feature makes the process of reporting less labor-intensive and time-consuming. It helps report patient safety and quality data as well as public health data.

Reviewing the content and functionalities of EHR will help us to understand the nature of such context and, thus, the data quality requirements in order to enhance the quality of care.

3. DATA QUALITY

"Fitness for use" is one of the best definitions of the data quality. This definition takes us even further beyond the traditional concerns with accuracy of data, as it will end up with many dimensions of data quality. So data quality is a concept with multi-dimensions. Data quality includes not only data validation and verification, but also the appropriateness of use (Orfanidis et al. 2004). Despite the fact that there are many frequently used dimensions such as accuracy, consistency, completeness, and timeliness, there is no consensus on rigorously defined set of data quality dimensions (Strong et al. 1997; Tayi & D. Ballou 1998; Wand & R. Wang 1996).

3.1 Data Quality Dimensions

As the definition of data quality stated earlier, data has been best described with multiple dimensions. However, there is no clear consensus on the data quality dimensions. Moreover, this definition implies that many other attributes of data quality including usefulness and usability are very important aspects of quality. (Strong et al. 1997) classified these dimensions into four categories; intrinsic, accessibility, contextual and representational. Table 1 below summarised some frameworks for data quality dimensions and its originality.

Table 1. Data Quality (DQ) Dimensions

Research	Data Quality Dimensions
(D. P. Ballou & Pazer 1985)	Accuracy, completeness, consistency and timeliness.
(Strong et al. 1997)	Accuracy, objectivity, believability, reputation, accessibility, access security, relevancy, value-added, timeliness, completeness, amount of data, interpretability, ease of understanding, concise representation, consistent representation.
(R. Y. Wang et al. 1995)	Accessibility, interpretability, usefulness, believability.
(Fox et al. 1994)	Accuracy, currentness, completeness, and consistency.
(Anany Levitin & Thomas Redman 1995)	Contents (relevance, unambiguous definitions, obtainability of values), scope (comprehensiveness, essentialness), level of details (attribute granularity domain precision), composition (naturalness, occurrence identifiability, homogeneity), consistency (semantic consistency, structural consistency) and reaction to change (robustness, flexibility).

3.2 Health-related Data Quality Dimensions

Many researches have defined some data quality dimensions in the context of health. Canadian Institute for Health Information (CIHI) defined five dimensions, namely accuracy, timeliness, comparability, usability and relevance. Each of these dimensions is divided into several related characteristics, and each characteristic is further made up to some criteria. Table 2 shows some frameworks of health-related data quality dimensions. (Liaw et al. 2012) stated in their survey the most frequent DQ dimensions; accuracy, completeness, consistency, correctness and timeliness.

Table 2. Health-related Data Quality (DQ) Dimensions

Research	Data Quality Dimensions
(Canadian Institute for Health Information 2009)	Accuracy, timeliness, comparability, usability and relevance.
(Orfanidis et al. 2004)	Accessibility and availability, usability, security and confidentiality, provenance, data validation, integrity, accuracy and timeliness, completeness, and consistency.
(Liaw et al. 2012)	Accuracy, completeness, consistency, correctness and timeliness.

3.3 Impact of Poor Data Quality

One of the key challenges of healthcare services is mitigating medication errors in the medication process. The motivation of developing a framework data quality assurance is to tackle the poor quality of data that badly affects the quality of care. These errors could lead to death as, for instance, there is an estimation of 98000 deaths each year in the U.S. costing as much as $29 billion (Hoffman & Podgurski 2008). Utilisation of EHR can result in improved patient safety by reducing the medical errors in hospitals (Bates 2000; DW et al. 1998). Even more, this type of environment could help care providers to identify and notify their patients about important changes in drug therapy (Jain et al. 2005; Parker et al. 2006).

3.4 Research Gap

The existing frameworks of the dimensions were usually based on literature review, industrial experiences or intuitive understanding. The definition of a dimension may vary from one framework to another. For

instance, different definitions are given to Completeness in these researches (Wand & R. Wang 1996; Naumann et al. 1999), and accuracy are differently defined in different approaches, see the example given by (Wand & R. Wang 1996). The conception of data quality depends on the actual use of data. Thus, this depends on the application, and what may be considered as good quality of data in an application may not be sufficient in another application (Wand & R. Wang 1996). So Wand and Wang (1996) emphasized the importance of providing a design-oriented definition of data quality that will reflect the nature of information systems. The other issue of the existing approaches is the fact that they are too generic to adopt, as some attributes may be EHR-irrelative. The next section addresses these issues by proposing EHR-specific data quality framework.

4. THE PROPOSED FRAMEWORK

This framework should address the issues identified earlier. By reviewing the contents and functionalities of EHR systems, and discussing the DQ dimensions within the context of EHR system, this would lead to clear definitions of the attributes as well as EHR-relevant dimensions.

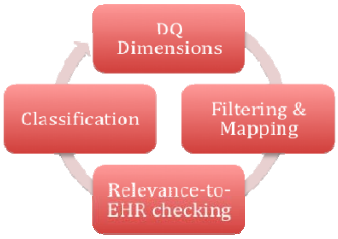

Figure 1. The Process of the Framework Development

Figure 1 illustrates the process of developing the proposed framework. It started with gathering data quality dimensions in organizations and healthcare systems. These dimensions were filtered and mapped to each other, if needed, to eliminate the redundancies. In this step, literature review and dictionaries were used as a guideline to avoid having two attributes with the same implication. The next step is to check whether the dimension is relevant to the EHR functionalities and content. After that, the resulting dimensions were grouped and classified into three categories, which form the elements of our framework. These are information, communication and security, which are considered the main elements of e-healthcare systems (Shoniregun et al. 2010).

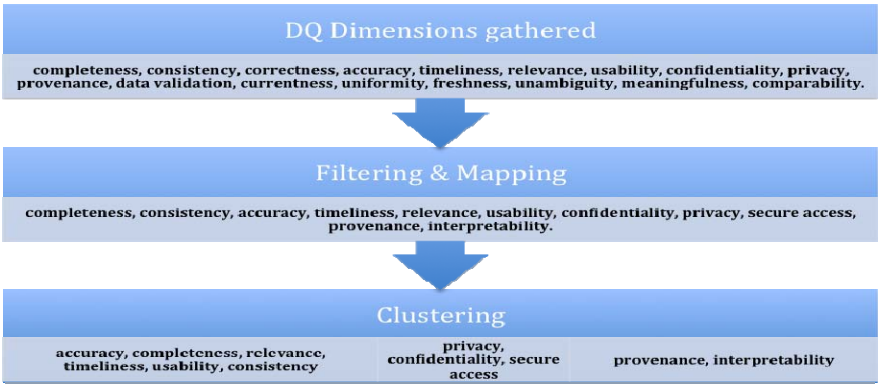

Figure 2. The Flow Output during the Development

Figure 2 shows the flow of the dimensions output in each stage. In the last stage, the dimensions are classified into three categories. This classification fits into our framework, and this would cover all aspect of EHR systems as it balances between the comprehensiveness of DQ dimensions and the nature of EHR systems. Fitting the output into the proposed framework, we believe, would give a clear definition of each dimension, and help assure about what to measure and how.



Figure 3. The Proposed Framework of the Data Quality In EHR

The characteristics of high-quality data consist of three categories: information, communication, and security aspects. As can be seen from figures 3, there are 11 data quality dimensions fitted in a framework of three categories.

4.1 Information

As mentioned earlier, information is one of the main elements that shape the e-healthcare systems. This category holds all dimensions that associate with data holdings. They are as follows:

- **Accuracy**: The Extent to which registered data is in conformity with the actual value.
- **Completeness**: The state in which information is not missing and sufficient for the task at hand. Linkage between data could promote the existence of further data.
- **Consistency**: The representation of data values remain the same and consistent between items of multiple data from multiple sources.
- **Relevance**: The extent to which information is appropriate and useful for the intended task.
- **Timeliness**: The state in which data is up-to-date, and its availability is on time.
- **Usability**: It reflects the ease with which data can be accessed, used, updated, understood, maintained and managed.

4.2 Communication

Communication is the second part of the initial framework. It concerns about the correspondences between different care units. As a result of this communication, EHR systems have items of multiple data from multiple sources.

- **Provenance**: The source of data should be shown and linked to metadata about provenance of data.
- **Interpretability**: The degree to which data can be understood.

4.3 Security

Security will prevent personal data from being corrupted, and control the access to ensure privacy and confidentiality.

To sum up with, the proposed framework has three categories in which the data quality dimensions in the context of healthcare fit into. These categories represent the main elements of e-health systems. The development of this framework went through many stages, and reflects the nature of EHR systems.

5. CONCLUSION AND DISCUSSION

As defined earlier, data quality is "fitness for use" and a concept with multi-dimensions. Yet there is no consensus on rigorously defined set of data quality dimensions.

EHR is seen as promising solution to problems in health information management despite the threats posed during data storage and transmission. However, one of the key barriers of optimally using the routinely collected data is the increasing data quantity with poor quality. This would raise the need of automating the mechanism of data quality measurement and semantic interoperability (Liaw et al. 2012).

Existing research focuses on DQ in generic information systems. DQ in these researches is addressed in many aspects align with data consumers. So that, we developed a framework that concerns DQ in the context of electronic health care systems. This framework is a result of filtering the existing data quality dimensions in many research, and checking their suitability to the nature of e-health systems.

The next step will be examining and evaluating the proposed framework by conducting semi-structured interviews with EHR stakeholders in order to confirm the structure of the framework.

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A MARKETING CHALLENGE OF INTERNATIONAL E-RETAILING: A CASE OF SMES IN THE OULU REGION, FINLAND

Helena Ahola, Sinikka Suutari and Taina Vuorela
Oulu University of Applied Sciences, School of Business and Information Management
Teuvo Pakkalan katu 19, Oulu, Finland

ABSTRACT

Small e-retailers need to grow and internationalize to be competitive. For global e-business, the internet provides a rich and flexible channel. The City of Oulu supports local e-entrepreneurs by providing services needed in marketing. This paper discusses marketing capability and provides an exploratory case study of how marketing capability is being built in Oulu. In addition to the efforts made at present, it is suggested that big retail operators should develop e-retail concepts which could then be franchised to e-retailers. Similarly, e-retailers need easy to use platforms with partnerships integrated in their interfaces. Furthermore, as marketing is context-dependent, marketing capability about how to operate in different market areas or countries should be built into the platform to make it easy to start doing e-business. Further research is suggested on e-business platforms for different business models and marketing concepts. In addition, more permanent and continuous support for local e-entrepreneurs is systematically needed within the e-retailing ecosystem.

KEYWORDS

E-retailing, internationalization, marketing capability, SME

1. INTRODUCTION

SMEs have to grow and internationalize to be competitive. The internet provides a rich and flexible retail channel and a potential mechanism for retailers for broadening target markets, improving customer communications, extending product lines, improving cost-efficiency, enhancing customer relationships, and delivering customised offers (Basu and Muylle, 2003). Big retailers and retail chains in Finland have already started to intensify their online operations in 2012.

In the whole area of the European Union a need to promote e-business has been recognized; online markets are deeply fragmented and still insufficiently developed in the EU. Both consumers and businesses have difficulties in accessing online shops and the latter in offering their services in other EU countries. There are barriers: Some of them relate to language, demographics, individual preferences, technical specifications or standards, internet penetration or the efficiency of the postal or payment system. The EU has an action plan for doubling the volume of e-commerce in Europe by 2015 (see http://europa.eu/rapid/press-release_IP-12-10_en.htm). Furthermore, online internationalization brings e-risks besides the existing traditional risks for small e-retailers (see Pezderka &Sinkovics 2010).

The City of Oulu has seen a need for supporting e-entrepreneurs. The 'physical' Vercco centre as infrastructure for e-businesses will, in due course, be built in Oulu. In the chosen lots, the idea of a hub for e-business will be further developed. Recent studies in the Oulu region reveal some of the challenges in e-business to be particularly marketing related. In addition, local SMEs are strongly oriented towards the domestic market and do not put much effort into internationalizing their activities, although, in the region, there is a strong belief in the opportunities of internationalization (See Ahola & Vuorela & Suutari 2010).

The Oulu region in Finland is a favourable geographical ecosystem for high technology services and e-business. Successful e-retailing requires, not only concrete skills – such as ICT-skills - and knowledge of retailing and wholesaling, but also - because the internet is global - multiple new capabilities and know-how, such as capability of international trade (Ahola, Vuorela & Suutari 2012).

In the present paper, the following research question will be answered: What kind of marketing capability (intellectual and relational) do small e-retailers need, and how is this capability being built and supported in the Oulu region? Besides defining the concept of marketing capability and the internationalization challenges of small e-retailers, the case study strategy is used as a research method. Case research is an investigation of a contemporary phenomenon, including the emerging body of knowledge concerning that phenomenon (Yin, 1994). The present preliminary case study is based on observation, documents, presentations in seminars organized by regional and national organizations, newspaper articles, and interviews of the focal e-business actors during the year 2012.

2. THE CONCEPT OF MARKETING CAPABILITY

Marketing is defined as "an organizational function and a set of processes for creating, communicating, and delivering value to customers and for managing customer relationships in ways that benefit the organization and its stakeholders" (Definition of marketing approved by the AMA Board of Directors August, 2004).

Marketing capability consists of relational and intellectual market-based assets (Srivastava, Fahey, and Christensen 2001). Relational market-based assets are outcomes of the relationship between a firm and key external stakeholders, including distributors, retailers, end-customers, other strategic partners, community groups, and even governmental agencies. The bonds constituting these relationships and their sources may vary from one stakeholder type to another. For example, brand and channel equity reflect bonds between the firm and its channels and customers. Brand equity may be the result of extensive advertising and superior product functionality. Channel equity may be in part the result of long-standing and successful business relationships between the firm and key channel members. Intellectual market-based assets are the types of knowledge a firm possesses about the environment, such as the emerging and potential state of market conditions, and the entities in it such as competitors, customers, channels, suppliers and social and activist groups. The content or elements of such knowledge include facts, perceptions, beliefs, assumptions and projections. The content of each equity type and its sources vary greatly from one type to another (Srivastava et al. 2001, 782).

3. CHALLENGES AND OPPORTUNITIES IN SMES' E-BUSINESS ACTIVITIES

SMEs should be an important subject of study for academic researchers for several reasons. The employment scope of SMEs is significant in the US and EU countries (Bharati, Lee & Chaudhury 2010). Serious issues concerning the future of SMEs operating in a peripheral location, and their e-marketing provisions, arise regularly. SMEs still do not use e-marketing to its full scope and potential (Gilmore et al. 2007). The effective use of ICT can provide small firms with the opportunity to take advantage of shared platforms or portals that will allow small and medium companies to exploit the business benefits of ICT. This may allow SMEs to create and take part in strategic alliances with other organizations and create new platforms for sharing knowledge. SMEs could become of global significance if they can grow and internationalize via the internet (see also Javalgi et al. 2010 on Indian SMEs).

By integrating information technology and marketing, special e-marketing capability can be developed. Trainor et al. (2011) suggest that researchers and practitioners should pay special attention to the complementary resources that are needed to successfully implement IT-enabled marketing initiatives and that an emphasis on the technology alone may not be sufficient.

There are many practical challenges that e-retailers encounter in Europe. They include the following: languages (customer service in 15 languages; use of Google Translator is not sufficient), currency and payments (euro plus 11 countries with their own money; country-specific price lists are needed), logistics (local partners usually needed). Additionally, every European country has its most popular portals, market places, certificates for trusted e-retailers, legislation and taxation.

4. CASE STUDY OF SUPPORTING THE INTERNATIONALIZATION OF SMALL E-RETAILERS IN OULU, FINLAND

4.1 Background

In the global contexts, SMEs and small e-retailers need to build intellectual and relational capabilities to survive in the e-markets. How to support the development of e-marketing capability of small retailers interested in entering different European markets? It is important to acquire knowledge of the marketing environment, marketing practices, cultures, customers and competitors. The staff of SMEs also need to know how to build relationships with partners and customers.

In Finland, such knowledge is readily available and trends of e-business are discussed in different seminars throughout the value chain. The focus is on future customers, international trends, trust, mobile business etc. The 'E-revolution' increases competition in retailing as well as the power of customers through the alternative ways of doing shopping. In Finland, international e-business grows rapidly; Finns favour German e-retailers (e.g. Zalando). Finnish e-retailers get their customers mostly from Nordic and Baltic countries. In the present state of affairs, however, Finnish companies do not utilize their full potential in international markets, and Finland clearly lags behind many other European countries in spite of e-retailers' access to easy-to-use platforms (e.g. ePages) with training, tips and trends for several different business model types.

Seminars are organized, nationwide and locally, to improve the understanding and know-how of e-business. In such seminars, best practices and successful case examples are presented and shared of going abroad via the internet. On the basis of our experiences, we claim that successful global e-business still requires more homework both ICT-wise and businesswise by aspiring e-retailers: building partnerships in different countries, selecting solutions for payments, understanding different cultures, offering versatile assortments, building logistics, learning taxation, and thus finally differentiating among hundreds of other e-retailers.

Increasing competition and complexity challenge also the established e-business players and as well as thinking in home markets. The challenges include, among other things, informed and empowered consumers, versatile and multichannel shopping and marketing, shifting real-estate demands and evolving supply chains. Dynamic market opens up new opportunities as well, such as authentic offerings, brand building and improved interaction with end clients, sales channels and platforms and disruptive innovations. The challenges are many and even the biggest retailers do not sell all their products in all countries. Even many big e-retailers find the challenges of differentiation, marketing, logistics, competitive advantage and customer loyalty overbearing. One example is Fruugo, an e-commerce centre which offered a business model providing brands of several e-retailers; it failed and went bankrupt.

4.2 Activities of Building Intellectual and Relational Marketing Capability in Oulu

Oulu being a high-tech City, there are brick-and-mortar shops with a potential to establish e-shops. **Vercco**, previously a project on e-business development (www.vercco.fi), continues to serve e-retailers in Oulu with consultation and offering networking services. The purpose of Vercco is to build long-term partnerships and networks in e-business and increase the number of professional e-entrepreneurs in the area to form a real e-retailing ecosystem.

In Oulu the challenges and opportunities of global business have been recognized. Competition in e-business is global. Buying online is basically easy all over the world. However, there are many technical obstacles, such as languages, customs and customer service. Thus, understandably, global actors increasingly localize their solutions (currencies and languages). Especially new online stores have difficulties to be found among many others web shops. Therefore, the biggest problem of Finnish online stores is branding and marketing.

Gradually, Oulu is attracting the attention of international brands, and local business models are created. One interesting example is the biggest newspaper in the region, Kaleva. It promotes e-business by offering a concept for retailers (Kauppakeskus 24) to make it easy for an e-entrepreneur to sell online. Some brick-and-

mortar retailers have established e-shops e.g. in the music business, and the multi-channel model is gaining ground. The actors within Vercco have opened a pilot e-shop in Russia to gain more international experience (www.finnbrands.ru). The purpose is to build a model for marketing, logistics, customs, distribution and payments in the Russian market, which is still quite unknown to many e-retailers.

5. CONCLUSIONS AND DISCUSSION

Small e-retailers in the Oulu region, and probably in Europe in general need more marketing capability, intellectual as well as relational, in the fields of both ICT and internationalization. Leading e-business operators in Finland use the localization strategy successfully. Similarly, also small e-retailers can develop their intellectual and relational marketing capability by building new capability of digital marketing by including and integrating into their websites the functionalities of e-retailing, search engine optimization, newsletters, adwords, social media etc. They should be trained in selling online; updating and upgrading their websites; being present where the customers are, online, on Facebook, or in other digital environments, in Europe and all over the world. SMEs and small retailers should have the courage and be encouraged to learn to do e-business more efficiently and effectively.

Big retail operators (e.g. Kesko in Finland behind the K-brand) could develop retail concepts for starting a business as an online K-retailer. In this way small e-retailers could more easily utilize the existing ecosystem of e-retailing. In order to do this, e-retailers need easy to use platforms (e.g. ePages), with partnerships integrated in their interfaces. Furthermore, as marketing is context-dependent, marketing capability for every market area and country should be built into e-shopping platforms to make it easy to start doing e-business in a particular area and country.

Advancements in internet technology enable small e-entrepreneurs to engage in activities and innovations using new business models to achieve scale and scope as they begin to compete in the global marketplace. An understanding of how these entrepreneurs are successfully growing and rapidly expanding their businesses is critical, not only from a research perspective, but also from a practitioner point of view.

We suggest further research on e-business platforms for different business models and marketing concepts. We also propose, based on our empirical experiences of the present case study, that more permanent and continuous support for local e-entrepreneurs is needed so that they can exploit the retailing capability they already have, and the growing e-business skills that they have developed. Through such support they would gain intellectual and relational capability; in practice this would entail that they be trained in marketing, ICT, marketing communication and business culture. This could pave the way for them to become part of the new e-retailing ecosystem in the making in our area, the Oulu City Region.

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MEETING NEW ONLINE CONTACTS – CHANGES IN EUROPEAN CHILDREN'S PATTERNS OF SOCIALITY

Monica Barbovschi, Věra Kontríková and Fatih Bayraktar
Institute for Research of Children, Youth and Family, Masaryk University
Brno, Czech Republic

ABSTRACT

This article discusses children's offline meetings with new contacts established online by taking country-level predictors (i.e. importance of family, importance of friendship and interpersonal trust). The data was drawn from two projects: EU Kids Online II and European Values Survey 2008. The sample of the study included 25,142 children and adolescents aged between 9 and 16 from 25 European countries. The prevalence of meeting online contacts offline differs significantly across countries. Two-level hierarchical logistic regression was conducted to predict odds of meeting with online contacts based on family type and country-level predictors as importance of family, importance of friends and interpersonal trust (operationalised as trust in most people). The results indicated that meeting online contacts offline increased with children's age. Children living in typical families were less likely to engage in online meetings. The importance of family and friends significantly lowered the probability of meeting online contacts offline. Contrary, interpersonal trust increased the probability of such a meeting. The findings suggest that already existing social bonds might shape the social integration of youth via online contacts, but new media has facilitated the replacement of close-knit ties with more loose, extended peer-based networks. The results were discussed in scope of contributions, limitations and further suggestions.

KEYWORDS

Children, adolescents, online contacts, social integration, social bonds, EU Kids Online, European Values Survey

1. INTRODUCTION

Children and adolescents' contacting new people online and meeting them offline has been met with numerous concerns regarding the safety issues and the specific factors which might account for this practice. Previous works have dealt with explanations connected to internet access and type of use (Hasebrink et al, 2011; Livingstone et al, 2011), psychosocial factors and risk behaviour online and offline (Barbovschi et al, 2012; Smahel et al, 2012) and focused less on how children's making contact with new people online and meeting them offline is connected with a new type of sociality enabled by internet and new media. Also, previous research has not yet taken into consideration country-level predictors, which have been indicated as playing a significant role in shaping young people's online communication and patterns of internet use (Lobe and Ólafsson, 2012). Drawing from the quantitative data collected by the EU Kids Online network and data from the European Values Survey 2008, this article contributes to the body of research on the changes in the nature of sociality and connectivity of children, changes fuelled by the widespread of social media. This article looks at how different individual backgrounds (family type) and country-level measures of importance of family, friendship and interpersonal trust play a role in children's practice of expanding their social connections/ circle of friends via online communication and meetings offline with new people met online.

2. LITERATURE REVIEW AND RATIONALE

The internet (and especially social media) has radically changed the dynamics between individuals and their social context, with the online communication bringing its own features to the child and adolescent development (see Valkenburg and Peter, 2011). Even before the internet, the rise of "personalised networks"

(Wellman, 2001) has meant that traditional groups (family and other close social ties) have started to play a smaller role in individual choices in terms of breadth and depth of connections, while the emergence of computer mediated communication has contributed to the development of increasingly diverse social networks. The ubiquitous proliferation of social media among all age categories means that children and young people nowadays also enjoy greater flexibility in forming multiple, fragmentary and more diverse social bonds. The particular appeal of social media among young people has been linked to the enabling of peer-based sociality, identity formation and expression, and participation in cultural and public life (boyd, 2007). Building on this theoretical corpus, this paper examines the impact of family type, perceived importance of family and friendships, and interpersonal trust on children's offline meetings with online contacts which is described as one of online risky behaviours (Livingstone et al., 2011) but at the same time can constitute a mean for young people to expand their social circle. Late childhood and adolescence is a period of gaining autonomy, when peer relations and romantic partners become more important than family (Carlo et al., 1999), although the family relations keep their decisiveness for the behavioural and cognitive outcomes of children and adolescents. From the viewpoint of Ecological Theory (Bronfenbrenner, 1979), these two social agents (i.e. peer group and the family) form the Microsystem -the system which directly influence the development of the individual. Accordingly, peers and families might play an important role in young people's meetings offline with online contacts.

Although there is a lack of empirical evidence which shows direct associations between importance of family, family structure and meeting online contacts offline, the literature on parental mediation of children's internet use can give some hints. For example, perceived family support with high quality communication on internet use was found to be negatively related with risky online behaviours (Appel et al., 2012). The literature on social capital also can help us to understand this association: having new online contacts (especially the "*bridging"* type of social capital) was not related with the proximity with parents or the family structure (e.g. Best and Krueger, 2006). In sum, the relation between specific family backgrounds and meeting online contacts offline remains unclear. Aforementioned, peers are one of the most important socializing agents for children and adolescents. Studies have showed that children and adolescents' offline relationships continue online (Bayraktar and Amca, 2012; Subrahmanyam and Greenfield, 2008) and one third of European children use internet to make new contacts (Livingstone et al, 2011). In other words, the internet works as a socialization context in which existing friendships continue and/or new contacts made. Accordingly, meeting online contacts (but not complete strangers) "in real life" is generally for extending social networks (Best et al, 2006) and can be an indicator of giving importance to friendships. However, recent reports suggested that meetings offline with online strangers can increase the social risks especially for younger and vulnerable children (Barbovschi et al, 2012).

One of the key psychological constructs in offline and online relations is trust. Numerous studies indicate that young people form the roots of trust within the family and continue to develop it within peer relations (e.g. Schneider and Younger, 1996; Silver, 1989). Therefore, trust can be a tool for the adaptive social integration of youth. Accordingly, the literature on dyadic and general trust handled this construct as a protective factor against risk behaviours and a catalyser of socialization (Uslaner, 2000). Recent research showed that trust to parents and friends might be related to a more secure social environment and less risk taking behaviours among young people (Engels, & ter Bogt, 2001) and general trust can increase the social networks via internet (Best et al, 2006). Nonetheless, the relationship between trust and risk is not univocal (Nickel & Vaesen, 2012), one approach pointing towards "risk-averse" (Gill, 2007) societies being more likely to discourage interpersonal trust (which includes trust in strangers) and risk-reduction strategies decreasing the actual need for trust (Nickel & Vaesen, 2012, p. 861). In addition to this, a number of research showed that under certain conditions such as sensation seeking, interpersonal trust can increase risk behaviours (Jones, 2004).

3. SAMPLE AND METHODS

The EU Kids Online II project (EUKOII) data collected in 2010 in 25 European countries were used. Each country subsample is representative and contains at least 1000 children aged 9 to 16 (Görzig, 2012). Dependent variable was based on the question: "Have you ever gone to meet anyone face to face that you first met on the internet in this way?" Significant differences across countries in rate of meeting online

contacts offline were noted ($\chi^2(24) = 674.39$, $p < 0.001$), for more information see Livingstone et al. (2011). Typical family was assessed as household with two parents compared to household with only one parent or other setting. In addition to the EUKOII data, European Values Study (EVS) data collected in 2008 in 47 European countries (EVS, 2011) were used. Country means of importance of family and importance of friends were computed to serve as country-level predictors. Interpersonal trust was created as proportion of respondents in each country, who agreed with statement that most people can be trusted. Importance of family, importance of friends and also interpersonal trust varied significantly across countries ($F_{family}(46) = 57.20$, $p < 0.001$; $F_{friends}(46) = 152.98$, $p < 0.001$; $\chi^2_{trust}(46) = 8487{,}00$, $p < 0.001$). Importance of family and importance of friends correlated only weakly ($r = 0.20$, $p < 0.001$). Descriptive statistics of all predictors are summarized in Table 1.

Table 1. Description of predictors and their relationship with meeting online contact offline (based on EU Kids Online II dataset extended by variables computed from European Values Study data).

	N	M	SD	Min	Max	Have met online contact offline		
						Yes (9%)	No (91%)	Yes vs. No
Individual-level (EUKOII)								
Age (years)	25142	12.48	2.25	9	16	$M = 14.17$ ($SD = 1.80$)	$M = 12.52$ $SD = 2.22$)	$t(3012.5) = 39.63$***
Gender (male)	25142	1.50	0.5	0	1	49.1%	50.5%	$\chi^2(1) = 1.60$
Typical family (yes)	24901	0.78	0.41	0	1	74.8%	78.5%	$\chi^2(1) = 15.42$***
Country-level (EVS)								
Importance of family	25142	3.83	0.08	1	4			
Importance of friends	25142	3.36	0.18	1	4			
Interpersonal trust	25142	35.97	18.80	9	76.1			

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

4. RESULTS

Two-level hierarchical logistic regression was conducted using STATA (v. 12). The multilevel approach was necessary because children were nested within countries and cross-country differences were identified in previous analyses (Lobe and Ólafsson, 2012). The odds of meeting online contacts offline increase nearly 1.5 times with every year of children's age. No gender difference was found. Children living in household with both parents are less likely to engage in such meetings (the odds are reduces to 85%). If the importance of family is the only country-level predictor, it significantly lowers probability of meeting online contacts offline. But when importance of friends and trust in people are added, importance of family is no longer significant. However importance of friends lowers the odds of meeting online contact offline to 14% with every unit. Contrary the trust in people increases the odds of the meeting by 20% with every 10 units. Model generation process is captured in Table 2.

Table 2. Estimated coefficients for the prediction of meeting online contacts offline among European children and adolescents: Multilevel logistic models with random intercept (N = 21161).

	Model M1		Model M2		Model M3	
	B (SE)	OR	B (SE)	OR	B (SE)	OR
Individual-level						
Age (years)	0.40 (0.01) ***	1.48	0.40 (0.01) ***	1.48	0.40 (0.01) ***	1.48
Gender (male)	-0.03 (0.05)	0.97	-0.03 (0.05)	0.97	-0.03 (0.05)	0.97
Typical family (yes)	-0.16 (0.06) **	0.85	-0.16 (0.06) **	0.85	-0.17 (0.06) **	0.85
Country-level						
Importance of family			-4.72 (1.26) **	0.01	-2.27 (1.32)	0.10
Importance of friends					-1.96 (0.69) **	0.14
Interpersonal trust (10)					0.18 (0.05) ***	1.20
Constant	-7.49 (0.23) ***		10.59 (4.81) *		7.22 (3.99)	
Country-level variance	0.414 (0.124)		0.258 (0.080)		0.159 (0.050)	
-2LL	-6123.6 ***		-6118.0 ***[a]		-6112.4 ***[b]	
AIC	12257.3		12248.0		12240.8	
BIC	12297.1		12295.8		12304.5	

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, [a] LR-test: M1 vs. M2 $\chi 2(2) = 12.39$, $p < 0.01$, [b] LR-test: M2 vs. M3 $\chi 2(1) = 10.10$, $p < 0.01$

5. CONCLUSION

Almost one third of European children and adolescents have contacted new persons online and nine percent have met face to face someone contacted in this way. Clearly, young people's new practices of extending their social circle via online tools can be linked to both changes in the means of connectivity and broader social factors. At an individual level, children from atypical families are more inclined to go to meetings with people met online. In countries with a decreased emphasis on family life, children are more inclined to extend their social networks through meetings with online contacts. Surprisingly, the decreased importance of friendship at the country level (which should more likely be interpreted as a reduced reliance on close, face to face interpersonal relationships) could signify a tendency towards a more flexible, expansive and fragmentary type of personal networking. Interpersonal trust at country-level increases the probability of meetings, which could indicate lower perceived risks from online relationships. Also, interpersonal trust has been positively linked to increased social and participatory media use (Romer, Jamieson and Pasek, 2009). However, trust works in a gradual way, meaning that as soon as enough trust is established, the relationships are moved from the online to the "real life" (Bargh and McKenna, 2004). The contribution of this piece of research is related to the incorporation of country-level predictors in explaining young people's formation of interpersonal relationships. However, the limitations stem from the quantitative design which offers an *a priori* modelling of the investigated phenomenon. More research should investigate in-depth connections between psychosocial individual factors and societal tendencies in shaping young people's social integration.

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TOWARDS THE DEMOCRACY OF KNOWLEDGE: BRINGING GENDER DIVERSITY TO WIKIPEDIA

Ilona Buchem[1], Antje Ducki[1], Nils Weichert[2] and Julia Kloppenburg[2]
[1]*Beuth University of Applied Sciences Berlin, Luxemburger Str. 10, 13353 Berlin, Germany*
[2]*Wikimedia Deutschland e.v., Obentrautstrasse 72, 10963 Berlin, Germany*

ABSTRACT

With Wikipedia becoming one of the key global sources of information, the question about who generates and redistributes knowledge in Wikipedia becomes crucial in democratizing access to knowledge creation. In view of unequal representation of male and female Wikipedia contributors leading to unequal coverage of different content areas, the democracy of knowledge in Wikipedia may be in danger. This paper focuses on the relevance of gender balance for the democratization of knowledge, reports on the nature and the consequences of the gender gap in Wikipedia and describes the conceptual framework aiming at enhancing gender-diversity in the German Wikipedia. The conceptual framework introduced in this paper is part of a larger effort called the Wikipedia Gender-Diversity (WiGeDi) project starting at the beginning of 2013. The project aims at participatory design, implementation and evaluation of a set of measures in a multi-stakeholder community of practice. This process is anchored within the open innovation approach and transdisciplinary inquiry, and utilizes action research methodology with the aim of improving the gender balance and active participation of female contributors on all levels of engagement in the German Wikipedia.

KEYWORDS

Wikipedia, diversity, gender balance, democracy of knowledge, open innovation, participation.

1. INTRODUCTION

The printing press in the 15th century, the wide-spread of schools and libraries in the 18th century and finally Wikipedia in the 21st century, they all have been viewed as important milestones in the history of knowledge democratization. Together with the digital revolution and the empowerment of Internet users gaining new tools for commodifying and sharing knowledge, the need to democratize knowledge must be discussed not only in terms of equal access to knowledge but also in terms of representative participation in knowledge production. The 21st century public equipped with Web 2.0 tools, such as wikis, has been able to transform from its long-lived role of consumers of dominant culture to prosumers of niche cultures, engaging in mass collaboration, crowd creation and peer production of knowledge. Undoubtedly, Wikipedia is the flagship example of this historical change in how knowledge can be produced and redistributed by the self-organising crowd. In context of Wikipedia, the democracy of knowledge has referred to providing an open platform with access and edit rights to all (open access), with structures enabling engagement in collective co-production of knowledge by all (open collaboration), and with tools to making this collaboratively created knowledge available to all (open source). Thus it is the openness with its commitment to citizenship and participation, that has been viewed as one of the central principles of the democracy of knowledge on the Web, especially in terms of access, collaboration, co-production, reuse, modification and transparency of knowledge. However, openness alone does not seem to guarantee equality on the presumably egalitarian Web. Despite openness on a number of levels, the Wikipedia has been struggling with unequal representation of different user groups, most notably with the dominance of male editors and the shrinking numbers of female editors. While the UNU-MERIT survey reported on fewer than 13% of Wikipedia female contributors in 2010 (Glott, et al., 2010), further studies pointed towards this onward negative trend with fewer than 9% of Wikipedia female editors in 2012 (Khanna, 2012). A number of studies has confirmed the widening of the Wikipedia gender gap and indicated some consequences, including different participation patterns among Wikipedians with women making fewer revisions (Antin, et al., 2011), and the disparity in the quality of coverage of

topics with particular interest to female and male users in terms of length and depth of articles, scarcity of biographical pages about notable women, and greater number of males than females becoming Wikipedia administrators, enjoying additional capabilities, such as protecting pages and blocking others from editing (Lam, et al., 2011). Based on the previous research, which provides first insights into the nature of the gender bias in Wikipedia, this paper takes the next steps in proposing an approach to designing and implementing diversity-promoting measures in the German Wikipedia. The conceptual framework presented in this paper is the first step of a joint project of Wikimedia Germany and Beuth University of Applied Sciences Berlin. This project, called Wikipedia Gender-Diversity (WiGeDe), is scheduled to start at the beginning of 2013.

2. GENDER DIVERSITY

Gender diversity has been widely discussed and postulated in different contexts, e.g. public policy debate, corporate governance, workplace, sports, education, especially as a chance for more creativity and innovation, higher task performance, broader talent pools, improved relations and motivation, better decision outcomes, positive organisational image and reputation (McKinsey, 2007). Gender diversity in context of ICT has been the focus of debates and research on fostering equal access of females to ICT, increasing interest of girls and women in ICT and designing gendered information system as prerequisites for participation and inclusion. Numerous studies pointed to gender differences in ICT access and practices, including ICT competencies, frequency and intensity of ICT use, access to ICT training, education and work, different perceptions of online privacy and different presentations of the self on digital media (Hafkin et al., 2001; Stockdale et al., 2007). Research on technology adoption suggests that females lag behind males in adopting new technologies and are also more likely to perceive difficulties in using ICT (Venkatesh, et al., 2000). These and other gender differences are often linked to different media biographies, gendered ICT practice emerging already in schools, socioeconomic status, including education, income, and employment (Buchem, 2012). Further research indicates that women are underrepresented among ICT students, working conditions in ICT professions are often not attractive to women (e.g. recruitment practices, working hours), and the dominant ICT culture relies on male-oriented patterns which are exclusionary to females (Vendramin, 2003). The gender inequalities in ICT access and use have been termed as “digital gender divide” (Bimber, 2000; Shaw et al., 2002; Nsibirano, 2009). A comparison of statistical data from studies on ICT and gender conducted in the last ten years shows that in general the digital gender divide has been diminishing, mainly due to the female uptake of social media (Buchem, 2012). Tufekci (2008) explored the rapid adoption of online networking sites and showed that female users are more likely to participate in some social networks such as Facebook or Twitter. Other studies also confirm this worldwide trend. Facebook studies showed that that 61% of Facebook users are women and females are taking over on Facebook in terms of frequency of use and the number of friends (Watkins et al., 2010; Sensis, 2011). The ComScore 2011 report suggests that women have become a digital global mainstream shaping the Internet today, with social networking sites reaching more women (75.8%) than men (69.7%) (Abraham, et al., 2010). From this perspective, social media can be considered as an agent of change, enhancing female ICT uptake.

With females catching up or even taking over on Internet use, the large gap between male and female contributors on Wikipedia points towards a reverse development. Research shows that male editors dramatically outnumber females (Figure 1), and that the number of female editors has been shrinking from 13% in 2010 (Glott, et al., 2010) to 9% in 2012 (Khanna, 2012). Since the digital gender divide on Wikipedia causes disparities in how knowledge is created and represented, endangering the coverage of topics about, by and for female users (Lam, et al., 2011), both Wikimedia Foundation (USA) and Wikimedia Germany have set a goal to increase the proportion of female contributors at all levels of engagement.

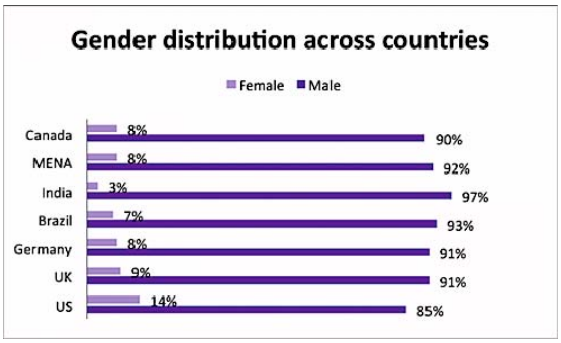

Figure 1. Gender imbalance in Wikipedia (2012)

In order to address Wikipedia gender gap, it is necessary to understand why female participation has been diminishing. The evidence from current research and reports from female Wikipedia editors point to the the male-dominated culture in Wikipedia inhibiting female participation (Lam et al., 2011). Further studies provide evidence for this "clubhouse effect". The Wikipedia culture has been reported to be confrontational, unwelcoming and deterring from participation, with contributors pointing to cyber mobbing, "insulting, sexist, double standard behavior", which may cause female editors to leave Wikipedia (Stierch, 2011).

3. CONCEPTUAL FRAMEWORK

With openness being the core of the Wikipedia philosophy, the conceptual framework of the Wikipedia Gender Diversity (WiGeDe) project is based on the principles of open innovation. The contemporary openness approach has its origins in the free software and open source movement of the 1980s. The idea of openness, however, dates back to the Enlightenment age in the 18th century, which set philosophical foundations of modern society based on freedom of expression, open discussion and democracy of knowledge. In the contemporary interpretation, Habermas (1989) emphasised the role of egalitarianism, common concern and reason for the public sphere, in which citizens are able to engage in an open, discursive practice crossing the boundary between the private sphere and the sphere of public authority. In a similar manner, the open innovation paradigm relies on crossing traditional boundaries of intra-organisational communication, making boundaries more permeable. Open innovation is based on the inward and outward transfer and a wide distribution of problem-solving knowledge (Lakhani et al., 2012). This shift in knowledge creation is motivated by research and practice suggesting that generation of innovative solutions occurs in a distributed manner, such as in self-organising communities freely sharing knowledge. However, as Lakhani et al. (2012) point out, critical tasks requiring innovative solutions can be best approached in mixed structures combining closed vertical integration and open strategic alliances with stakeholders. The WiGeDe project is based on the principles of open innovation and aims at engaging diverse stakeholder groups in co-creation of innovative solutions addressing the digital gender gap in Wikipedia. By exploiting knowledge of different stakeholders, including Wikipedia editors, administrators, readers, gender and diversity experts, open source communities, the project shifts the locus of innovation to users themselves. To ensure a holistic approach, the open innovation process is informed by the principles of transdisciplinary inquiry, which integrates diverse forms of research and diversity of perceptions in defining objectives and strategies to promote social change in practice.

We use action research as an overarching methodology aiming at participatory problem-solving and facilitating change by defining, planning, taking and evaluating social action in communities of practice. This methodology is based on iterative cycles of inquiry with four stages: analyse (define action), design (plan action), implement (take action) and reflect (evaluate action). To ensure the continuos improvement of practice, the methodology goes beyond a mere repetition of cycles and systematically integrates an ongoing inquiry about intended goals. This process is known as double-loop learning, in which multiple stakeholders critically examine the appropriateness of defined goals (Argyris et al., 1991).

Within this framework, *research themes* are derived from the intervention context and represent a set of questions driving research (Holwell, 2004). An initial set of themes is jointly selected based on the outcomes

of preliminary analysis of current research and evidence from practice. We initially defined three core meta-themes giving primary direction for research and development: (1) How to enhance active participation of female users in Wikipedia?; (2) How to improve information-diversity especially in relation to underrepresented Wikipedia articles?; (3) How to increasing the number of active female editors in Wikipedia and other Wikimedia projects? Based on these three core themes (questions), initial sets of interventions addressing each theme will be proposed and prioritized (closed vertical integration). In the next step, the process of open call for contributions will be initiated with the aim of discussing and rating proposed interventions and eliciting new ideas from the community to approach the three core themes (open strategic alliances). This process will be iterative, i.e. ideas discussed and generated as part of open call will be reflected and rated internally in the project team and then fed back to the stakeholders and wider community. In this way, we intend to enhance the inward and outward transfer as key processed of open innovation.

The main priority in the first stage of the project has been given to Theme 1: How to enhance active participation of female users in Wikipedia? This theme can be broken down to the following sub-themes: (1.1) How to increase activity of female editors in Wikipedia? (1.2) How to increase engagement of females in Wikimedia panels, networks and groups? (1.3) How to increase active participation of females in Wikimedia projects such as Wikiversity, Wikisource, Wikibooks? An initial set of interventions will be proposed for each of these sub-themes. These interventions will be derived from the list of current barriers impeding positive developments in each of the sub-themes. For example, for the sub-theme "How to increase activity of female editors?" we first identify current barriers to editing, such as (1.1.1) low interest in editing Wikipedia articles, (1.1.2) lack of experience and editing skills, (1.1.3) lack of role models, (1.1.4) cyber-mobbing, (1.1.5) harsh tone of communication, (1.1.6) non-transparent structures, (1.1.7) missing sense of community, (1.1.8) little personal support, (1.1.9) lack of reputation-building mechanisms, (1.1.10) lack of ownership. In order to address each barrier, an initial bundle of interventions is proposed. For example, the intervention bundle "Facilitate first editing experience and help develop editing skills of female users" directly addresses the barrier 1.1.2 and encompasses a number of specific interventions, such as (a) visual tutorial on how to edit, (b) organise local workshops and webinars, (c) identify and promote female ambassadors and role models, (c) raise awareness among male contributors, (d) enhance reputation, visibility and promotion mechanisms, (e) build alliances with women organizations and diversity experts. These interventions are then proposed to stakeholder and the wider community and the open call for contributions is initiated. Within the open call all users are able to discuss, rate and propose ideas for implementation of the initial interventions as well as propose new interventions based on a simple template (name of the intervention, goal, ideas for implementation). Since all research themes will be evolving as part of the collaborative inquiry with identified stakeholders and in a wider community, this initial set of themes serves as a starting point for open innovation informed by the principles of transdisciplinary inquiry and based on action research methodology.

4. CONCLUSION

Due to the widespread use of Wikipedia in the worldwide population, ensuring and fostering representative participation of diverse demographic groups, including female contributors, seems to be indispensable for democratizing reception, construction and redistribution of knowledge. The initial studies reporting on the nature on gender gap in Wikipedia provide good starting points for further research aiming at the developing innovative solutions for improving gender balance and active female participation in various Wikimedia projects. The conceptual framework described in this paper offers possibilities for collaborative, multi-stakeholder inquiry into how to best identify and address the factors inducing gender disparities in Wikipedia and their negative effects on the democracy of knowledge in Wikipedia. The Wikipedia Gender Diversity (WiGeDe) project will provide first insights into the open innovation process at the beginning of 2013.

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US AND THEM: IS THE FUTURE REALLY DIFFERENT?

Mike Brayshaw and Neil Gordon
Department of Computer Science, University of Hull
Cottingham Road, Hull, HU6 7RX, England

ABSTRACT

This paper reflects on the notion of change. Has the world changed? Are we new people populating a new conceptual space or just the same old folk, going about our world as we always did? Cute new interactive gismos like smart phones and tablets seem to allow us to update old working practices in new clothes - but do they? This paper considers a number of aspects of the digital revolution and how government and educational policy has the potential to address this. The context reflects data from the European Union, but this is representative of many developed countries and demonstrates the longer term issues that developing countries will have to face. The paper will address some of the cultural and societal issues that pose a threat to having a fair and equal society – where many people now embrace online lives alongside their offline lives in a blended existence, but others are excluded from the opportunities and benefits of the online environment through cultural, financial and educational constraints. The paper concludes with a meta-reflection on how changes to the net itself will impact and how individuals in an eSociety may be changed by a move to a Semantic World and a world of the Wisdom of Things.

KEYWORDS

Interactivity and Virtuality, Internet Communities, eHealth, Digital Divide.

1. INTRODUCTION

As the Internet becomes ever more pervasive and encompassing for increasing aspects of many people's lives, it is timely to consider the nature of the technology's empowerment and some of the issues that widen the barrier between those who utilize the Internet as an everyday tool, and those for whom it remains an irrelevance. In considering this schism, we review some of the individual issues that can create schisms within society and that require a comprehensive set of policies to address, namely education; wealth and social group. In Brayshaw & Gordon (2006) the authors considered the way in which eCommerce and eBusiness is not really new but does offer some new opportunities. In this paper a similar analysis is made of eSociety more generally, where the issues around creating sustainable blended lives – that is offline and online living – are reviewed and issues and potential solutions identified. We conclude with reflections on how the uptake of the Semantic Web and the Web Wisdom of Things will have further implications.

2. BARRIERS TO THE UBIQUITIOUS INTERNET

The Internet has the potential to offer a wide range of services and access to amenities that are truly life changing. Through a wide range of web technologies, the initial technical barriers of the Internet itself, in terms of interface issues, have been addressed overcome. With the rise in provision of internet access through smart phones, web tablets and cyber cafes the relentless incursion of the Internet into everyday lives seems to many to be inevitable and complete. The move to eGovernment and eServices has the potential to open up new opportunities for citizens to engage with their society in a more democratic and open environment than ever before. However, a little more consideration shows that all is not as indisputable as it may first appear, and that there are many groups within society who risk being excluded from this new social order.

2.1 Education

Education is potentially the largest barrier whilst offering the key to allow a truly equal and open eSociety. The first aspect of education concerns basic literacy and numeracy – the two skills that underpin most social activities and which are integral to individuals' abilities to access the Internet. Leading on from this is fundamental vision that online learning can deliver fair access to knowledge and skills.

2.1.1 Literacy

The Internet as it is currently constructed, enabled and delivered is still primarily a textual medium. Web sites are identified via URLs, data is submitted via forms, and information is most frequently conveyed via onscreen text. This all requires a reasonable level of literacy and reading ability. However, literacy rates even in the Western world, are far from high. For example, a recent survey on UK literacy (Skills for Life, undertaken by the Department for Business, Innovation and Skills) shows 15% of UK adults have a reading and writing age equivalent to a child aged 11 or younger. When information is conveyed mainly in a textual form, this shows that many are immediately excluded before they could begin.

2.1.2 Numeracy

As noted above, literacy can be a barrier in engaging with internet content. Another barrier to connecting with internet material relates to mathematics – at its simplest level that of numeracy. The same survey that identified literacy as a problem for 15% of UK adults also shows that numeracy is a challenge to 24% i.e. that nearly a quarter of UK adults have the number skills of child aged 9 or younger, and would struggle with quite elementary numerical based problems. When the Internet itself frequently presents data numerically, and decisions on actions on the Internet are moderated by statistical or numerical interpretation, this immediately creates a barrier to many.

2.1.3 Digital Literacy

There is a growing move to develop digital literacy within school education. Digital Literacy (Buckingham, 2010) is still being defined, but offers a range of more advanced skills than those covered in the previous two sections. As a more specialized and new set of skills, whilst perceived as well developed in reality these are still in their infancy in many respects. Examples of issues around digital literacy include problems encountered in Higher Education, where students - and indeed staff – exhibit difficulty in appreciating the distinction between information resources such as Wikipedia as opposed to edited and moderated content (whether on the Internet or published through other means); there is a lack of understanding of the very real and severe consequences of online statements and interactions; knowledge of how to utilize internet and computer tools to verify identity and the veracity of messages and content generally.

Another aspect of digital literacy relates to the issue of safety and security on the Internet, something that is well recognised as a barrier to many to engaging with the Internet. Due to a variety of historical design decisions as well as the commercial market that drives technology, computers remain susceptible to viruses and malware. Technological solutions remain complex and difficult for many, with the need for service packs, software updates and understanding seemingly arcane error messages common requirements for those wishing to engage with online services and to utilise an online identity. A failure to implement any form of common digital identity and certification leaves the Internet a strange environment to many who expect or desire the reassurance of analogies to their real life transactions. Having the skills and knowledge to interpret the meaning of secure communications, validity of identity and understanding how to check the location and veracity of a web site leaves users susceptible to fraud and data theft. However, these skills are still not common parts of the curriculum in the developed world.

2.2 Finance and Technology

Regular access to the internet is constrained by basic infrastructure and finance in a number of ways. Firstly, individuals require relevant hardware. In many places basic twisted pair telecommunication is lacking and fibre is an aspiration (ref needed). In more fortunate circumstances this may be provided through ISPs or public services, such as libraries. However, public funding on such resources is limited and in many countries being rolled back, leaving less free access. Cyber cafes offer a commercial route – but are not common

throughout communities, frequently being clustered in certain regions (city centres, student areas etc). Personal computers or mobile devices offer the most common route for most people's regular internet access, but are costly and have an implicit education and social requirements that still exclude many. The data costs (ISP provision) are not insubstantial, even where communities have ready access to high speed internet.

3. INTERNET LIFE

3.1 Social Life

As individuals share more of their personal information online, the implications to privacy and their offline life are increasing. Children lack awareness and appreciation of the implications. Their parents and teachers are likewise unlikely to have considered the longer term implications and concerns. Social networking offers entirely new models of behaviour for humanity – with children claiming hundreds of friends that they have never met. Whilst Facebook, Google+, and other social networking sites offer social opportunities for many, they also open up new risks and fears for others, and continue to exclude those who do not have regular internet access. They are also limited to those who share a vision. Many 1970's email users do not see the point. These are technologically emancipated people but do not buy in to the concept. To this mental zeitgeist computers are a functional device and their social affordances are not paramount in their list of properties. To them Email is utilitarian, Ebay is commercial, and not a vital social networking tool and a great fun game! To them the future is not different but more of the same

3.2 Commerce

eBusiness and eCommerce have been two of the drivers of the growth of the Internet. With bricks and mortar companies switching to clicks and mortar models, and new start-up businesses showing that an entirely virtual storefront can (finally) make money through companies such as eBay and Amazon, individuals have moved to an embrace online consumerism. Whilst high street and traditional selling models are still the favoured and majority choice, online shopping is increasingly part of the blended life that many people are adopting.

However, this model of consumerism hides a number of inequalities that seem to be growing rather than receding. Price comparison sites and services mean that those with internet access can search and find cheap deals – whereas those not able to access them spend more on less varied products and services. Opportunities to locate and source products and services become limited for those who have not embraced the Internet. Travel, utilities, jobs as well as consumer products are becoming increasingly split between those who can access the wide range and cheaper prices online, and those for whom limited choice and higher prices become a burden.

3.3 Civil

Governments across the globe are adopting the Internet and web technologies as mechanisms through which to make governance cheaper and more efficient, and potentially more inclusive. The Greek democratic ideal has the potential to be achieved through the opening up of direct influence and communication from the masses to those responsible for governing them. Of course, such use depends on the culture itself – democratic countries being more likely to offer these routes into governance. In these environments, the politicians and government bodies frequently use the tools as part of their own publicity and control mechanisms. As governments focus more on the eDelivery of their services the concerns around digital divide become more telling (Gordon, 2011).

3.4 eHealth

A particular aspect of the civil developments mentioned above is the increasing interest in Telehealth (and more generally eHealth). As health provision takes an increasingly large proportion of government spending,

with increasing populations and longer lifespans, ways to reduce the cost and to provide access to facilities is a priority for governments. eHealth offers new facilities and the potential for reduced overheads. However, with the potential misuse and misunderstanding of such facilities, the barriers mentioned above – literacy, numeracy and digital literacy – take on a more important role, as the potential misuse and misunderstanding of such provision can have more serious consequences.

4. A SUSTAINABLE INTERNET AND BLENDED SOCIETY

4.1 How to Tackle the Digital Divide

Education offers the key to many of the divides identified above. Models for education should ensure the development of literacy and numeracy at primary and secondary levels, with the development of digital literacy skills in secondary and further education. Higher education offers the final stage of formal education, where digital literacy can be developed in the context of sustainable communities (under the more general remit of sustainable development). Higher education also has a key role to play in developing this understanding of the complex inter-relationships between policy, society and technology and to prepare the next generation of policy makers and technologists who will be providing the frameworks and tools that will determine whether the digital divide deepens or is bridged.

4.2 A Model for Fair eGovernment

Developing principles for eServices by government becomes important (Gupta, 2003) to avoid the digital divide growing, and more insidiously creating further divides within societies. Principles such as ensuring that there remain non-digital access to all services (i.e. clicks and mortar not pure-virtual), that education policies reflect and prepare populations for shifts in services from bricks and mortar to clicks and mortar, and that social funding policies ensure access is provided – whether through community services such as libraries, or through individual access with free broadband and devices capable of accessing the facilities.

Table 1. The 4 elements that make up eSociety

Web Intelligence	Web Agents – where agencies vary along a continuum from simple automata to traditional AI knowledge based systems Web Based Engineering Intelligence – data mining, knowledge discovery, machine learning
Ubiquitous/Pervasive Intelligence	Smart Objects in the World, Intelligent Apps, Smart Cards, Sensed Biometric Data
Brain Informatics	A holistic model of Brain Research that combines classic problem solving and cognitive approaches with modern brain imaging/activity views and other observational studies
Cyber Individuals	The imaging of real people into the online selves. The use of avatars and the presentation of self in virtual life (c.f. Goffman, 1959).

4.3 Holistic eSociety in the Wisdom Web of Things (W2T)

The Web Wisdom of Things (Zhong et al, 2010;2011) is a holistic post-WWW perspective of an Internet based eSociety. It sees a changed eSociety consisting of a symbiosis of four elements – see table 1.

In this narrative eSociety forms the basis of normal life. We all live online in a *hyper world*. We live in a social world that is online. We normally interact with information/people/computers in a transparent and non-pejorative manner. In a Turing context we may not know to whom we are speaking, be they human, artefact, or bot, our role is to provide the right information and collaborate with the consequences. The hybridisation of our correspondence disappears in the Web Wisdom of Things. That this has already happened domestically has passed many by. Traction controlled cars and the like of ABS are day to day artefacts.

Many are dependent on their IPhone or equivalent to get them through day-to-day existence! To many the move to online ESociety is a natural evolution that is already well advanced.

5. CONCLUSION

In this paper we have discussed how the nature of eLife and as a consequence eSociety has evolved. One pressing conclusion to all this is that connectivity and bandwidth, along with appropriate education and access to knowledge, remain crucial issues. The types of developments and progression presuppose open and free access to the internet. Increased demand for services devours bandwidth and the more people see the new media vision this is only going to increase. We are not only in danger of a two speed world, but a many speed world with those who have the infrastructure and money to afford the technology surging ahead and those who do not left in their aspirational wake. Or is aspirational too strong? Is calling anyone who does not embrace Social Networking (for example) a intellectual luddite fair? A Web Wisdom of Things allows for many any different Things. The Thing you interact with might be a finite state automata or a mono-syllabic human interlocutor – the hybridisation nature of the W2T means that all can be accommodated.

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MOBILE VOTING IN THE EGYPTIAN CONTEXT

Hend El-Shoubashy[1] and Rasha Abdel Aziz[2]
[1]*Arab Academy for Science and Technology, Jamal Abd El Nasser, Miami, Alexandria, Egypt, 1029*
[2]*University of the West of England, Coldharbour Lane, Bristol, England, UK, BS16 1QY*

ABSTRACT

To build a strong democratic country every citizen should practice his/her right to vote. During the elections, Egypt suffers in each of its electoral constituency at the election polls from crowd, hired thugs, people trying to impose their views on voters, and lack of privacy. The advances in information and communication technologies, has made it possible to engage Egyptian citizens in the country's democratic process. Mobile devices in particular are extensively used in the Egyptian context, where with a population of around 85 million, there already over 70 million mobile subscribers. This highlights the high potential of m-government applications, which offer a wide range of services, on top of which is the mobile voting (m-voting). However, technology adoption is not only a matter of making it technically available, but is always framed in a social context. This makes m-voting in Egypt a tempting area to study. Accordingly, the study at hand, seeks to collect data about the current voting situation by videotaping the election polls during the coming parliament and presidential elections. Then, a structured questionnaire will be designed, and distributed over a sufficient number of Egyptian citizens, in order to get a better picture of the citizens' preferences, attitude, and acceptance regarding the m-voting adoption. Finally, based on the data collected and analyzed, an m-voting prototype will be designed taking into consideration the technology adoption criteria in the Egyptian context.

KEYWORDS

Democracy, Elections, M-government Applications, M-voting.

1. INTRODUCTION

"The will of the people shall be the basis of the authority of government; this shall be expressed in periodic and genuine elections." (The Universal Declaration of Human Rights, 2011)

Human rights and voting are interrelated concepts, where voting is not just a normal human right it is more than that, it is rather one of the basic human rights that a person need to have and practice (The Universal Declaration of Human Rights, 2011). It permits citizens to affect the governmental route, decision-making like the presidential elections, parliament elections and national referendum and to express their right in a democratic environment. Voting is a legal right and basis to all citizens in any country in order to detract from the force of dictatorship (Hamzawy et al., 2005).

Through the years democratic governments strived to maintain their elections as fair as possible to provide their citizens with appropriate democratic life that involved its people in the country's political decision-making. As a result, there have been many attempts to ensure that the voting process is free from malpractices and falsification of results, in order to ensure justice, accountability and transparency (Kargin et al., 2006). There have been many trials adopting the Electronic Voting (e-voting) systems such as; Estonia, United Kingdom, Switzerland, Austria and Ontario (Kim et al., 2007).

Although, these e-voting systems played important role, a need for a solution to have access even if there were no Internet connection, called the idea of mobile applications (m-applications) (Kumar et al., 2008). Egyptian people still have doubts regarding Internet applications, especially those at lower social classes. However, they do not feel the same towards m-applications, where 70 million of the population is mobile subscribers (Arab Republic of Egypt Ministry of Communication and Information Technology, 2011).

As the m-voting system endures many benefits for both the government and people, it became worthwhile to examine the relevant aspects and mobile user acceptance of m-voting application especially in Egypt.

2. RESEARCH PROBLEM

In Egypt the election process is one of the painful procedures for both the government and the Egyptian citizens in particular. Elections ballots in Egypt face many problems like; the over- crowded ballot polls due to the high population, which may lead to lower level of participation in the elections. This crowd in turn leads to long queues of participants, and decrease in the parking slots. In addition some of the dominating parties use the police force frame polling stations to prevent voters from reaching the polls and sometimes hire thugs to attack voters in order to prevent them from voting to any of the opponents' party. Not to mention, that most people forget or sometimes are even unaware of the elections date and time. Moreover, Egyptians living outside Egypt, patients in hospitals and the majority of the disabled are deprived from their right to vote, and further malpractices are sometimes being practiced against voters in rural areas during elections, where people try to influence voters' decisions by convincing them at the polls. Finally, the voting process can be faced with misuse and forgery by different means and the whole process is generally slow and it usually takes a long time to announce the ballots results.

Although literature is rich with m-voting studies, they mainly target Western countries. The main subject of the research is to investigate how citizens perceive m-voting in the Egyptian context and whether adopting m-applications would contribute to solving the chronic voting problem. Accordingly, the following objectives were set:

a. Identify the main voting problems in Egypt.
b. Investigate the Egyptians readiness for adopting m-voting applications.
c. Develop a prototype for m-voting application.

3. M-VOTING

M-voting is the techniques where the voter can cast his/her vote using cell phones instead of the ballot booths. M-voting can be seen as an additional but not a replacement platform for the electronic voting systems. It is an m-government application that introduces remarkable capabilities to enhance democratic participation (Ekong et al., 2010). By the m-voting system the voter can cast his/her vote more accessibly within the planned period in the election day anywhere, anytime as the voter can access the voting ballot regardless of the lack of the internet connection or privation of the voting booths (Kim et al., 2007).

Mobile phones play an important role since the appearance of the Short Message Service (SMS) application in the political life of many countries. There is a trend nowadays towards adapting m-applications in general and m-government services in specific all over the world; especially with the wide use of mobiles where for Internet user, there are two mobile phone users. There have been a number of attempts like Estonia has used e-voting in 2005, 2007 and 2009 and for the first time in 2011, the country presented Mobile authentication system in its election. Another m-voting pilot project adopted by Norway government that will cover some cities in 2011 to be used in 2017 (Chowdhury, 2010).

Potential Benefits of M-voting: the presence of m-voting application encompasses many benefits as it provides election with more transparency, accountability and justice on behalf of existing governments. It also enables voters with a more convenient way to involve them in political decision-making. In addition, voters would save hours of standing in lines waiting for their turn in polling booths (Ekong et al., 2010). M-voting is cheaper and simpler to manage, helps in increasing the number of participants in elections, and decreases the stress any electorate can face. It is also faster and is an ideal alternative for the disabled and patients in hospitals regardless of their conditions (Ekong et al., 2010). M-voting is highly motivated in developing countries due to the high adoption rate of mobile devices that is higher than the presence of national ID card holders (Pau, 2010).

Usability Concerns: usability can be defined as the quality attribute that evaluates how user interfaces are friendly and easy to use; it also refers to methods used to improve the ease-of-use during the design process (Campbell et al., 2011). M-applications have usability metrics as well as Internet applications that must be considered and they are Efficiency, which is the time measured for any applicant to fill in a ballot, Effectiveness, which measures the number of errors made by an applicant during the filling of the ballot, and User Satisfaction, which is measured by the System Usability Scale, for each voting system.

There are two factors, the first factor; is related to the mobile device itself and its problem with the small-screen displays, data entry, slow network speeds and lack of enhanced mobile content. While the second factor is the human factor that depends heavily on user experience, the short lifetime of mobile batteries and wireless network reliability (Campbell et al., 2011). Browsers can present another limitation as they render every website differently on different mobile platforms. The mobile hardware is not as fast as desktop computers due to the size and functionality. Limited interaction possibilities and this is related to the direct interaction between the user and the application, as it may be unfriendly to user experience.

Security Concerns: Security concerns include identity confidentiality, authentication, data confidentiality (Kumar et al., 2008), accuracy, anonymity of voters and vote verification (Ok et al., 2010).

3.1 Customer Attitudes towards M-voting

The adoption of mobile phones had grown impressively especially in developing countries as they spread fast in these countries as a result of cultural nature. Consequently, in the last 5 years m-applications had become one of the most growing industries (Kargin et al., 2006) and started to offer more services. Although, m-applications had made life easier for a lot of people but there are limitations associated with mobile devices that affect user experience. These limitations include; small screen size, absence or limited functionality of pointing devices, small and limited keyboard, battery power and slow connections (Kaasinen, 2007). Application limitations and possibility of votes' fraud are also common limitations (Menno et al., 2007).

Mobile phones have an excessive effect in the political life, as they have been part of the progression effect of elections. In 2004, the Short Message System (SMS) had played an important role in Spanish election as it was used in the wake of an unprecedented terrorist attack and lead the young who were encouraged to participate in the elections to part of the opposition party. In Malaysia, SMS voting was found to be generally accepted by the public (Sulaiman et al., 2010). Also, in Nigeria, the future of m-voting seemed more acceptable than the traditional voting method (Ekong et al., 2010).

Originally, there have been many models that measure customers' acceptance (Abd El Aziz, 2012) like the Theory of Planned Behavior (TPB) (Ajzen et al., 1980), Innovation Diffusion Theory (Agarwal & Prasad, 1998; Moore & Benbasat, 1991; Rogers, 1993) and the Technology Acceptance Model (TAM) (Davis, 1989; Kargin et al., 2006). The TAM is the most popular one as it adapts many aspects regarding technology adoption in general and m-applications in particular, in addition the Technology Acceptance Model for Mobile Services (TAMM) was created based on a sequence of field trails (Kaasinen, 2007). The TAM includes four general concepts: Ease of Use, value, Trust and Ease of Adoption. Thus, the research aim is to measure these variables and to what extent they affect m-voting application.

3.2 M-voting in Egypt

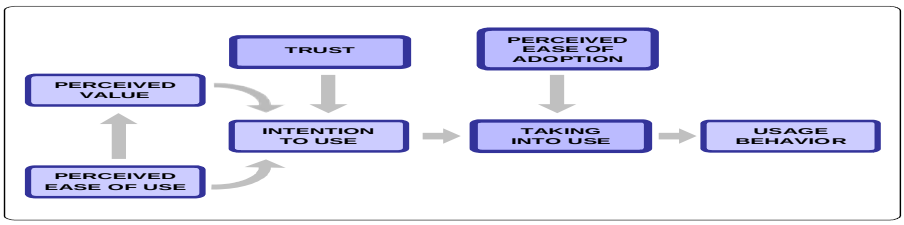
The market of mobile phones in Egypt is enormous as reported by Egypt Ministry of Communications and IT, February 2011 that the population of Egyptian citizens is 78,300,000, while the number of mobile phones are 71,460,000 which means that 91.3% of the Egyptian population own mobile phones (Arab Republic of Egypt Ministry of Communication and Information Technology, 2011). Egypt went through periods of political changes that affected every part of the country. Before the revolutions, the political life in Egypt was divided into two parties the first is the National Democratic Party (NDP), which dominated most of the important positions. The second party was the opposition parties (Hamzawy, 2005). Subsequently, the NDP dominated the election process in which there were many irregularities. They used the police forces and thugs to prevent voters from going to the voting polls. After the revolution these irregularities have changed.

These major changes had created a respectable potential, as it will offer people new stress free service aiding them to make the decision without external influences. Regardless, of citizens' educational or social levels they use mobile phones extensively and accept new m-applications especially when they will help them in lessening time and effort.

4. RESEARCH METHODOLOGY

This section explores the research methods used for gathering the data. In order to achieve the research objectives the following hypotheses were devised:
H1: Factors that affect citizens' readiness to vote are equally important.
H2: Egyptian citizens have no usability concerns with regards to mobile usage.
H3: There is no significant difference between m-voting readiness in Egypt with regards to demographics.
Research Methods: This research will focus only on three methods, namely videotaping, questionnaires, and prototyping. To overcome the disadvantages of every single method used, a triangulation between different techniques is done. First, videotaping, the researcher will go to the voting booths in the election days and record the long queues outside these booths, side talks, how people influence each other, and the irregularities conducted and time and place of the recorded video must be saved. Then, around 600 questionnaires will be distributed over Egyptian citizens both inside and outside Egypt. Finally, a prototype will be designed for an m-voting application that involves steps. Firstly, the user will have to choose whether the election is a presidential or parliament. Secondly, candidates' names will appear and will give the user a choice whether to read their electrical programs or not, after which the user will choose a candidate. Then, the user will enter his ID. After that, a message will appear asking him/her to confirm. Finally, casted votes will be sent and recorded.

The Technology Acceptance Model (TAM) framework was constructed originally for the purpose of measuring the user's beliefs about the perceived usefulness and perceived ease of use when explaining the user's purposes when using a system (Rao et al., 2007). However, mobile users have a lot in common with system users; there have been some differences that must be studied. As a result the Technology Acceptance Model for Mobile Services (TAMM) will be investigated in this study in order to measure the perceived value, perceived ease of use, trust and perceived ease of adoption in order to know the factors affect the intention of use. Accordingly, the below framework will be used to test the Egyptian Users acceptance towards the m-voting application and how they will perceive it (Kaasinen, 2007).



Source: adapted from (Kaasinen, 2007) p.1.

Figure 1. Research Framework Mobile Service Acceptance Model

5. CONCLUSION

Nowadays, the technology is being employed in order to serve the will and provide extraordinary services for people. Mobile applications can be considered as one of the key corner applications that best suit and help users; especially in developing countries. M-voting is an application that will guarantee the civic right of every citizen through providing a new service like this in order to vote. This application ensures availability, privacy, help avoiding political influences and conflicts, in addition to overcoming citizens' inconveniences.
As literature has left this area with a clear gap and an unmet need, a thorough investigation would help fill the gap and tie loose ends.

Egypt in particular seem to be a perfect candidate for m-voting, due to the extremely high rate of mobile subscribers, and very fast political changes that continuously need elections, whether for presidency or the parliament. Thus, a number of methods are used to collect data, get the broader picture and overcome the disadvantages of every single method. This includes videotaping in order to record the long queues, side talks, how people influence each other, and the irregularities conducted. Questionnaires will enable the researchers collect large amounts of data that can be easily analysed in order to test the hypotheses previously

stated. Finally, a mobile voting system prototype will be designed and proposed to decision makers for possible adoption and implementation.

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TELEHOMECARE: A CARE SOLUTUION FOR HEART FAILURE PATIENTS OF NORTHWESTERN ONTARIO

Gwen Third RN, BScN, MHS, CCN(C)
Thunder Bay Regional Health Science Centre
Thunder Bay, Ontario, Canada

Dona Ree RN (EC), MN NP. PHC (Adult)
Thunder Bay Regional Health Science Centre
Thunder Bay, Ontario, Canada

Dr. S. Zaki Ahmed, MD, FRCP(C), FCCP
Thunder Bay Regional Health Science Centre
Thunder Bay, Ontario, Canada

ABSTRACT

Northwestern Ontario (NWO), Canada is a geographical region with a landmass equivalent to the country of France. The region is comprised of approximately 250,000 residents with 50% residing in sparsely populated rural areas, each challenged by limited professional resources to provide health-based programs for their residents. Thunder Bay Regional Health Science Centre (TBRHSC) serves as the sole acute care referral center within this region.
In 2003 the Northwestern Ontario District Health Council (NWODHC) identified inequities in the delivery of Cardiac Services in NWO with many of these issues remaining unresolved. In response to ongoing bed utilization challenges specifically related to the Cardiology services at TBRHSC, a detailed review of health records data was completed in 2010 to determine potential target patient groupings. The data clearly identified resource utilization concerns related to provision of care for patients admitted with Heart Failure with readmission rates well above the provincial average but also a significant number of cases experiencing extended length of stays.
Given the prevalence of cardiac disease throughout NWO, it was imperative that a cost-effective means of ensuring a regional approach to this issue be implemented, with all providers having access for their patients. TBRHSC partnered with the Northwest Local Health Integration Network (NWLHIN) and the Ontario Telemedicine Network (OTN) in the spring of 2011 to introduce utilization of a remote home monitoring solution, Telehomecare, with the focus on deferring patient admission and / or to facilitate a shorter length of patient stay. Through the use of this technology we have provided access within the region to a specialized program that is in the early stages of implementation and is impacting acute care resource utilization with potential to improve quality of life, caregiver burden and patient/family satisfaction.

KEYWORDS

Access, Technology, Partnership, Cost-effectiveness, Regional

1. INTRODUCTION

Thunder Bay Regional Health Science Centre (TBRHSC) is the sole acute care referral centre for Northwestern Ontario. As such the health institution has a maximum bed count of 375 with no capacity to transfer acute care patients to an alternate location without utilization air transport to communities outside of the city proper. This geographical isolation has challenged the institution to maintain effective utilization of our limited resources but also has been a catalyst to consider alternative methodologies of providing care to our patients.

Through the 2010 Flo Collaborative process TBRHSC examined service opportunities to improve bed utilization and patient flow. A review of the Cardiology ward service data clearly identified that the Heart Failure case mix group (CMG) represented a significant patient population for the service. Further review highlighted two significant indicators. The first was frequent readmission of patients in less than 7 day

category (28.1%) but also in the 8 to 28 day category (38.4%) with provincial rate comparators of 3.7% and 8.3% respectively. Secondly, our total average length of stay (LOS) of 8.1 days exceeded the provincial average LOS at the 50th percentile of 5.9 days. Data from the previous year was also examined and confirmed that Heart Failure patients continue to represent a significant patient population for the service with increasing readmission rates in both categories (< 7 days and 8 to 28 days) remaining above the provincial comparators.

A detailed chart review of individual patients during a one year time period was also undertaken. The review suggested that many of these patients had similar characteristics with two significant unique patient groupings (Figure 1). It was acknowledged that this patient population is medically challenging and complex and would require considerable care, including readmission to hospital on a recurring basis; however the data comparisons suggested that our rates were considerably higher than the provincial norm. The data review could not clearly indicate which patients were considered palliative in nature and who would benefit from an alternative or modified service model. It was noted that there was a significant death rate of the CMG as expected within the disease process.

Common Patient Characteristics

- Unattached, without access to a consistent Medical Care provider
- Multiple care providers as a result of different Physicians providing care on each admission leading to inconsistent care practices
- Limited access to timely follow – up especially from the Cardiology specialist on discharge
- Co-morbid conditions such as Diabetes and /or Renal Failure
- Elderly population with mixed Social Supports

Unique Patient Characteristics

- Residents of Long Term Care Facility
- Aboriginal Patients transferred from outside of Thunder Bay to receive service.

Figure 1.

As part of a provincial initiative the Cardiac Care Network of Ontario (CCN) hosted a Heart Failure Summit in August of 2010, reviewing the varied models of caring for this patient population throughout the province. This session highlighted common issues related to caring for this medically complex disease that is chronic in nature.

In response to this system review, both internally and provincially, we have developed a supportive care Heart Failure Clinic With development of this service our goal was to not only improve the quality of the services we provided but to also impact the bed utilization within the institution.

2. HEART FAILURE CLINIC

Bui and Fonarow (2012)[2] supports the premise that Heart Failure does indeed challenge management issues related not only to the age of the patient population but to the “often subtle onset of decompensation, the complexities of the required lifestyle changes, medication regime, laboratory monitoring and interactions with comorbid conditions.”(p.97). In response to these complex care issues a Heart Failure Clinic based on the 2009 ACCF/AHA Guidelines [3] was incorporated into our existing Internal Medicine Clinic (IMC) whose mandate is to prevent admissions from the Emergency Department and or to shorten length of stay for admitted patients. The IMC clinic has an interprofessional team under the medical supervision of the Medical Chief of Internal Medicine. Patients are referred by their attending physician or associated Nurse Practitioner. It was recognized that many patients are unattached and referred as a result of an inpatient stay or attendance at the Emergency Department. Through utilization of the principles of Self Management of Chronic

Diseases[6] the staff work along with patients and families to maximize their health status not only medically but also through education and support programming.

Anker et al (2011) [1] supports this approach to providing care and suggests that for heart failure patients a " Well structured outpatient care could reduce the need for hospital admission, facilitate early intervention, prevent crisis management, and avoid complications or disease progression" (p.731). The author further indicates that telemedical management may be an approach to providing care but comments on the wide variation in program models challenging evaluation of its effectiveness. Analysis conducted by Schmidt et al (2010)[5] did identify a trend suggesting that telemonitoring procedures appeared to be more effective in patients with cardiac diseases than those with other chronic illness. Wootton (2012) [7] stated that of all the chronic diseases within his literature review on telemedicine that utilization in the heart failure population appeared most favorable.

With funding provided by the Northwest Local Health Integration Network (NWLHIN) as part of their Chronic Disease Prevention and Management priority programming and in partnership with the Ontario Telemedicine Network (OTN) we have integrated an in-home monitoring system referred to as Telehomecare into our clinic matrix. Commencing in the spring of 2011 heart failure clinic patients may be monitored utilizing standard monitoring equipment provided by OTN. Enrollment can be from anywhere within the North West LHIN promoting equitable access for a significant portion of the regions residents with referral required by an attending physician or NP. At the onset of the program referrals were somewhat limited, but with increased familiarity and acceptance of a shared care model of practice, improved utilization of the program has been achieved.

It is to be acknowledged that our present system requires utilization of an analog telephone line for connectivity, limiting access for key patient groupings such as residents of long term care facilities and First Nations communities in the remote areas of the region. For residents challenged by management of the system, we have partnered with community based services for assistance in the home setting.

Through utilization of the OTN "Turtle" device individual patient data including vital signs and weight are transmitted to the central monitoring system via telephone line from the patient's home. As well the patient responds to scripted questions rating their response to indicators related to their medical status. This data is coded to indicate need for response: red for acute, yellow for caution and green for good. Data is tracked for trending, with appropriate response based on patient needs.

As an extension of the routine Self Management [6] supportive model delivered as part of the larger provincial Telehomecare program, we have incorporated a medical management component providing early prescriptive intervention to this medically complex patient grouping. Through the utilization of the services of a senior well experienced Nurse Practitioner (NP), supported by a Registered Dietitian and Pharmacist, 40 heart failure patients at any given time are monitored by the system, with timely intervention to alerts. This model is not only effective with respect to management of the patient conditions but provides a cost effective programming solution in a region with limited specialist resources. Klery et al (2010) [4] indicated that "remote patient monitoring (RPM) strategies may delay or prevent hospitalization or even death due to worsening of heart failure by recognizing early changes in haemodynamic and clinical status" (p. 451). The author elaborated to suggest the their study "shows for the first time that management of HF patients by remote monitoring is cost saving due to a substantial reduction in healthcare resource utilization mostly driven by a reduction in the number of HF hospitalizations. "(p.456). As well they suggested that the early detection of signs and symptoms of decompensation would result in a less severe decompensated status, shortening required length of stay when hospitalized.

Review of health records data within TBRHSC supports the impact of the Telehomecare programming within our institution. Data extraction reports have been prepared detailing readmission rates for Case Mix Group for Heart Failure without Cardiac Catheterization. From April 2011 to March 2012 time period representing one fiscal year of activity TBRHSC had 368 cases of CHF with a total LOS of 3, 408 days including Alternate Level of Care days, with an average length of stay of 9.3 days. When data correction is completed to exclude 446 Alternate Care Days the average length of stay is determined to be 8.0 days, slightly lower than the average at the onset of our program of 8.1 days.

In the category of readmission in less than 7 days for April 2011 to March 2012 time period we have experienced a significant reduction in the % of readmitted cases from our 2010 data of 28.1% down to 6.8% with the provincial average comparator from 2010 of 4.0% now reported. With respect to the readmission activity in the 8 to 28 day category April 2011 to March 2012 time period our % or readmits has dropped from 38.4% to 14.9% with the provincial average of 2010 now reported as 8.2%.

Our institution also tracks the Top 15 CMG's as per reason for admission in the same time periods of < 7days and 8 to 28 days. At the onset of our Telehomecare program January to December 2010 CMG 196 Heart Failure was number 1 on the listing for < 7 days at a rate of 9.5% with data from July to September of 2012 showing the indicator positioned at 5th place with a readmission rate of 2.5%. In the 8 to 28 day category for January to December 2010 time period Heart Failure was 2nd on the listing behind COPD with a rate of 19% with data from July to September of 2012 showing the indicator in 1st place with higher at a 22%. We will continue to track this variable in comparative time frames to gain a true reflection of patient activity, with potential influence of limited patient numbers impacting interpretation of outcomes.

Our data analysis is challenged by limited data sources along with a wide variation in collection methodologies throughout the region. As noted the main outcome data source is TBRHSC that identifies all heart failure patients with no capacity to identify those participating in the Telehomecare program as a separate grouping. Outside of TBRHSC the multiple regional facilities utilize a wide variety of Health Records systems with many being paper based, challenging data collection and analysis. Adoption of a common Health Care Record for the region is in progress at this time.

A review of the program activity specific to patients enrolled in the Telehomecare program to date indicates a total of 104 participants. Each participant was enrolled in the programming for 4-6 months with a limited number with extended enrollment as approved by the program medical director. As expected 31.7% of the patients experienced a readmission to hospital with 54% of that subgrouping being admitted with a diagnosis not related to heart failure. Of the 44% admitted with heart failure only a single patient was readmitted within the < 7 day time period, and subsequently died within three days of admission. Of the 11 remaining in the readmit grouping 8 patients were admitted in the 8-28 day category with 3 admitted in a period > 28 days. A total of 3 patients were admitted twice to hospital, 2 patients being admitted three times and a single patient experienced 4 readmissions.

3. CONCLUSION

The 2010 Flo Collaborative review by TBRHSC has been a catalyst to the development of the Telehomecare programming for heart failure patients within the NWLHIN of Northwestern Ontario. Early outcome indicators demonstrate a significant impact on reduction of readmission rates which may be attributable to timely and effective intervention post discharge. However, the project to date appears to have minimal impact on the length of stay when readmitted indicators which will be reviewed in the upcoming months.

In daily interactions with our patients and families we are told of the program benefit to them with respect to quality of life as well as relief of care giver burden. In the upcoming months it is our intention to commence an evaluation on the impact of this element of the programming. We are confident that the data will reflect positively. As well, we will be working on a methodology to establish a comparator group with patients who have not received telehomecare services to further evaluate the significance of this program.

Ongoing discussions are continuing with the NWLHIN to secure new technology that will enable the program to reach the remote First Nations communities as well as provide programming for residents in the Long Term Care facilities. This endeavor will ensure full access for all residents of Northwestern Ontario.

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CREATIVE INTERNET USES – DIFFERENCES IN DIGITAL ENGAGEMENT AMONG ADOLESCENTS IN CENTRAL AND EASTERN EUROPE

Bianca Balea[1] and Monica Barbovschi[2]
[1]*Faculty of Sociology and Social Work, Babeș-Bolyai University, Cluj-Napoca, Romania*
[2]*Institute for Research of Children, Youth and Family, Masaryk University, Brno, Czech Republic*

ABSTRACT

Drawing on the EU Kids Online data, this article aims to emphasize how the differences in internet use of adolescents in Central and Eastern Europe (Poland, Hungary, Romania and Bulgaria) persist in spite of their incorporation of technology in everyday life. The findings show that once children use the internet on a daily basis, demographic variables do not account for difference in use, but other factors fuel "silent inequalities", which in turn reinforce already existing inequalities, digital and social. Adolescents who are online for more years, use the internet for a larger amount of time, have internet access from their bedroom, or have more skills are also more likely to engage in creative activities and therefore to undertake a wider range of online opportunities. Parental education (which also predicts parental digital literacy) influences the likelihood of children engaging in creative internet activities both in direct and indirect ways.

KEYWORDS

Digital divide, social integration, creative internet use, adolescents, Central and Eastern Europe.

1. INTRODUCTION

EU Kids Online II findings have revealed that the number of online activities young people undertake correlate highly with their level of digital skills and their confidence in own use (Livingstone et al., 2011). According to them, children "climb on a ladder of opportunities", beginning with information seeking, progressing through games and communication, taking on more interactive forms of communication and culminating in creative and civic activities, seen by several scholars as capital-enhancing activities. Moreover, if a child does four things on the internet, for sure these will include information seeking, games and email. Only those who undertake all other activities (in the case of EU Kids Online II survey more or at least 13 activities) will most likely engage in website creation and chatting (Livingstone & Helsper, 2009). Only a quarter of European children reach the last, most advanced and creative step according to the "ladder of opportunities" model proposed by Hasebrink et al. (2011), thus debunking the popular myth that children and young people are all "digitally savvy" (Livingstone & Helsper, 2009; Helsper & Enyon, 2009). Adolescents in Central and Eastern Europe deserve a special focus, due to their positioning on the lower end of the ladder of opportunities despite their intensive internet use (Romania and Poland), and due to their classification as "new use/ new risk" countries (Romania, Bulgaria). Hungary was added as a low use/low risk country. Last, all these four countries were cases of "digital natives", with children's internet use surpassing their parents'. This article looks at individual (children and parental) factors that shape adolescents' engagement in creative internet uses across Central and Eastern Europe.

2. LITERATURE REVIEW

While the traditional approach of digital inequalities has concentrated on demographic factors like age, gender and SES (Witte & Mannon, 2009; Katz & Rice, 2002), recently, scholars turned their attention to other factors which can increase "silent inequalities" among internet users (DiMaggio et al., 2004, Hargittai,

2010). Digital literacy has received a lot of attention lately in relation to opportunities that children and adults take up online, making internet skills a possible contributor to social inequalities (Livingstone & Helsper, 2007, 2010; Van Deursen, 2011; Helsper and Enyon, 2009). Witte and Mannon (2009) consider digital literacy in their analysis as a particular "skill set" and "knowledge base" that might be used to maintain class advantage while the lack thereof may translate into class disadvantage. Numerous studies on children and young adults' internet use have shown, indeed, that those who are more skilled undertake a broader range of activities and are able to participate to a greater extent in digital practices. However, the assumption that all children are "digital natives" has been challenged (Helsper and Enyon, 2009), while an "emerging digital differentiation" perspective (Peter and Valkenburg, 2006) assumes occurring differences in the levels of digital engagement of young people. Previous research has been also preoccupied with how parental background plays a role in shaping children's internet uses (the conflict paradigm advanced by Witte and Mannon, 2009).

According to Helsper (2008) there are two main approaches to measuring digital engagement: through a qualitative lens, focusing on the nature or content of engagement, or through a quantitative one by evaluation of the number of things/activities that people do using the technology. On these lines, in order to measure digital inclusion of 9-19 year olds in the UK, Livingstone and Helsper (2007) used the number and types of online opportunities taken up, which allowed them to map a continuum in the breadth of internet use and to uncover systematic differences between those who take up more and those who take up fewer opportunities. In addition, studies that investigated this topic from a "qualitative approach" emphasized that some activities are undertaken frequently by the majority of children while more sophisticated ones are carried out by fewer children, and less frequently (Kenedy et al. 2008; Bennett & Maton, 2010). For example, content creation activities (such as creating text, graphics, audio or video) are consistently less common. In fact, with the exception of social networking, most activities associated with web 2.0 are engaged in by a minority of respondents on key large-scale surveys (Kennedy et al. 2008; Bennett & Maton, 2010; Jones et al. 2010). Interview data from studies revealed that many students were unsure what some web 2.0 tools, such as blogs, were. Importantly, these studies began to highlight significant variations across age, gender and socioeconomic status (Bennett & Maton, 2010; Sewlyn, 2011; Jones et al., 2010).

Following the work of Livingstone and Helsper (2007), Hasebrink et al. (2011) have differentiated the number of online opportunities taken up, resulting in a "ladder of opportunities" composed of five stages. According to this hypothesis, certain basic activities tend to be done first, and by most of the children, such as searching information for school work and playing games on the computer, while more creative and participatory activities come later and are used only by a small number of children (Livingstone et al., 2011, p. 33). Playing with others online, downloading films and music, and sharing content peer-to-peer is common only for one in two children while only a quarter of them reach the final, most advanced and creative step which includes visiting chat-rooms, file sharing, blogging, and spending time in a virtual world. According to Livingstone and Helsper (2009), young people represent a smaller group that is pushing the boundaries of conventional practice. Having strong digital identities, these young people are making the shift from consumption to creation. Last, it seems that if a child does four things on the Internet, for sure these will include information seeking, games and email. Only those who undertake all other activities will most likely engage in website creation and chatting (Livingstone & Helsper, 2009).

In sum, these findings emphasize that while some common technology-based activities are frequently used by a majority of respondents, more advanced, and creative activities are unevenly used by young people (Bennett & Maton, 2010). There are some who engage in a wide range of technology-based activities, including content creation and self-publishing, at high frequencies while there are significant young people who never participate in those activities. Since only 14 per cent of Eastern-European 11-16 years olds that make use of the internet every day reach the final step on the hierarchy of online activities, the purpose of this paper is to investigate the main determinants for an adolescent to take up of creative and capital-enhancing online uses, building on the literature on digital inclusion.

3. SAMPLE AND METHOD

In order to explain which factors influence the odds ratio for a young person to involve in the most creative and advanced step when access the Internet, a logistic regression was conducted on 11-16 year olds from

Romania, Bulgaria, Hungary and Poland which use the Internet on daily bases (EU Kids Online data, N= 2372). Furthermore, a dummy variable was created in order to measure the creative and most advanced step, based on the continuous variable that measures the number of online activities (Total=17) , where creative use (more than 13 activities) equals 1 (N= 323). Based on the previous literature, six factors were introduced in the model, out of which two are demographic variables (i.e. adolescent's gender, parent's education - highest in the household, online experience, time online, private use from own bedroom, and digital skills). Interaction terms among the variables were all entered, of which only those that contributed significantly were kept in the model (due some variables report missing values, e.g. online experience reported 341 missing values, 1968 subjects were entered in the model, out of which 272 conduct at least 13 activities when accessing the internet). Additionally, the interaction effect between child's age and gender was introduced in the model in order to test for the theory that even if gender gap seems to diminish if we look at the entire cohort, there are important gender differences between adolescents, with boys more likely to engage in a creative use than girls. More details about measures and methods can be found at eukidsonline.net (see also Livingstone, Haddon & Görzig, 2012). Table 1 presents the variables in the model.

Table 1. Description of Independent Factors and Dependent Variable (Creative Internet Use).

	Mean	Std. Deviation
Child's age	13.62	1.70
Child's gender (Female=0)	.53	
Education (Highest in the household. 4 point scale)	3.13	0.64
Digital Skills. Total (8)	4.49	2.59
Private use. own bedroom or other private room at home (Yes=1)	0.65	0.48
Online experience (13=Max)	4.16	2.06
Time online (270=Max)	130.27	62.4
Online activities. Total (17)	8.90	3.20
Creative use (> 13 activities=1)	.13	
Valid N (listwise)= 1968		

Base: All children, +11 year olds that use the internet every day.

4. RESULTS

Our analytical model was statistically significant and explains about 19 per cent of the variation in the data, indicating a moderate relationship between our predictors and dependent variable. However, one needs to keep in mind that this R square is a pseudo R square and it does not have the same significance as the R square in the linear regression. However, the value of Hosmer and Lemeshow goodness-of-fit (3.109) at a p value .927 indicates that the model appears to fit the data reasonably well. Prediction success was overall 85.8%. The Wald criterion demonstrated that Education has a significant impact on the likelihood to achieve the final step of internet use when all other variables are held constant. Accordingly, Central and Eastern-European adolescents who live in households where the highest level of education is primary or lower are less likely to make use of the internet in an advanced and creative way than those who live in high educated households. Parental education has also a significant effect through the level of digital skills of adolescents, with our results suggesting that the chances for a child whose parents have only lower secondary education to achieve the final step being smaller than for a child whose parents have tertiary education, even if their level of digital skills are high. However, education is not the only predictor that has a significant impact on the chances for a child to become digital experienced. Furthermore, at each year of experience gained, a young person has, in average, about 1.4 more chances to achieve the final step of digital inclusion, when all other variables are controlled. On these lines, adolescents whose parents have upper and post-secondary education are more likely to use the internet in a creative and advanced way as their years of experience increase, than young people whose parents have completed the tertiary education. Using the internet in a private setting increases the odds for a child to become an experienced internet user, when all other variables are held

constant. Thus, young people who do not access the internet from the privacy of their own bedroom have, in average, about 67% less chances to achieve this step. Digital skills also help adolescents to benefit from their internet use. At each digital skill gained, one is almost two times (1.95) more likely to belong to the group of "digital natives". Moreover, to reach the creative stage of internet use, the differences in digital skills matter more for children with less years of online experience.

In spite of our sample consisting of 11-16 year olds, according to the Wald criterion, the interaction effect between age and gender has a significant impact on the likelihood for an adolescent to become experienced internet user. Accordingly, older boys are more likely to engage in advanced and creative ways of using the internet than are girls of the same age. These findings are even more important as the interaction between gender and online experience are significant and shows that girls are less likely to use the internet in a creative way even when they are as experienced as boys, when all other variables are held constant. The logistic regression model is represented in Table 2.

Table 2. Logistic regression predicting the odds of adolescents engaging in creative internet uses.

Variables in the Model	B	S.E.	Wald	Df	Sig.	Exp(B)
Education (Tertiary – reference category)			10.99	3.00	.01	
Primary or less education	-12.46	6.03	4.27	1.00	.04	.00
Experience online	.34	.15	4.73	1.00	.03	1.40
Private use (No access from own bedroom – reference category)	-1.12	.65	2.99	1.00	.08	.33
Digital skills	.67	.22	9.53	1.00	.00	1.95
Child's age by Gender (Female- reference category)	.13	.06	4.35	1.00	.04	1.14
Gender (Female- reference category) by Experience online	-.18	.07	6.65	1.00	.01	.83
Upper and post-secondary education by Experience online	.17	.08	4.65	1.00	.03	1.19
Education * Digital skills			11.73	3.00	.01	
Lower secondary Education by Digital skills	-.35	.13	7.31	1.00	.01	.70
Experience online by Digital skills	-.03	.02	3.69	1.00	.05	.97
Constant	-7.20	1.68	18.43	1.00	.00	.00

Chi-square=221.022, 24(df), Sig. =.00 (Omnibus Tests of Model Coefficients).
Cox&Snell R Suare =.104;Nagelkerke R Square= .192; -2 Log likelihood=1360.08; 85.8% correctly classified cases.
*only significant predictors were presented in the Table.

5. CONCLUSION

Adolescents in Central and Eastern Europe make an interesting focus for the perspective of digital inclusion since they are those whose level of digital engagement surpasses the one of their parents. Still, having to rely less on their parents' skills might mean fewer of children being able to enjoy the full opportunities that the internet has to offer. Therefore the contribution of this piece of research relies on looking at those adolescents who engage in creative internet uses, emphasizing the factors that push them over the boundaries of common use. These findings are even more important since are focused on 11-16 years olds that are online on daily basis, often described as "digital natives". Unfortunately, the mainstream discourse of digital native narratives often omits that breadth of use, experience, digital skills and education generate differences in the way young people make use of the internet, as this paper shows. Furthermore, the interaction between the children's digital skills and their parents' education for predicting their creative internet uses indicates support for a conflict perspective of reproduction of digital inequalities (Witte and Mannon, 2009), which maps digital inequalities into existing (socioeconomic) background inequalities, while the interaction between age and gender suggests persisting gender inequalities among children the same age, which indicate support for children's emerging digital differentiation (Peter and Valkenburg, 2006). The limitations of this analysis are related to the use of quantitative measures for digital skills and digital engagement, in spite of growing emphasis on the need for qualitative measures of children's online behaviour. Another important limitation is given by the complexity of the concept "digital literacy". Defining and measuring it can become a difficult exercise considering the amount of studies that suggest different ways to approach this concept. Finally, the chosen statistical method (logistic regression) requires *a priori* decisions based on theoretical assumptions. Consequently, possible important factors which can also explain variations in digital

engagement might have been excluded from analysis. More research should investigate with qualitative tools the digital engagement of adolescents in Central and Eastern Europe.

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A ROAD MAP TOWARDS M-GOVERNMENT SERVICES IN EGYPT

Mai Morsy[1] and Rasha Abd El Aziz[2]
Business Information Systems, Arab Academy for Science and Technology and Maritime Transport, Alexandria, Egypt
[1] Jamal Abd El Nasser, Miami, Alexandria, Egypt, 1029
[2]10 Mohamed Saleh Abou Youssef, Saba Pacha, Alexandria, Egypt

ABSTRACT

With the high population, poor provided services because of employees' lack of professionalism, long queues, dilemma of paperwork and working hours the Egyptian government Over the past decade has been working on facilitating the delivery of government services through the Egyptian government portal which attempted to improve the current situation but unfortunately is not widely used so with the extensive mobile technologies development it has opened new opportunities to facilitate the easy communication between different parties that has encouraged The Egyptian government to start offering a number of mobile services, they are still few in numbers, not very popular and citizens do not even seem to be aware of their provision. The underlying study aims to understand how Egyptian citizens' view and rank m-government (m-government) services and determine the main factors that affect citizens' readiness to adopt m-government in the Egyptian context. An extensive literature review on different acceptance models and m-government implementations at different countries was undertaken; accordingly a conceptual model was formulated to examine the influence of perceived usefulness, perceived ease of use, social influence, perceived compatibility and perceived risk on the citizen's intention to use M-government services, using a triangulation of field observation and structured questionnaire for data collection. Finally a Comparison between the findings and results of the observation and questionnaire will be held to analyze it, find out results and make out recommendations.

KEYWORDS

M-government, technology acceptance, social influence, ease of use, compatibility, risk, usefulness.

1. INTRODUCTION

Egypt is a developing country with a population of 82,079,636 (CIA, July 2011) which are mainly centered in the northeast corner of the country. Egypt has a potential to be a rich country (Abd El Aziz, 2012) but it suffered from autocratic ruling hierarchy in the past three decades which did not permit a space of freedom or economic opportunity or prosperity to reach the mass of population. After the 25th revolution the government operates the country with a totally different strategy which views the achievement of citizens' prosperity and welfare as one of its priorities. Since 2004, the Ministry of State for Administrative Development (MSAD) has taken the responsibility for convenient delivery of government services through the Egyptian government portal, which is being continuously updated. MSAD has introduced new channels to access and deliver governmental services for different segments of users such as internet, landline phones, mobile phones and service providers.

According to the Ministry of Communication and Information Technology (March 2011), Mobile subscription has already reached to 73.8 million with a monthly growth rate of 1.2 % and an annual growth 28.0 %. The rate of mobile penetration reached 94.1 percent in March 2011 with a monthly growth rate of 1.0 percent and an annual growth 19.2 percent. The mobile technologies development has opened new opportunities to facilitate the easy communication between different parties. The MSAD has promoted the use of mobile phones to deliver government services, where citizens may send SMS to ask for services from governmental agencies that offer those services.

2. RESEARCH PROBLEM

With the high population, poor provided services because of employees' lack of professionalism, long queues, dilemma of paperwork and working hours; the Egyptian government has launched its online portal in an attempt to improve the current situation though not widely used. The low usage rate may be due to computer illiteracy and internet inaccessibility to the majority of the Egyptians who are below poverty line. Although the Egyptian government has started offering a number of mobile services, they are still few in number, not very popular and citizens do not even seem to be aware of their provision. Therefore this research problem can be translated in to the following questions:

Q1: how do Egyptian citizens' view M-government (M-Government) services?

Q2: what are the main criteria that affects M-Government acceptance in the Egyptian context?

The overall aim of the research is to understand how Egyptian citizens' view and rank m-government services and to determine the main factors that affect citizens' readiness to adopt m-government in the Egyptian context. Accordingly, the following objectives have been stetted:

- Explore the main problems with the governmental services in Egypt.
- Investigate how Egyptian citizens' view and rank M-Government services.
- Analyze the main factors that affect citizens' readiness to use m-government services.

3. GOVERNEMNT BACKGROUND

Government is the only organization that has the power to implement specific rules and regulations in a country. Government holds the responsibility of facilitating the delivery of services by utilizing means and communication channels in order to improve its effectiveness and efficiency (Al-khamayseh et al., 2006; Pardo, 2000). E-government can be defined as a tool where governments use the recent information and communication technologies, especially web-based Internet applications, to offer easy accessibility to government information and services (Turban et al., 2002; Sprecher, 2000). The government has created centers in rural areas with the cooperation of the private sector through which illiterate citizens can request e-government services using the help of specialized personnel (Ismail, 2008).

M-government could be considered as a subset of or a complement to e-government, providing flexible access and value added services in context or processes which make relevant use of mobility among users (Rossel et al, 2006). It is a relatively new trend of the information society that involves government outreach through mobile technologies which enables the government to get closer to citizens (Borucki et al, 2005). It involves the utilization of wireless technology (Kushchu, 2003) in order to provide its citizens with the benefits of getting services and information from anywhere at any time (El-Kiki, 2006).

M-government has different interaction levels where the government communicate with different parties at each level; citizens, government itself, employees and businesses. M-government to citizen (mG2C) refers to the interaction between government and the citizens which includes the information dissemination to the public and offering basic services in different areas. M-government to government (mG2G) refers to inter-government relationships and the interaction between governmental agencies. M-government to Employee (mG2E) refers to government interaction with its employees for example maintaining better day to day operations and training the employees to adapt new technologies. M-government to Business (mG2B) refers to the government interaction with business which includes rules, policy and regulations dissemination, results in e-procurement improvement (Amailef, 2008; Turban et al, 2006; Kushchu, 2003).

M-government services also being classified into four main categories in the public sector which are mobile communication, mobile services, mobile democracy and mobile administration. Mobile communication involves the improvement of information provision to the public as it is the foundation of citizens' empowerment through which they form intelligent opinions and act according to it. Information is needed to establish transparency and accountability. Mobile services involve the provision of a communication channel between the government and the citizens via SMS and the ability to conduct mobile transactions and payments. Mobile Democracy involves the citizens' usage of mobile devices to submit their political decision making. Mobile Administration involves the improvement of internal operations performed inside the public agencies (Jahanshahi et al., 2011; Amailef, 2008; El-kiki, 2006)

3.1 M-government Potential Benefits and Challenges

The value obtained from services provided by m-government to citizens in one year is several times more than that obtained from the services provided in e-government (Kumar, 2008).M-government has a number of potential benefits; M-government reaches various levels of society through mobile devices regardless of their experience with computers and internet but they are aware of mobile communication that facilitates the acceptance, adoption and the usage of governmental services electronically as each citizen is being communicated through more personal, familiar and a convenient device which is always on, carried around giving the advantage of using governmental services and get instant and critical information not only anywhere but also anytime with quick update for the data and information. M-government can be a better way to reach the citizens in rural and remote areas which increases the communication channels in order to improve the interaction with them (Mengistu et al., 2009; Alijerban, 2010; Kushchu, 2003; El-kiki, 2006) (kushchu, 2003; Amine, 2005).

Despite all the obvious m-government benefits, there are a number of physical and soft challenges associated with it; M-government needs information technology infrastructure presence both physical and soft. (Kushchu, 2003). M-government needs a payment infrastructure which the citizens will trust enough to send over their credit card information. One of the most significant challenges is the citizens' concerns that their mobile phone number may be traced, when they send their opinions and inquires to the government as mobile phones numbers and mobile devices are relatively easy to be hacked; therefore, privacy and security represents an obstacle that should be taken in consideration when developing mobile device (Mengistu et at, 2009). The government should increase the m-government accessibility by offering ease of access to m-government information in alternative forms as well as using video and voice communications. M-government may face some technical difficulties due to computability issues of the mobile systems with the existing e-government systems. At last legal issues may arise due to non existence of laws that recognize mobile documents and transactions & the non existence of clear legal status for government's online publications, no regulations and laws for online fillings, online signings and online taxable transactions (El-kiki, 2003; Lanwin, 2002).

4. USER ACCEPTANCE MODELS

There are various technology acceptance models such as Technology Acceptance Model (TAM), Uniform theory of Acceptance and use of technology and Diffusion of Innovations.

According to Davis (1989), TAM has been the base of various technology acceptance and adoption researches. It has determined two important independent variables that affect the technology intention to use which are perceived ease of use and perceived usefulness. Diffusion of innovation (DOI) theory states that the diffusion of new innovations is a process by which an innovation is communicated through certain channels over time among members of a social system. The theory claims that the user's perception towards new innovation depends on the innovations' relative advantage, complexity, compatibility, trial ability, and observe-ability. Uniform Theory of Acceptance and use of technology (UTAUT) determined four constructs that significantly affect user acceptance and behavior which are performance expectancy, effort expectancy, social influence and facilitating conditions (Venkatesh et al., 2003).

Reviewing and evaluating these models has revealed that similar constructs have been identified under different names, such as perceived ease of use identified in TAM could be similar to the technical complexity identified in both the DOI and effort expectancy of UTAUT. Also, the perceived usefulness identified in the TAM model could be similar to the relative advantage identified in DOI, and the performance expectancy defined in UTAUT (Kanat, 2009).

5. M-GOVERNMENT IN EGYPT

The Egyptian government has launched its first attempt of mobile services where it provides some of its services through different mobile channels such as SMS, Mobile phone and Mobile internet.

The Egyptian government portal is providing some of its services through SMS services such as Doctor charging service where the charging results for doctors, dentist, physiotherapists, pharmacists and nurses are available through the mobile phone. The doctor just has to send his/her graduate number in a short message to the number 91405 from any mobile with just 1 L.E, Government job vacancies service where the citizens Receive announcements for vacant posts in the Egyptian government, the citizens just send the word "govjob" or the number "10" to 9999 from any Vodafone number only for 50 pts, Government tenders service where the citizens Receive announcements for Egyptian government tenders , the businesses just send the word "tender" or the number "20" to 9999 from any Vodafone number only for 50 pts.

The Egyptian government portal is providing one of its services over WAP on mobile "mobile.egypt.gov.eg. The appeal courts services as well as electricity bill inquiry are newly launched as well as signing an agreement with Mobinil company one of the biggest communication companies in Egypt, the agreement state that Mobinil offers some of the governmental services through the hotline 8000, the citizens can extract National ID, Death document, Divorce document, family record, marriage document and Birth certificate, Also the citizens can inquiry about the required documents to extract & renew passports and other public sector services (Egyptian government portal, 2011).

6. RESEARCH METHODOLOGY

A triangulation of field observation and questionnaire will be used to collect data. Two stages Observation at government premises will be sued in order to gather accurate information about how government services are normally provided. It also helps get a closer picture of the citizen-government interactions without relying on people's willingness or ability to participants. A survey will be used where a convenient number of questionnaires will be randomly distributed (Sekaran, 2003) in order to quickly and easily reach large number of respondents (Sato, 2005). Direct observation as a qualitative data gathering method is used to earn knowledge about the naturally occurring routines, interactions and practices of a particular group of people in their social environments (Slack, 2001). A Comparison between the findings and results of the observation and questionnaire will be held to analyze it, find out results and make out recommendations.

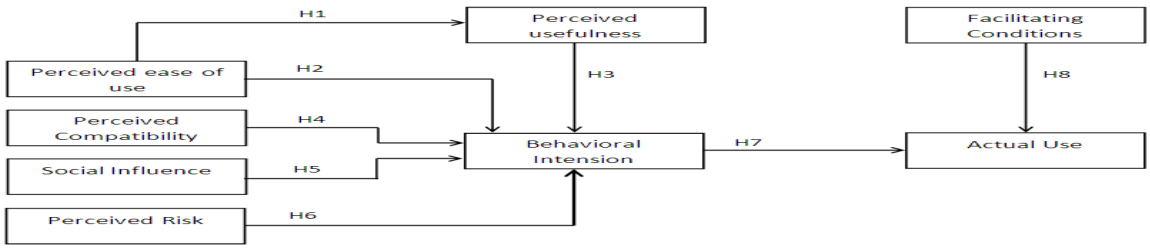

Figure 1. Research Model

In order to answer the research questions, the following hypotheses have been devised:

H1: There is no significant difference between perceived ease of use and m-government perceived usefulness

H2: There is no significant difference between citizens' perceived ease of use and behavioral intention towards M-government services

H3: There is no significant difference between citizens' Perceived usefulness and behavioral intention towards M-government services

H4: There is no significant difference between citizens' perceived compatibility and behavioral intention towards M-government services

H5: there is no significant difference between social influence and behavioral intention towards M-government services

H6: There is no significant difference between Perceived risk and behavioral intention towards M-government services

H7: There is no significant difference between citizen's behavioral intention towards M-government services and M-government services usage

H8: There is no significant difference between facilitating conditions and M-government services usage

7. CONCLUSION

Egypt is a major country in the region. Of a population of around 82 million, around 74 million are already mobile subscribers. This has highlighted the very high rate of mobile invasion to the Egyptian market. Thus, it seems to be a handy and an ideal vehicle to provide more and more services every day. The Egyptian government has started to realize this and have implemented a number of mobile services and made them available to citizens. However, these services are still few in numbers, not very popular and citizens do not even seem to be aware of their provision.

The research at hand have addressed the importance of studying and understanding how Egyptian citizens' view and rank m-government services and identifying the main factors that affect citizens' readiness to adopt m-government in the Egyptian context. With an extensive literature review on different acceptance models and m-government implementations at different countries; accordingly a conceptual model was formulated to examine the influence of perceived usefulness, perceived ease of use, social influence, perceived compatibility and perceived risk on the citizen's intention to use M-government services, using a triangulation of field observation and structured questionnaire for data collection. Finally a Comparison between the findings and results of the observation and questionnaire provides a comprehensive analysis that would enable the researchers to propose a road map to governmental units in order to provide an ideal service that best meets citizens' needs.

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PRODUCT REPUTATION TREND EXTRACTION FROM TWITTER MICRO BLOGGING

Bizhanova Aizhan[1] and Osamu Uchida[2]
[1]*Graduate School of Engineering, Tokai University*
[2]*Dept. of Human and Information Science, Tokai University*
4-1-1 Kitakaname, Hiratsuka, Kanagawa 259-1292 JAPAN

ABSTRACT

Micro blogging today has become a very popular communication tool among the Internet users. Real-time web services such as Twitter allow users to express their opinions and interests, often expressed in the form of short text messages. Many business companies are looking into utilizing these data streams in order to improve their marketing campaigns, refine advertising and better meet their customer needs. In this study, we focus on using Twitter, for the task of extraction product reputation trend. Thus, business could gauge the effectiveness of a recent marketing campaign by aggregating user opinions on Twitter regarding their product. In this paper, we introduce an approach for automatically classifying the sentiment of Twitter messages toward product/brand, using emoticons and by improving pre-processing steps in order to achieve high accuracy.

KEYWORDS

Twitter, opinion mining, sentiment analysis, natural language processing

1. INTRODUCTION

Micro blogging today has become a very popular communication tool among the Internet users. Millions of messages are appearing daily in popular websites that provide services for micro blogging such as Twitter, Tumblr, Facebook. Authors of those messages write about their life, share opinions on variety of topics and discuss current issues. Such data can be efficiently used for marketing or social studies (e.g., Pak, A. and Paroubek, P., 2010).

Through these opinions, we can extract information about the product, that we are interested in and numerate reputation of product. Knowing the reputation is very important for marketing analyzer because they enhance the public's view of product by analyzing extracted reputation. In the past, market analyzer conducted manual survey to find reputation of product. However, manual survey not only costs high but also requires lots of labor.

The purpose of our study is to extract opinion from micro blog automatically and to summarize extracted opinions to provide reputation of product in which we are interested (Fig. 1). In this paper, we propose a method to extract sentiment automatically from a tweet, which are the Twitter user's status messages. Many companies want to analyze their customer satisfaction, thus we apply our method to a "negative" and "others" (positive and objective tweets) classification task of tweets. We assume that "negative" tweets can be more informative, so merchandise department can use it to gather critical feedback about problems in newly released products.

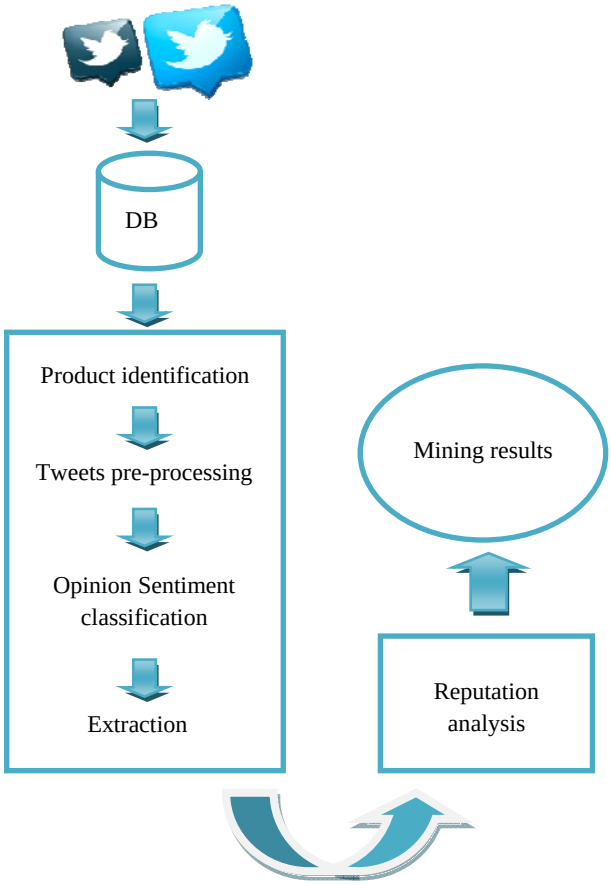

Figure 1. Proposed System

2. EXISTING STUDY

Multiple papers have been published on sentiment analysis. Many of them have also explored using Twitter as their primary source of data.

Earlier works on sentiment analysis uses the traditional text classification methods on normal text forms like movie reviews. Pang and Lee (Pang, B. et al., 2002) present a comprehensive comparison of machine learning algorithms in a fairly narrow domain of film reviews. Starting from being a document level classification task it has been handled at the sentence level (Hu, M. and Liu, B., 2004) and more recently at the phrase level (Wilson, T. et al., 2005). These methods are mainly fully supervised (e.g., Jansen, B. J. et al. 2009) which uses manually labeled data to train the classifier. Recently, distantly supervised methods (Go, A. et al., 2009), as using emoticons as noisy labels, and integration of these two methods (Liu, K.-L. et al., 2012) into the same learning framework were proposed. In the work of Agarwal (Agarwal, A. et al., 2011) they are examine sentiment analysis on Twitter by conducting experiment with unigram model, a feature based model and a tree kernel based model.

In our work, we will pay attention to the most important pre-processing step before training the classifier. Emoticons, which can give us a lot of information about text sentiment are usually ignored or stripped as noisy label. Thus, we believe that, by using emoticons in text sentiment classification we can get high accuracy in performance of our classifier.

3. APPROACH

Our approach is to use Naïve Bayes machine learning classifier for sentiment classification. First, we present how we collect data for training set and test set. Then, we propose a very effective and efficient way of tweets pre-processing. Finally, we will present the results of experiments.

3.1 Data Gathering

In this work for tweets collection, Twitter API (http://dev.twitter.com/) was used. Twitter is an information network and communication mechanism that produces more than 300 million tweets a day (Liu, K.-L. et al., 2012). The Twitter platform offers access to that corpus of data, via APIs. The Twitter API supports searching tweets pertaining to a query, thus we can obtain a large training set.

In this study, to collect data for each class (negative and others, as for "others" class we use positive+neutral/objective tweets), positive ("☺") and negative ("☹") emoticons were used. As for neutral/objective tweets, spam or commercial tweets about product or service were considered as objective. We also make an assumption, that most of positive tweets toward product or service must contain positive expression words, like "good", "great", "amazing", when words like "bad", "awful" describes negative feelings. Thus, we increased our training set with tweets, which contains feeling descriptive words (http://ja.scribd.com/doc/48820833/Personality-Adjectives).

3.2 Data Pre-Processing

Twitter users are much more likely to have grammatical/spelling errors, colloquialisms, and slang incorporated into their output, due to the 140 character limit that is imposed on users. As a result, regular expression matching of common errors and substituting with standard language is necessary.

In this study we introduce new resources for pre-processing twitter data.

1. We replaced all emoticons with their sentiment polarity by looking up to the emoticon dictionary (http://en.wikipedia.org/wiki/List_of_emoticons). In Table 1, we show some of emoticons with its replacing pattern.
2. Non-informative Twitter usernames, URL links and hashtags were stripped from the tweets.
3. We build an acronym dictionary, to replace acronyms as OMG ("*Oh My God*"), LOL ("*Laughing Out Loud*"), ILU ("*I Love You*") and etc. with their expanded forms.
4. Stop words list (http://norm.al/2009/04/14/list-of-english-stop-words/) was used to remove all non-informative stop words.
5. Emotions identifier as *wow*, *awww*, *xxx* (*"many kisses"*) or *kkkkk* (*giggling*) and laugher as hahaha, *hehehe*, *jajaja* and *ahahaha* also were replaced with their sentiment polarity.
6. All tweets were lowercased.
7. All digits and unnecessary punctuation were removed.
8. Repeated letters as yeeeees, yahooooo, looooove were also removed.
9. We ignored all Non-ASCII characters.
10. All doubled tweets and re-tweets were removed.

Table 1. Example of emoticons to be replaced using emoticon dictionary

Emoticons	Meaning
>>.<<, -_-, -.-	[troubled]
<3	[heart]
^3^, :*,=*	[kisses]
^_^, ^^	[happy]
;_;, T.T	[crying]
>3	[hate, angry]

3.3 Opinion Sentiment Classification

The Naïve Bayes method for classification is often used in text classification due to its speed and simplicity. It makes the assumption that words are generated independently of word position. For a given set of classes, it estimates the probability of a class c^*, given a document *d*, with terms *t*, as

$$c^* = \arg\max_c P(c \mid d),$$

$$P(c \mid d) = \frac{P(c)}{P(d)} \prod_k P(t_k \mid c).$$

Parameters $P(c)$ and $P(t_k \mid c)$ are obtained through maximum likelihood estimates (MLE). The classifier then returns the class with the highest probability given the document.

4. EXPERIMENT AND RESULTS

Our experiment was conducted by gathering large amount of tweets using Twitter Stream API (from October-December, 2012), to be used as training, validation, and testing data. For the training set, data were collected by querying Twitter API for two types of emoticons:

- Smiley emoticon
- Frowny emoticon

Also, emoticon corpus from Go, A. et al. (2009) were used additionally to our training set.

For the neutral dataset, objective tweets with no sentiment or tweets with spam context were considered as neutral. The collected dataset was used to extract features, which will be used to train our sentiment classifier. The product reputation was estimated by analysing the output result of classifier within given product name. For test data, tweets mentioning service, mobile phones, video game console, OS and popular music was used (Table 2).

As in the paper by Liu, K.-L. et al. (2012), we adopt accuracy and F-score as our evaluation metrics. Accuracy is a measure of what percentage of test data are correctly predicted, and F-score is computed by combining precision and recall. The results of the evaluation are shown in Table 3.

Table 2. Test data

Product/service	Number of tweets
AirAsia	196
WiiU	146
Galaxy S III	168
Windows8	168
iPhone5	210
Psy/Gangnam Style	123

Table 3. Classifier accuracy and F-score for two way classification task

Product/service	Accuracy	F-Score	
		Negative	Others (Positive and objective)
AirAsia	81.1%	64%	87.2%
WiiU	87.6%	57.1%	92.8%
Galaxy S III	72.6%	41%	82.2%
Windows8	83.3%	53.3%	89.8%
iPhone5	72.8%	42.4%	82.2%
Psy/Gangnam Style	87%	57.9%	92.3%

From the results we can say that our proposed method with more concentration on the pre-processing step, as using emoticons, acronyms and etc. is practicable, especially in case with objective tweets during its difficulty in classification.

Sentiment classification toward product is the challenging one. Let's have a look for the tweet, mentioning recently released iPhone5: "*i have to admit im a little jealous of robbies iphone5 :-(*". In common, it is negative tweet, but from the point of Apple Inc. it is positive tweet which tells, that their product is highly demanded.

5. CONCLUSION

Micro blogging nowadays became one of the major types of the communication. A recent research has identified it as online word-of-mouth branding (Jansen, B. J. et al., 2009). The large amount on information contained in micro blogging websites makes them an attractive source of data for opinion mining and sentiment analysis.

This study investigates how product reputation can be automatically extracted from famous Twitter micro blogging service. We have proposed an approach based on opinion sentiment classification. We used the collected corpus to train a sentiment classifier. Our classifier should be able to determine positive, negative and neutral sentiment from tweets and estimate the reputation of given product for the certain period of time.

As for the future work, we plan to collect data with detection of fake twitter accounts, to prevent fake reputation of product/service and make improvements in our approach to get high reputation accuracy.

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AUTONOMIC GOVERNMENT KNOWLEDGE BASE

Stainam Brandao[1], Sergio Assis Rodrigues[1], Tiago Silva[1], Luis Araujo[2] and Jano M. Souza[1,3]
[1]*COPPE/UFRJ - Computer Science Department, Graduate School of Engineering, Federal University of Rio de Janeiro, Brazil*
**Fundao Island - Center of Technology*
Office: H-307 - PO Box: 68.511, ZIP: 21.941-972 - Rio de Janeiro, RJ – Brazil
[2]*Brazilian Department of the Treasury, Brasilia, Brazil*
Esplanada dos Ministérios, ZIP: 70.040-906 - Brasília/DF – Brazil
[3]*DCC-IM/UFRJ - Computer Science Department, Mathematics Institute, Federal University of Rio de Janeiro, Brazil **

ABSTRACT

Currently, ontologies are widely used in the Semantic Web, Semantic Grid and Linked Data initiative. However, the success of its use is intrinsically related to increasing need for development and maintenance of domain ontologies. The paper summarizes the governmental knowledge base constructed from Brazilian laws and how it is linked and management by domain ontologies through the autonomic computing paradigm. This knowledge base is being one more effort compromised in Open Government Partnership (OGP, 2012) to reflect the country's commitment to strengthen the transparency of government action. The autonomic ontology characteristic was obtained through architecture that treats it as knowledge represented that requires a management system to monitor known events and execute specified actions on undesirable scenarios. This system is used by the Secretary of Federal Treasury and presents a primary founded basis for checking the accuracy and validity of the decrees in a Federal Budget domain.

KEYWORDS

Government Knowledge Base, Ontology, Autonomic Computing.

1. INTRODUCTION

According to (Breitman, K. et al., 2012.), to guarantee Open Government Data integration at a global level, it is necessary to promote the use of standard RDF vocabularies. Adequate tooling is thus necessary during the triplification process to help users map local concepts to existing RDF vocabularies used by other datasets in the LOD Cloud.

(Bugiotti, F. et al., 2012) assert that the amount of available RDF data sources on the Web increases rapidly and there is a constant need for scalable RDF data management tools.

(Garcí-a-silva, A. et al., 2012) tackles that classification schemes, such as thesauri or taxonomies, are generally created and maintained by controlled user groups. Recently, several methods have been proposed for managing ontologies and knowledge bases. But as described below, they act in specific activities of ontology engineering.

Our proposal includes the assessment phase and applies the contribution within knowledge bases that use domain ontologies as semantic resources. In this paper, autonomic ontology are the domain ontologies with active rules that deal with the actions on the configuration, healing, protection and optimization of the ontology. Furthermore, the monitoring strategy occurs through defined rules with metrics used as guard expression. Actions associated with the events identified by the rules start the process of ontology maintenance.

2. CONCEPTS AND RELATED TECHNOLOGIES

(Sacramento, E.R. et al., 2012) defines and relates ontology, knowledge base and data sources such as used within this research:

(a) An ontology is a pair O=(V,S) such that
(i) V is a finite alphabet, the vocabulary of O, whose atomic concepts and atomic roles are called the classes and properties of O, respectively;
(ii) S is a finite set of inclusions in V, the constraints of O. The constraints (or Axioms) capture the semantics of the terms.
(b) A knowledge base is a triple KB=(V,S,A) such that
(i) (V,S) is an ontology;
(ii) A is a finite set of assertions in V.
(c) A data source is a pair DS=(V,A) such that
(i) V is a finite alphabet;
(ii) A is a finite set of assertions in V.

Within this work, ontology, knowledge base and data sources are used carefully, due to their widely use in the Semantic Web, Semantic Grid and the Linked Data initiative.

According to (Suárez-Figueroa, M.C. et al., 2011), methodology for building ontologies mainly includes guidelines for single ontology construction ranging from ontology specification to ontology implementation. While NeOn Methodology, suggests pathways and activities for a variety of scenarios; METHONTOLOGY, On-To-Knowledge and DILIGENT are the most referred methodologies for building ontologies and prescribe a rigid workflow.

(Slimani, S., Baïna, S. & Baïna, K., 2011) describe about distributed ontology evolution approaches. Also, the complexity of ontology change management increases, especially if the services ontologies are heterogeneous (like dynamic environments like Semantic service architecture - SSOA). The approach take into account some constraints: (1) Ontologies must be autonomous and communicate with each other in reactive way. (2) Not all changes should be managed: there are some changes, which are not interesting to manage because they not affect the interconnection between ontologies. (3) Ontology should receive just changes that affect the mapping with its interconnected ontologies. (4) To have well understanding of changes. Changes will be translated according to the mapping between ontologies. (5) Mapping is a charred resource between two ontologies. So, access to this resource can generate conflicts.

According to (Albuquerque, F. da C. et al., 2012), a proactive application advocates a paradigm shift from human-centered to human-supervised computation. In their perspective, a system to be proactive must: (1) have a direct connection with the real world; (2) be able to execute actions in response to external stimuli; (3) execute actions faster than the human response. In other words, a system with proactive behavior must detect interesting situations before they happen and must be able to handle such situations without human supervision. For this, (Calhau, R.F. & de Almeida Falbo, R., 2012) applies technical and administrative procedures for developing, producing and supporting the life cycle of a product to control product evolution.

3. ONTONOMIC: DOMAINS ONTOLOGIES WITH AUTONOMIC CARACTERISTICS

According to (Fuad & Oudshoorn 2007), autonomic elements are the heart of an autonomic system. The autonomic elements have a control loop that regulates the workflow of different sub-components of an autonomic system.

The autonomic computing paradigm uses actions and predefined rules to lead a new ontology configuration, where the autonomic characteristics of configuration (C) acts on ontology for normalization, mapping and alignment to other existing ontologies. Besides, healing actions treat undesirable scenarios during the autonomic evolution. Likewise, ontology instances require actions and rules to address issues related to protection. Also, ontology querying indicates the need for treatment optimization in scenarios that compromise the service quality offered by the ontology.

The autonomic project developed by (Nami, M.R. & Bertels, K., 2007) defines the following components:

- Autonomic Element (AE): basic block of autonomic system, where its interaction with other AE produces the self-managing behavior;
- Managed Element (ME): resource with it behavior controlled;
- Autonomic Manager (AM): component that monitors and controls the ME.

Within our approach, each Managed Element (ME) is autonomic domain ontology and the Autonomic Manager (AM) is the meta-knowledge describing the workflow with its specified active rules that are the policies defined by the ontologist.

According to (Hovy 2005), ontologies are better accepted by traditional critics only if at least two conditions are addressed: well-founded methodologies for construction and evaluation and, if ontologies prove its usefulness in real applications. Our proposal contemplates the assessment phase by monitoring ontology metrics and applies its contribution within governmental knowledge bases that use the domain ontology as a semantic resource. Our approach makes use of autonomic computing paradigm to achieve accuracy in the evaluation and ontology management, removing the ontologist procedure details.

Firstly, the monitoring aims to guarantee the ontology quality with evaluation as an activity of their whole life cycle. This goal is addressed in two scenarios: knowledge base and ontology querying.

Then, we define autonomic ontologies as domain ontologies that obey active rules that deal with the special actions on the ontology behavior and their knowledge bases. Accordingly, the actions are related to configuration, healing, protection and optimization of the ontology (Self-CHOP).

3.1 Autonomic Actions

Autonomic Action is any algorithm developed under autonomic computing paradigm that acts upon domain ontologies after an event identified in order to generate a new configuration, healing, protection or optimization. In this short paper, we present the first autonomic action already implemented and evaluated through the case study present below.

Balance Semantic action includes or maps concept to an unbalanced sub-graph through common instances between the sub-graph concepts and concepts from other ontologies. The advantage is to guarantee ontologies mapping, since the common instance ratifies the semantic relation between the concepts involved. Thus, the apporach aims to cure the ontology in a coordinated and orderly way to avoid unexpected / unwanted result, maintaining consistency based on metrics already established in the literature.

3.1.1 Model

As the structure taxonomic metrics evaluate the ontology quality structure, the guard expressions use the Width and Depth metrics to identify a sub-graph that reaches a value not desirable by ontologist.

This action treat the cure of sub-graph by mapping concepts with common instances. When the guard expression is triggered, the instances associated with the sub-graph concepts are used as input for the re-design of the unbalance sub-graph through the following algorithm:

1) Identification of the sub-graph;

2) Sub-graph Analysis:

a) Iff Sub-graph has reached a non-acceptable value for the width (FIGURE 1), then cure action will be vertical with the identification of 'NEW concepts' with semantic relation with child classes of the sub-graph;

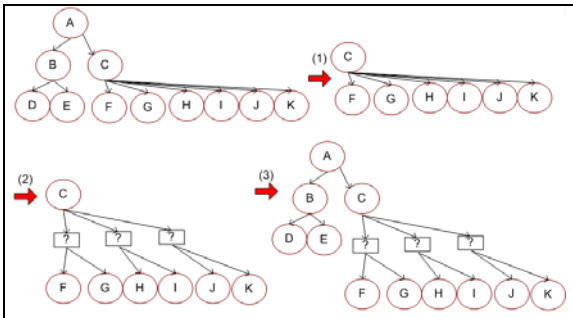

Figure 1. Semantic Vertical Balancing Strategy

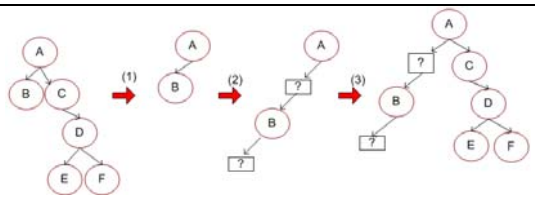

Figure 2. Semantic Horizontal Balancing Strategy

3) Iff the sub-graph reached a non-acceptable for depht (FIGURE 2), then the cure will occur with the concept inclusion on leaf of the sub-graph, in the most perfect, between a father-class and child-class, expanding vertically ontology.

4) Retrieve the sub-graph instances;

5) For each instance:

6) Check if the resource (identify by rdf:resource) is referenced by other instances, even if in other ontologies;

7) Check if the concept type is different between instances identified in the previous step;

8) Check the existence of a common concept between the concept type of instances;

9) Create a semantic relationship between the concepts identified in the previous step;

4. CASE STUDY

The Managed Element (ME) monitors domain ontologies through ontology metrics in the form of Jess production rules (JESS, 2012) and implements the workflow transition conditions of each ontology management. The ontology is registered as a Web service, which the desirable values are filling by ontologist. At this moment begins the self-management.

This section presents a brief case study to demonstrate how the architecture works. The case came from Secretary of Federal Treasury responsible for control and oversight of federal spending in accordance with the legislation, case law and administrative acts. The Knowledge Organizational System - SIOP-LEGIS (Brandao, S.N. et al., 2011A) is a project that aims to provide knowledge management for legislative domain through changeable representation, which deal trends in the law. The system represent the knowledge from Official Gazette, allowing to answer questions that were required during the monitoring, auditing and oversight. This knowledge base is linked to other Brazilian Open Data and being one more effort compromised in Open Government Partnership (OGP, 2012) to reflects the country's commitment to strengthen the transparency of government action, to prevent and combat corruption.

The governament knowledge base is constructed from Brazilian laws, the events that surround them and authorities responsible for these. The knowledge base is built on RDF language through the Brazilian Official Gazette, which is the access for official information (Brandao, S.N. et al., 2011A).

The initial study was done with two different ontologies: Social Security and Legislative domain (Chamber of Deputies, 2012). The first ontololgy has a overload concept called 'Law'. While, Legislative ontology used by Chamber of Deputies treat specifically the federal law documents with other 14 concepts.

Whilst, for Social Security domain is not necessary to detail the 'Law' concept, given the undesirable scenario, the treatment is the fragmentation of the concept. Given the need to deal with the overloaded concept 'Law' on Social Security ontology, which reference the same official documents of Legislative ontology, then the first cAm import the child-concepts of Legislative ontology, which more specific types allowing treat overload 'Law' concept in the Social Security ontology.

5. CONCLUSIONS

The SIOP-LEGIS (Brandao, S.N. et al., 2011A) project is part of Presidency and Federal Budget Secretary initiative to provide information for society. In addition, linked and interoperable open knowledge base, the proposal allows the development of tools to read the data provided by own government..

In general terms, the methodology presents as main advantages: (i) the semi-automation process of domain ontologies managment, minimizing human intervention, (ii) greater dynamics, due to knowledge base is constantly updated and consequently under failures, although the control monitoring ontology metrics. thereby, if an undesirable scenario occurs, the proposal allows a new configuration, healing, optimization or protection. Even to return to a previous version of the domain ontology.

The first suggestion as future work is to create a workflow with actions containing priority, treatment of infinite loop and treatment of undesirable behavior and scenarios.

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EXTRACTING AND VISUALIZING PEOPLE'S NEEDS AND TOPIC TRENDS FROM USERS' COMMENTS ON VIDEO STREAMING SITES OR BLOG POSTS

David Ramamonjisoa, Tatsuya Suzuki and Basabi Chakraborty
Faculty of Software and Information Science, IPU
152-52 Sugo Takizawa Iwate, Japan

ABSTRACT

This paper describes a method and prototype deployment for extracting people's needs from social blogs or by analyzing trends in social media. Case studies presented in this paper include (1) video comments from a streaming site in Japan for a week in March 2011 during the TEPCO Fukushima accident and (2) the SAVE IWATE blog where people from the region Iwate in northern Japan were able to post their needs and comments relating to their daily life after the Great Tohoku Earthquake in 2011.

KEYWORDS

Text data mining, blogs and comments topic analysis.

1. INTRODUCTION

Analyzing dynamically evolving textual data is a task for social knowledge and information management. Thanks to the rapid and exponential growth of social sites in the last few years, this need has suddenly arisen and taken on dramatic urgency. Live video streaming sites, Twitter, Facebook, and blog sites such as USTREAM and NICOVIDEO in Japan, allow users to post comments in real-time, accumulating an important amount of social data on these platforms. A social knowledge task gathers and records the concerns of people and problems following an event. These concerns may consist of the general trends or needs of individuals or groups participating in video comments or blog articles. Generally, this task is performed manually by collectors and poll media staff to devise business marketing strategies or political and social action. This is because users' comments can produce a new consensus among users and this consensus has a bearing on users' thoughts. Thanks to text mining techniques, topic trends or users' needs can be analyzed and summarized autonomously.

This paper describes an experiment to replace a human with intelligent systems to perform the task (or part of it) for him. Intelligent systems have a natural language processing capacity, a feature extraction module, text mining techniques for co-occurrence, topics extraction function, pattern-matching of social concerns according to a social pattern database, and a temporal change of focuses on a problem.

In this paper, we will first present the methods used during the experiment and the datasets. Next, we will detail the experiments and discuss the results obtained. Finally, we will draw conclusions and discuss future work.

2. APPROACHES

The general architecture of the system is depicted in the flowchart in Fig. 1. The data model for the experiments is described as follows:

Users' comments or blog posts are designated as document collections. The model of the document collection is described below:

$D = \{d_i\}$ *where* $d_i = (docID, day\ or\ month, title_i, content_i)$

A natural language processing (NLP) task was processed to extract important keywords such as nouns or adjectives from the $content_i$ of each d_i. A bag-of-word model was constructed by attaching a weight to the extracted words. A weight may be just the frequency of a term, *tfidf* [Salton,G. et McGill, M.J.,1986] or *LSA* [Landauer, T. K. and Dumais, S., 2008] results. The content of the document is then a set of tuple keywords and weights as follows:

$content_i = \{(k_{ij}, w_{ij})\}\ j \in [1..n], n: \text{number_of_keywords_in_the_content}, w_{ij} > \tau(\text{threshold})$

A document collection is therefore a table where rows consist of the weights of each keyword in each document and columns list the documents. This document list is arranged as time-series data so that old posts and comments are the first element of the list and the newest comments and posts are the last. The document table is formalized as follows:

$D^T = [content_i(row) \times d_i(column)]\ i \in [1..m], m: \text{number of documents in the collection}$

Next, topic extraction and graph analysis programs based on text mining techniques and data analysis algorithms with visualization tools were executed to build a visual output for the end user. This process outputs the top *n* keywords, charts, or graphs representing topics or trends during a given period.

Related research on Twitter analysis is described in [Yang, S. and Kavanaugh, A. L.,2011].

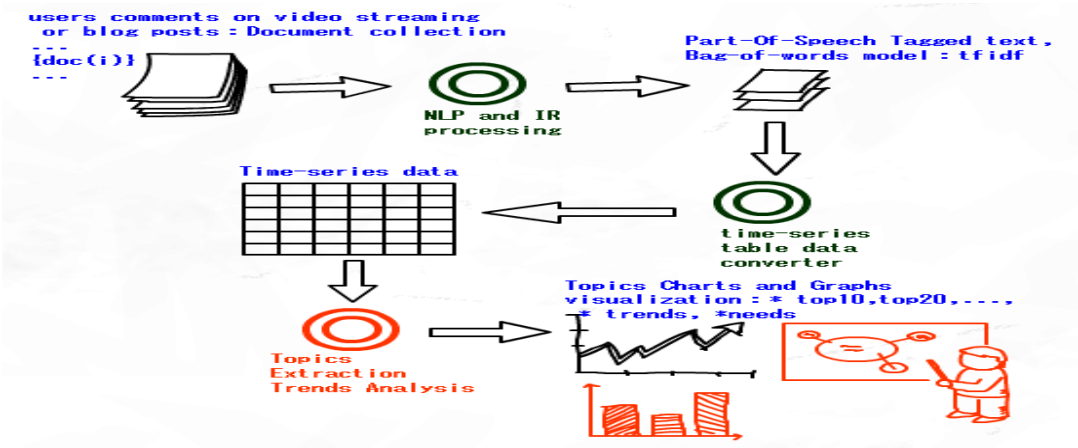

Figure 1. System Architecture

The next section describes the method used for the extraction of topics.

3. TOPICS EXTRACTION AND ANALYSIS ALGORITHMS

Table 1. Procedure for Extracting Topics and Analyzing Topic Trends

1. We assume that the documents are gathered together and that we do not need to crawl the web or process raw html data. $D = \{d_i\}$ is given.
2. Build the document table D_1^T by setting the weight as a term frequency $w_{ij} = tf_{ij}$
3. Remove high and low frequency words and predefined stopwords in a list (slang used in video stream comments or specific terms in blogs such as single character terms)
4. Plot keywords representing the top n keywords according to their weight. This figure represents the general topics of the documents.
5. Rebuild the document table D_2^T by changing the weight *tfidf* $w_{ij} = tf_{ij} \times idf_i$
6. Plot charts representing the Top n keywords according to their weight. This figure depicts topics varying along the interval of days or months and shows rare topics within the collection.
7. Calculate the correlation between keywords over the timeline, and extract keywords that exceed the threshold
8. Search for the co-occurrence of words of a keyword within the document using a Dice or Jaccard coefficient measure. Temporal changes on focused topics can be traced.

The algorithm in Table 2 is a modified version of the one proposed by Fukuhara et al. which they used for the analysis of weblog articles [Fukuhara, T. et al., 2007].

Table 2. Algorithm for Finding Daily or Monthly Topics

Let **DM** be the set of days or months. If we want to know about topics during Q days or months, **DM = {dm_1, dm_2, ... ,dm_Q}**
Let **W** be the set of words that have appeared through Q days or months. If we seek P words during Q days or months, **W = {w_1, w_2, ..., w_P}**

For each w_i ($1 \leq i \leq P$) in **W**, repeat as follows

For each dm_j ($1 \leq j \leq Q$) in **DM**, repeat as follows

1. Let cp_{ij} be the number of comments or posts containing w_i on dm_j
2. Calculate **sum(cp_i)**=$\sum_{j=1}^{Q} cp_{ij}$, max value: **max(cp_i)**, and SD(Standard Deviation)/average ratio: **sd(cp_i)/avg(cp_i)**
3. Print w_i as a topic word of day/month dm_j if (**sum(cp_i)** $\geq$ **th1**) and (**max(cp_i)** $\geq$ **th2**) and (**sd(cp_i)/avg(cp_i)** $\geq$ **th3**) where **th1**, **th2**, and **th3** are thresholds.

4. EXPERIMENTS

Our experiments were based on two datasets. The first dataset was obtained from previous research in [Hashimoto, T. et al., 2012]. The second was retrieved manually from the Iwate Banya Nippo website[1].

4.1 Dataset 1: Tokyo Electric Power Plant Accident Interview Comments

The first dataset is a collection of users' comments obtained from NICOVIDEO during live press conferences of the Tokyo Electric Power Company (TEPCO) between March 15th and March 20th, 2011. On average, there were 2400 comments a day and 14450 in total.

4.2 Dataset 2: Save Iwate Blog Posts

The second dataset is a collection of users' posts on a blog for the refugee camp or disaster area after the Tohoku Great Earthquake on March 11th, 2011. This blog enabled people to express their needs and report their concerns, so that the organization responsible for the site could understand their requirements and provide assistance. The site was also used to report social activity conducted by the organization in order to raise funds from readers. The website for the blog was called "SAVE IWATE" because it focused only on the disaster area of the Iwate prefecture. The collection has 700 posts from June, 2011 to December, 2012, which are categorized into various categories such as "voices from victims", "voices from inland evacuees", "voices from coastal residents", and "wanted to start support."

4.3 Experimental Environment

We used the Python programming language to code scripts for basic processing. We also used a ready-made text mining tool [Higuchi, K., 2012] to deal with topic extraction and trend analysis for steps 7-8 in the procedure described in Table 1, Section 3. Plots were obtained using the online tool Wordle [Feinberg, J. 2012], KHCoder plotter, and the Python graph library, NetworkX.

[1] SAVE IWATE BLOG: http://sviwatebanya.wordpress.com/

5. EXPERIMENTAL RESULTS

In this section, we present the results of our experiments.

5.1 Results from Dataset 1: TEPCO Accident Interview Comments

5.1.1 Output of Algorithm 1

The result of steps 1-4 for the procedure listed in Table 1 in Section 3 is a plot representing the general topics pertaining to document collection.

The result of steps 7-8 in Table 1 is a graph of co-occurrence network (see Fig. 2 (a)). The graph represents the topics within a single document where nodes are keywords and edges are co-occurrence values. The Jaccard coefficient value was set to 0.07 to filter the edges number. Only proper nouns, nouns, verbs, and adjectives were selected. A graph has several sub-graphs. The sub-graph is an event and represented by setting *community modularity* for groups of connected keywords in the network using a single color. The result plot is interesting because it relates the events and representative topics in the document.

For example, there was sand liquefaction in the Tokyo Disneyland area during this period after the earthquakes, and so the 'Disney' keyword shares an edge with 'liquid', 'Urayasu', and 'disaster'. Urayasu, the location of Disneyland, indeed experienced a power outage disaster.

5.1.2 Output of Algorithm in Table 2

Results were obtained from the algorithm in Table 2 as follows: we counted comments for each document in the set DM and computed the total comments for the set. We extracted the set of words in the DM as W. We removed stopwords and unnecessary characters. Overall, there were 513 words.

We set the value of each threshold to th1=70, th2=50, and th3=0.6 after several runs and different values to obtain a small number of topics for each day. After sorting the results in decreasing order according to the values of sum_doc and max_doc, we obtained the following results for the days 15 to 16 March (see Fig. 2 (b)). The value of the sd/avg ratio does not change for each word for all of the documents (days).

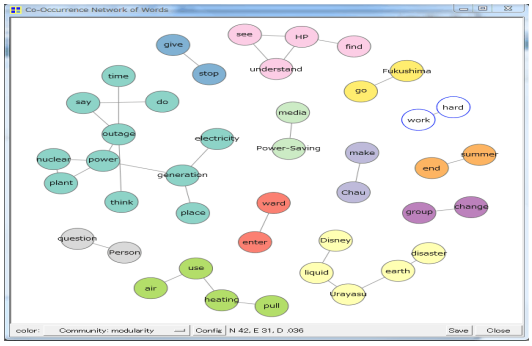

Figure 2 (a). Topic Graph Sample

Day 03-15:	Day 03-16:
Power outage,111,146,0.91	power outage,229.0,146.0,0.91
plan,84,128,0.6	plan,212.0,128.0,0.6
nuclear,70,117,0.65	nuclear,187.0,117.0,0.65
	good,181.0,131.0,0.62
	nuclear power,170.0,106.0,0.74
	nuclear power plant,152.0,92.0,0.84
	president,70.0,57.0,1.78

Figure 2 (b). Extracted Topics

The results of the algorithm in Table 2 confirm our finding from the process in Table 1. The topic trends for all days were *"power outage"*, *"plan"*, *"nuclear"*, *"nuclear power plant"*, and *"president."* We deliberately removed the word *"tepco"* because it was inherently the subject of the interview and the video stream.

The analysis clearly shows that during this period, only a few could imagine the Fukushima nuclear power plant melting down and the consequent long term effects. Therefore, the statistics on text data are not significant for this topic. A named entities extractor may prove to be efficient in locating these topics within the dataset. Manually, we discovered topics such as 'Chernobyl', 'Three miles', 'Caesium', 'Iodine', and 'Sievert' in the last phase of the document collection. Despite overseas panic, repatriation, and heated discussions, the people in Japan had been overwhelmed by successive events such as the power outage, and

the shortage of gas, energy, and food supplies. Therefore, the long term problem was excluded from community discussion during the interview with the TEPCO president.

The topic extraction results according to the algorithm in Table 2, and implemented using a Python script, were compared with the results of the algorithm in Table 1. We set the thresholds according to the document collection size. For example, for two documents (two days), as a set of 4000 comments and 500 keywords, we set th1, th2, and th3 to 5, 3, and 0.2, respectively, for a good size and quality of topics, enabling us to compare with the bag-of-words models where weights are set to *tf>5* and *tfidf>0.5* (i.e. top150).

5.2 Results from Dataset 2: SAVE IWATE Topics

The collection has on average 40 blog posts a month. Posts were categorized manually by the administrator. We disregarded those categories, arranged all posts chronologically, and divided them by month. We ran the procedure detailed in Section 3 for each month's data and drew charts of the top 50 keywords. An example plot of the top 50 keywords with the weight set as *tfidf* can be done easily. The document is labeled 'June 2011' as the starting point of the blog. During this period, disaster areas were full of rubble and victims needed basic life assistance (three meals a day, pans, cup noodles, maternity care). Lifelines were disrupted and people required assistance to meet certain basic needs. Organizations gathered donations from all over Japan and the 'Donation' keyword has the highest rank in the top 50. The distribution of goods is also relevant as is volunteer (staff) recruitment to assist victims. Kitchen tools like 'kettle' and 'pan', and goods such as battery, hat, mat, etc. are also among the top 50 keywords. Peoples' needs in the community were reflected in the blogs and were extracted by our system.

Another result of our experiment is the ability to extract the top n keywords from each category defined by the blog administrator, allowing him to verify and autonomously index the blog posts. We run the program for the category "wanted to start support subjects" for the entire period (18 months). Topics related to support for the elderly and reconstruction are apparently popular requests. The results reveal that some people were starting to seek funding for the reconstruction of homes but the government doesn't want them to build on the same place (coastal area) for future Tsunami prevention. A cluster of keywords [Banya – continue – support – you – more] has been found and it means that the SAVE IWATE organization is continuing to support.

The results of the algorithm in Table 2 for this dataset during the month June 2011 is presented in Fig. 3.

```
>>> f=open('topics_1106month_eng.txt')
>>> topics=[l.strip().split(',') for l in f]
>>> topTopics = [topics[l][0] for l in range(len(topics))]
>>> f.close()
>>> topTopics
['Goods', 'House', 'Home', 'Donations', 'Car', 'Goods', 'Informa
tion', 'Foot', 'Housing', 'Destination', 'Original 4', 'Town', '
Food', 'Shop', 'Supplies', 'Hat', 'Government', 'Local', 'Hand',
'Food', 'Next', 'Food', 'Children', 'Miso', 'Bank', 'Apartment',
'Home', 'Money', 'Personally', 'Rubble']
```

```
>>> Topics_ja_en
[('Goods', '物資'), ('House', '家'), ('Home', '宅'), ('Donations',
'義捐'), ('Car', '車'), ('Goods', '品'), ('Information', '情報'),
('Foot', '足'), ('Housing', '住宅'), ('Destination', '先'), ('Orig
inal 4', '元'), ('Town', '町'), ('Food', '食料'), ('Shop', '店'),
('Supplies', '用品'), ('Hat', '帽子'), ('Government', '行政'), ('L
ocal', '地元'), ('Hand', '手'), ('Food', '食糧'), ('Next', '隣'),
('Food', '食べ物'), ('Children', '子供'), ('Miso', '味噌'), ('Bank
', '銀行'), ('Apartment', 'アパート'), ('Home', '実家'), ('Money',
'金銭'), ('Personally', '個人'), ('Rubble', 'ガレキ')]
>>>
```

Figure 3. Top topics during the month June 2011 in Save Iwate blogs

The problem with the algorithm in Table 2 is that we have to run the program several times by adjusting the values of the thresholds (th1,th2,th3) in order to obtain representative topics for the document (month). For example, the results in Fig. 3 were obtained with very low thresholds (th1=3, th2= 2, th3=0.0). Unsurprisingly, the results are similar to that in algorithm 1 results.

Another experiment to be conducted is to extract compound nouns in the sentences as they are common in the Japanese language. We can work out the needs of people with more details such as "fan for summer", "hat for summer", "stove during the winter", "money distribution", "shops next home", "staple foods", and so on. We can define the patterns of people's needs according to the season, the time interval starting from June 2011 to December 2012. After one and a half years, our analysis shows that the majority of people tended to forget the situation and returned to a normal life of work, education, leisure activities (hobbies, sports, and amusements), and participation in social events (concerts, festivals, and parties).

6. CONCLUSIONS AND FUTURE WORK

We conducted two experiments for extracting and analyzing people's needs and topic trends from online social data in a time-series. Our researches on topics discovery and topic maps in the past [Ramamonjisoa, D, et al., 2001] [Ramamonjisoa, D., 2003] [Ramamonjisoa, D. and Tan T., 2011] have motivated us to pursue this text data mining research on time series data. We used natural language processing and text mining techniques to process the data and adapted algorithms for the task. Text mining techniques, such as bag-of-words, co-occurrence networks, and topic extraction based on statistical features show the same results as described by the algorithms in Table 1 and Table 2. We can dynamically visualize these topics during a given period using an animation of daily or monthly graphs of topics, and we achieved our goal of visualizing the needs of people by using topic graphs and topic clouds.

At the moment, we are analyzing data offline and so we cannot predict the evolution of a topic into the future. Topic transition discovery can be implemented in the future to autonomously discover the needs of people in blogs for a particular event and report them to administrators. An extension of the system using linked data such as Wikipedia or Wordnet [Medelyan, A., 2008] is possible for categorizing peoples' needs into defined and higher level class labels, thereby allowing abstract views for larger situations in the virtual community.

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KNOWLEDGE MANAGEMENT CHALLENGES FOR BULGARIAN ORGANISATIONS

Elissaveta Gourova[1] and Boyan Bontchev[2]
[1]*Assoc. Professor*
[2]*Professor*
Dep. of Software Engineering, Sofia University
125, Tzarigradsko shosse Blvd. blok 2, 1113 Sofia, Bulgaria

ABSTRACT

Knowledge management (KM) is a new scientific discipline based on the rapid changes in information and communication technologies (ICT). In the knowledge-based economy, knowledge has become a key resource and success factor. Subsequently KM has gained a special attention among academic and business community during the last decades. This paper presents the main results of a survey on KM carried out in Bulgarian organisations in 2012.

KEYWORDS

Knowledge management, small and medium enterprises, survey results.

1. INTRODUCTION

Contemporary global economy is very dynamic and uncertain, characterized by a high staff mobility, global competition and market volatility. Knowledge has gained a key role for ensuring high quality, efficiency and competitive advantages. Thus, acquiring new knowledge and effectively managing and using the existing one is an important condition for organisational growth. The efficient KM is considered as a key challenge for organisations world-wide. It comprises several activities focused on implementing corporate strategy and goals, and providing individuals timely with the knowledge resources that they.

Since its establishment each organisation continuously learns and develops its knowledge. However, many organisations do not take appropriate measures for its proper management as essential asset. A survey undertaken in 2006 in 7 European countries shows that small and medium enterprises (SMEs) are not ready for KM challenges (Gourova et al., 2007). Subsequently, in 2012 the survey was repeated among Bulgarian organisations in order to monitor the progress since 2006. This paper presents the survey methodology and provides an insight into the results obtained, as well as the KM challenges that Bulgarian organisations face.

2. KNOWLEDGE MANAGEMENT CHALLENGES FOR SME

In Europe, SMEs are considered as backbone of economic growth. EU policy takes special measures to support them to overcome the challenges of global competition, market volatility, and the present financial crises. The adoption of KM was driven by large organisations and consulting companies world-wide, which earlier recognized the need for KM in order to respond quickly to customers demands, create new markets, rapid develop new products and handle emergent technologies (Nunes et al., 2006). KM is recognized to be important for SMEs, as well, but it is making very slowly its way to them. One of the factors behind this is the insufficient awareness and understanding of KM among SMEs managers (Wong et al., 2004). Lack of vision, short-term planning, not sufficient technical expertise, lack of resources and methods to respond to the increasing customer expectations are also considered as serious barriers for KM in SMEs (Singh et al., 2008; Lefebre et al., 2007; Nunes et al., 2006). Even knowledge-intensive SMEs often do not recognize the importance of KM due to the fact that their owners or chief managers do not perceive KM as a business

critical function. As stated by (Handzic, 2004), the KM introduction in SMEs starts with building KM awareness, and after that goes on with determining KM goals, evaluating the available knowledge resources, and finally, implementing those KM solutions that have the best potential to add value to the organisation.

The results of a survey among 199 SMEs in 7 countries (Greece, Bulgaria, Cyprus, Germany, Ireland, Austria and Romania) carried out in 2006 highlighted some barriers for KM implementation in SMEs. The lack of KM champions was considered as one of the major challenges, followed by management resistance, lack of experience in senior management, and lack of financial resources. Generally, cultural and organisational barriers turned to be the major KM barriers in the different countries (Gourova et al., 2007). As indicated in (Lefebre et al., 2007) the main KM obstacles in SMEs include:

- *Time and priority* – managers often lack time and resources to focus on KM and the related processes for capturing, organising and sharing organisational knowledge;
- *Lack of management commitment* – managers focus on business processes and rarely support KM;
- *Fear to share knowledge* – managers are suspicious to share knowledge in order not to loose the company control and the competitive advantages;
- *Apathy about sharing knowledge* – the lack of management commitment is crucial for organisational culture and thus the staff motivation for sharing knowledge;
- *Lack of confidence and trust in consultant companies* – due to past negative experience with external consultants. However, without appropriate internal expertise, SMEs would hardly go for KM.

A number of preconditions exist which could facilitate the introduction of KM in SMEs. For example, SMEs have flatter structure and less management levels, more simple systems and procedures then large companies. At the same time, the organisational culture is easier to change and to adapt to KM needs as it depends normally on the attitude of the owner(s) of the company (Singh et al., 2008; McAdam et al., 2001). Despite all barriers, many reasons exist for launching KM initiatives in SMEs, e.g. costs reduction and revenues growth, loss of key personnel, inefficiency of information management (duplication of information), desire to improve employees knowledge and expertise, opportunities for innovation and development of employees skills. Other reasons such as KM initiatives in competitors (10%), loss of market opportunities, or difficulty to acquire and use market information are less motivating for the survey respondents. Obviously, the major motivators for KM are internal incentives and external factors hardly could influence KM projects (Gourova et al., 2007).

3. SURVEY METHODOLOGY

In 2012 was undertaken a survey among knowledge-intensive Bulgarian organisations with the objective to monitor KM trends and the changes since 2006. The main challenges to be studied included:

- *Awareness challenges:* Do organisations recognize KM as an important management tool? Do they see it as having benefits? Is the concept of KM understood by organisations?
- *Technology challenges:* Is technology required to implement KM within organisations? Are there basic standardized technology solutions which can currently assist the implementation of KM or is it essential for technology to be customised? What are the basic issues which should be considered when deciding on suitable technology? Is such technology readily available to organisations?
- *Organisational challenges:* Which is the impact of organisational culture on KM? Which are the biggest barriers to KM? Do organisations support knowledge processes, and knowledge sharing? Which are the future intentions for KM?
- *Individuals' challenges:* How knowledge is used by individuals? How are individuals affected by KM? How can they be prepared for, motivated and supported in implementing KM?

The questionnaire comprised a general section on respondents, and specialized sections on KM state-of-the-art. Most of the questions were closed-ended requiring assessment by the respondents on a 5-grades scale. Open-ended questions were generally avoided – their usage was needed only to give insight for the follow-up qualitative survey. The specialised sections of the survey were focused on:

- *Awareness of knowledge use within the organisation and organisational culture* – investigating categories of knowledge used; internal communication and knowledge sharing; importance of knowledge to staff categories; staff and leadership attitude to changes; availability of KM vision, strategy or plans; assessment of future knowledge requirements; staff motivation and rewarding, etc.

- *KM status* – knowledge processes; systems for documents management; duplication of knowledge; protection of intellectual assets; access to knowledge; usage of previous experience; training programs; ICT support of knowledge processes;
- *KM future* – motivation factors, barriers and responsibilities for KM; training needs in the area.

4. ANALYSIS OF SURVEY RESULTS

This section presents the main results of the survey carried out in Bulgarian organisations in 2012, and makes a comparison with the 2006 survey. The questionnaires of both surveys were answered by circa 40 respondents, 40% of them with less than 3 years, and 30% - with more then 9 years experience in the same organisation. The majority of them were general organisational staff (46%), 34% belong to middle management, and 15% - to senior managers. It is interesting to note that the highest value to knowledge is given by administrative staff, while operational and management staff does not value it so high, however, slightly more then in 2006 (Figure 1). This might be behind the low introduction of KM in SMEs.

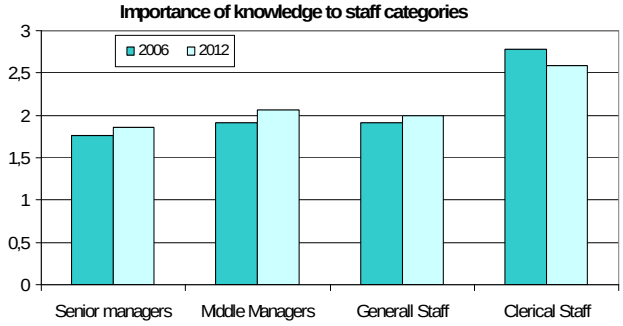

Figure 1. Importance of Knowledge to Staff Categories

Looking into the categories of knowledge valued in Bulgarian organisations (Figure 2), it is interesting to note that there is no major change since 2006. Actually, theoretical knowledge (know-what) still gas the highest importance, followed by the knowledge whom to ask for the required knowledge and expertise (know-who). While in 2006 the personal links to experts (know-who) were less essential, it seems that in 2012 they have higher value, whereas the importance of practical knowledge and skills (know-how) has decreased. The importance of theoretical knowledge could be linked to recent debates in ICT industries about required changes in educational programmes, especially at universities, focused on meeting demands for skills and competences of employees. On the other side, despite that the information overload of employees still is an issue, the application of more sophisticated searching tools and better knowledge organisation could explain the decreasing importance of finding faster qualitative knowledge (know-where).

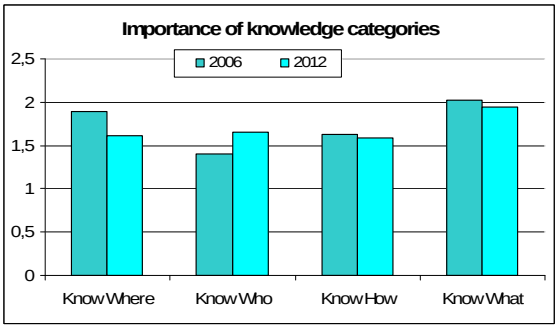

Figure 2. Importance of Categories of Knowledge

The importance of theoretical knowledge and formal education is a reason to increase the training courses offered by companies to their employees (Figure 3). Faces with increasing competition and market volatility,

organisation provide in 2012 more training linked to innovation management, ideas and knowledge generation, creativity and knowledge identification. It is interesting to note that training focused on knowledge sharing, networking and team work is rarely offered, taking into account that the new generation of computer savvy employees grows with Web 2.0 tools and is more open to sharing knowledge and networking with other peers then the previous one.

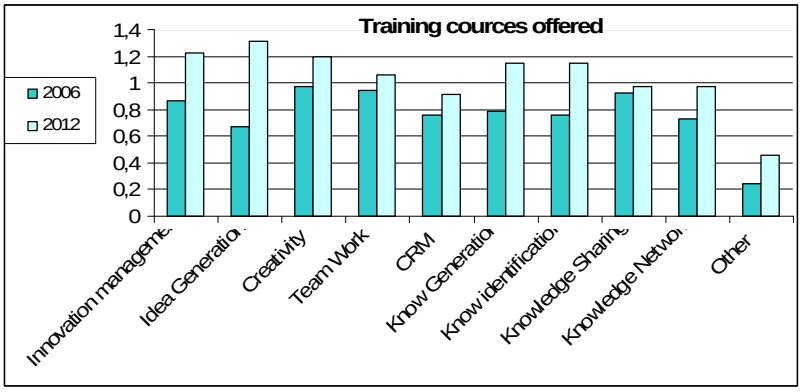

Figure 3. Training Courses Provided by Companies to Their Employees

Regarding recording and sharing of organisational knowledge the respondents of both surveys acknowledge its importance. It is essential for decreasing the duplication of work acknowledged as more significant in 2012 compared to 2006, as well as for the innovation processes in the organisation and better responding to customers demands. Subsequently, in 2012 companies pay higher attention to keeping lessons learned and documenting the experience of employees. It is not surprising, therefore, that in 2012 the vision on KM integration exists in more organisation (72%), and almost doubled since 2006. Thus, organisations have paid higher attention to KM tools and CRM systems since 2006 (Figure 4), and incorporating in them document management and groupware. E-learning tools usage has also slightly grown in SMEs practice.

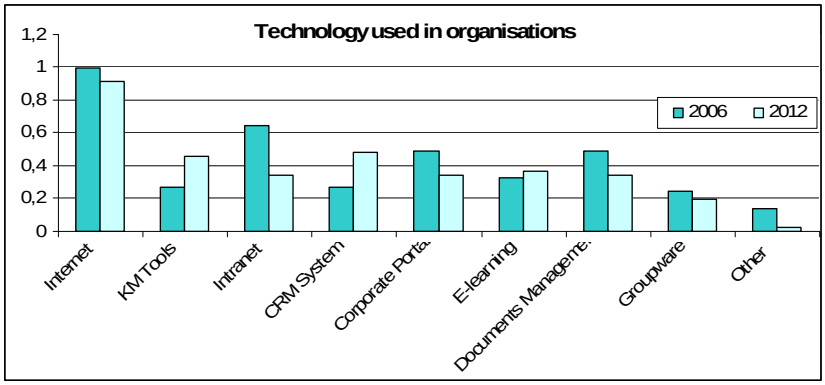

Figure 4. ICTs Used in Organisations

While generally the second survey shows greater awareness of knowledge importance for the organisations, some of the previous problems remain – linked to acquiring, organising and sharing of knowledge. The readiness to launch a KM initiative is further influenced by the general environment in Bulgaria – the financial crises and economic stagnation. On the other side, internal factors like growing debts of companies and lack of management capacity are still inhibiting investments in KM. Besides, the funding opportunities provided under Structural Funds in Bulgaria do not facilitate KM and innovation uptake.

5. CONCLUSION

The survey carried out in 2012 shows clearly a progress related to KM in Bulgarian organizations within the last 6 years. While the organizational and individual appreciation of knowledge as an essential resource for competitiveness and growth is increasing, the overall environment in Bulgaria for building a knowledge economy does not facilitate KM and knowledge transfer initiatives. The overall problem lays in the lack of synergy between the policies in the field of technological development, research and innovation and the poor linkages between the main policy making and funding bodies. On the other side, there is generally a weak change and strategic management capacity among SMEs, and a poor interest in investment in technology and business processes upgrade. The monitoring of e-business trends in Bulgaria shows wide differences between industry sectors, and according to the size and ownership of the company. Generally, SMEs are lagging behind in new technology adoption, except in the ICT sector which is a growth engine of economy.

Generally, enabling conditions for KM uptake are ICT skills. Individual commitment for ICT usage, group work, and intellectual and academic support in acquiring ICT skills could contribute to higher level of knowledge generation and communication. Therefore, a lot of efforts are made by the government to provide digital literacy at an early age, thus building computer labs, training teachers and providing Internet access in schools at all levels. The internet-savvy new generation is much eager for searching, sharing and using knowledge, which could contribute to KM uptake in Bulgaria.

The ICT adoption in enterprises raises the question whether small companies really need the same powerful solutions as large firms in order to derive an equivalent benefit. SMEs have profited enormously from the Internet, for example, simply by getting access to market information at low cost or by raising their own visibility, and of their own products and services. This has decreased the competitive disadvantage they used to suffer against larger companies. Besides, Web 2.0 presently provides great opportunities for SMEs to get knowledge from their environment, as well as to build easy-to-use and not cost intensive KM solutions.

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USING MARKERLESS AUGMENTED REALITY FOR REAL WORLD EDUTAINMENT

Takahide Sumikawa[1], Hiroyuki Mitsuhara[2], Keiji Miki[1], Jun Miyashita[1], Kazuhisa Iwaka[1] and Yasunori Kozuki[2]
[1]*Graduate School of Advanced Technology and Science, The University of Tokushima, JAPAN*
[2]*Institute of Technology and Science, The University of Tokushima, JAPAN*

ABSTRACT

Real World Edutainment (RWE) enables people to learn by viewing digital learning materials and interacting with real objects and human in the real world, based on a branched game story. We conducted a RWE-based evacuation drill as earthquake disaster prevention education. In the drill, however, the learning materials had some problems in terms of reality. Thus, this study aims at solving the problems by using markerless AR (Augmented Reality) that a virtual image (including animation) of earthquake damage is superimposed on the real-time video.

KEYWORDS

Edutainment, real world, evacuation drill, markerless AR, image processing

1. INTRODUCTION

Learning in the real world is effective in that learners can learn by hearing, seeing, touching, tasting, and smelling real things. Such learning is enhanced by mobile technologies (e.g., handheld devices, high-sensitive sensors, and high-speed wireless network) and often provided as mobile learning.

Nowadays it is said that learning in video game (virtual world) is also effective. Such learning is called "game-based learning" and realized as "edutainment" or "serious game". Edutainment is educational software which enables people to gain knowledge while playing video game and improves their learning motivation and understanding. For example, Sikiniotis et al. (2008) developed a card game based learning system where pupils learn binary numbers by playing a card game like Blackjack.

In this study, we focused on the fusion of mobile learning and game-based learning. There have been many game-based mobile learning systems. For example, "Environmental Detective", which works on a PDA with a GPS receiver, has a game story revolved in the real world and furnishes students with scientific argumentation skills.

We proposed Real World Edutainment (RWE for short) and developed an RWE system (Noda et al 2012). In RWE, a learner (or a learner group) can learn by viewing learning materials on a tablet PC and interacting with objects and human in the real world, based on a branched game story. The RWE system recognizes learning scenes (described in the game story) from his/her current location and direction (GPS) and real-object IDs (RFID), and then presents learning materials (e.g., video and single-choice quiz/question) associated with the recognized scenes. In addition, the system accesses the Internet through an equipped wireless network unit to store its logs (e.g., current location and selected answer to quiz/question) in a server (Miki et al. 2012).

We think that one of the learning topics well-enhanced by RWE is disaster prevention. This is because disasters occur in the real world and many people seem to be indifferent to disaster prevention. RWE can motivate people to learn disaster prevention in terms of "reality" absolute in the real world and "fun" provided by video game. We selected earthquake disaster prevention (EDP for short) as a learning topic for RWE because nowadays large earthquakes occur frequently all over the world (e.g., Tohoku Region Pacific Coast Earthquake on March 11, 2011 in Japan).

Although there are many things about EDP to learn from actual earthquake experience, a real earthquake is extremely dangerous. Therefore, RWE should provide the high reality of earthquake as learning materials,

but we have not yet realized it. To be more precise, the learning materials have been associated with the real world (e.g., locations) but independent of the real world in a visual aspect. To heighten the reality, we use AR (Augmented Reality) for learning material presentation in the RWE system.

2. RWE-BASED EVACUATION DRILL

We focused on "evacuation drill" in applying RWE to EDP. This is because evacuation drills are usually conducted in the real world and have a clear goal that participants have to reach a fixed evacuation site within a limited time. As learning materials in the drill, we created videos in the form of composite pictures that represented earthquake damages (Figure 1). We expected that such videos would provide the reality as learning materials for EDP and the students would think about appropriate evacuation behaviors more intuitively by comparing the videos (the virtual world) and their current view (the real world).



(a) Sudden rescue request (b) Ground liquefaction (c) A collapsed house

Figure 1. Examples of videos presented in the evacuation drill

We are not still satisfied with the reality provided by the videos, which were associated with the real world (locations), but not dynamically presented for the higher reality. In other words, the reality is insufficient in the static presentation of prefabricated videos which does not work with a learner's gaze direction. Therefore, we have to find another way to heighten the reality, thinking that the learning materials should be dynamically presented as if earthquake damages (e.g., ground liquefaction) are right in front of his/her eyes. The static video presentation based only on locations has the following specific problems.

(1) Lowering of reality caused by different directions

For example, when the prefabricated video of ground liquefaction (Figure 1-b) is presented at an intersection, a learner who is gazing at a different direction (i.e., different street) to the video's shooting direction cannot feel the reality of ground liquefaction. This is because he/she cannot properly compare the video and the real world. Therefore, we think that learning materials should be presented based on not only a learner's current location but also his/her gaze direction.

(2) Lowering of reality caused by unsynchronization

In Figure 1-c, for example, the whole shape of the collapsed house does not show up within the picture. When the learner looks up, the video should show the top of the collapsed house which was initially invisible. In the static video presentation, as a matter of course, there is not such a synchronization function. We think that this unsynchronization is one of the factors lowering the reality and learning materials should be presented in synchronization with a learner's gaze direction.

3. LEARNING MATERIAL PRESENTATION USING MARKERLESS AR

To heighten the realty of learning materials for EDP in RWE, we focused on AR (Augmented Reality). AR supports and enhances human activities by superimposing virtual objects (digital information such as texts and images) on the real world (the video captured in real time) based on a user's gaze direction. In this study, we aim at heightening the reality by linking the learning materials and the real world more closely with AR techniques.

3.1 Augmented Reality Techniques

From a technical perspective, AR is broadly separated into marker-based and markerless. In the former, a visual marker (fiducial marker) is used for visually-inartificial superimposing―position adjustment between the virtual object and the real world. There have been many learning support systems using a visual-marker AR technique. For example, an AR-based picture book superimposes digital objects (2D and 3D characters with sound effects) on a picture book and enables learners to interact with the digital objects (Taketa et al. 2007). Like this example, learning materials with high reality and interactivity can be provided.

In the marker-based AR, however, visual markers can be visible as artificial diagram patterns in the real-time video and intrinsically lowers the visual inartificiality. In addition, the visual markers must be prepared beforehand. Therefore, the markerless AR has appeared recently to heighten the visual inartificiality. For example, PTAM is a method of estimating camera pose in an unknown scene and can be used for building an AR workspace everywhere (Klein and Murray 2007).

3.2 Realization

The RWE system should adopt the markerless AR. This is because in addition to the visual inartificiality, it is difficult to set the visual markers at locations (learning scenes) in the real world beforehand.

A typical realization method of the markerless AR is to use GPS including an electronic compass. Recent mobile devices (e.g., smartphone) often have a GPS function and there have been mobile AR systems using this method using GPS and an acceleration sensor (e.g., Sekai Camera). GPS can recognize a user's current position and direction, but will not be able to recognize his/her current gaze direction. However, tablet PCs do not necessarily have such sensors.

Fortunately, almost all of the recent tablet PCs have a built-in web camera(s) and the users often look at the real world through the camera lens to take pictures and videos. Therefore, we aim at realizing a simple markerless AR by image processing of the real-time video captured from a tablet PC's rear camera.

3.2.1 Ideas

Our learning material presentation using markerless AR is realized through the following steps (Figure 2), which can heighten the reality of learning materials for EDP in RWE.

(1) A learner's gaze direction is recognized from a tablet PC's rear camera.

When the real-time video captured from the rear camera is presented on the tablet PC's screen, a learner will gaze at real-world objects through the real-time video. As a result, his/her gaze direction matches the camera's shooting direction. In other words, the real-time video can be identified as what he/she is gazing at.

Our idea is to recognize his/her gaze direction by calculating how much the real-time video (each frame) is similar to the pictures shot beforehand. If the calculated similarity is enough, he/she is judged to be gazing at a real object shown as a picture shot beforehand. This recognition is done after the GPS-based recognition of his/her current location.

(2) A virtual image of earthquake damage is superimposed on the real-time video.

The learning scene associated with the recognized gaze direction is recognized. Immediately after that, a virtual image of earthquake damage, which is associated with the recognized learning scene (his/her current location and gaze direction), is superimposed on the real-time video. The initial superimposing position of the virtual image is designated beforehand.

(3) The position of the virtual image is adjusted based on the relative change of the learner's gaze direction.

If the position of the virtual image is not synchronized with the learner's gaze direction, the reality will be lowered. To be more precise, if the superimposed virtual image does not stay at the apparent initial position when he/she moves the camera's shooting direction (his/her gaze direction), he/she will feel artificiality.

Our idea is to detect the relative change of the camera's shooting direction by calculating the motion vectors between two successive frames (images) in the real-time video and then adjust the position of the virtual image based on the motion vector. For example, when he/she looks up through the rear camera, the virtual image is moved downward to stay at the apparent initial position.

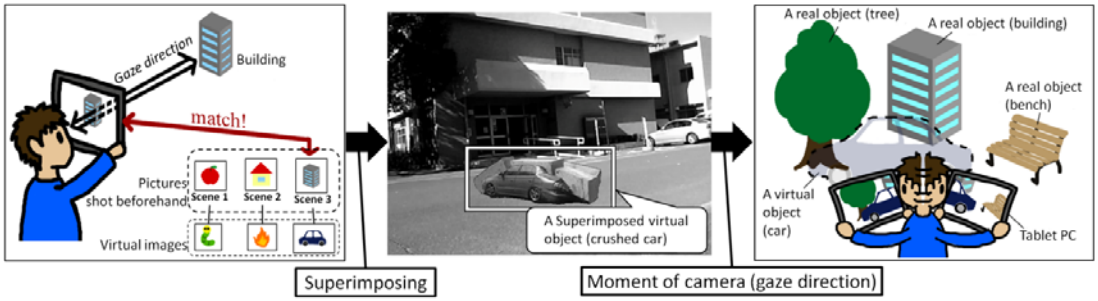

Figure 2. Process of our learning material presentation using markerless AR

3.2.2 Implementation

We implemented three functions for our learning material presentation (the above three steps), based on an open source library for image processing (OpenCV). Then, we integrated the functions into the RWE system.

(1) A learner's gaze direction is recognized from a tablet PC's rear camera.

To recognize a learner's gaze direction, the RWE system calculates SAD (Sum of Absolute Difference) defined by the following formula.

$$R_{SAD} = \sum_{j=0}^{N-1} \sum_{i=0}^{M-1} |I(i,j) - T(i,j)|$$

Here, $I(i, j)$, $T(i, j)$, M, and N mean the brightness of an image, the brightness of a comparative image, the common width of the two images, and the common height of the two image, respectively. SAD sums absolute differences of brightness per pixel between two images. Therefore, if the two images are the same, R_{SAD} (the calculated value of SAD) is zero. The more different the two images are, the greater R_{SAD} becomes.

The RWE system recognizes a learner's gaze direction (a learning scene) when R_{SAD} is less than a threshold. In the conditions of $M=640$ and $N=480$, the threshold is empirically set to about 26 million (indoors), or from 40 million to 45 million (outdoors).

(2) A virtual image of earthquake damage is superimposed on the real-time video.

The RWE system can superimpose background-transparent images including GIF animation on the real-time video.

(3) The position of the virtual image is adjusted based on the relative change of the learner's gaze direction.

To calculate the motion vectors between two successive frames in the real-time video, the RWE system uses the image processing method of optical flow. The specific procedure is shown as follows (Figure 3).

i. *Motion vectors of moving objects between the two frames are extracted by the Pyramidal Iterative Lucas-Kanade method.*
ii. *The average of the motion vectors is calculated—the relative change of the learner's gaze direction (the camera's movement) is calculated as the inverse vector of the average vector. This is because when the camera is moved, the almost all objects between the two frames will move to the same direction.*
iii. *The virtual image is moved by the average vector.*

When objects (e.g., person, bird, and car) cut across in front of the camera, motion vectors of the objects are remarkably extracted. In that case, the motion vectors affect the step (iii) inappropriately as noise vectors. In other words, the virtual image is moved by the motion vectors without the camera's movement. To clear this problem, on the presupposition that the motion vectors are extracted more by the camera's movement than as the noise vectors, the step (ii) is refined as follows.

- *The all motion vectors are classified into the long vectors and the short vectors through comparing with the average magnitude of the all motion vectors.*
- *The number of the motion vectors is counted in each of the two sets of the classified vectors.*
- *The set including more motion vectors is selected.*
- *The average vector is calculated from the motion vectors in the selected set.*
- *The virtual image is moved by the average vector.*

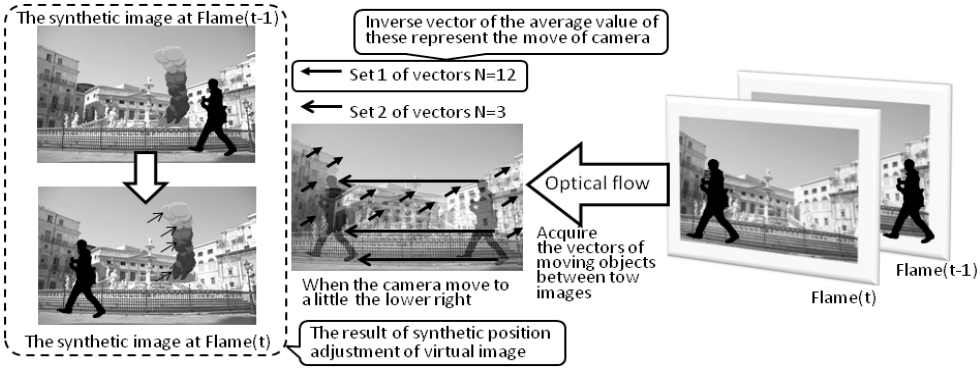

Figure 3. Overview of the movement (position adjustment) of a virtual image using optical flow

4. CONCLUSION

This paper described the RWE system that can present learning materials (background-transparent images) using markerless AR to heighten the reality for RWE-based EDP. We conducted a preliminary experiment and found out that the learning material presentation is somewhat usable, but has not yet obtained the high reality. Therefore, one of our future works is to heighten the reality by improving the functions. We expect that the improved functions will provide the following advantages of RWE-based EDP more surely.

- *Learners participate in EDP (evacuation drill) actively by AR's novelty.*
- *Learners imagine disasters in their living places easily and reinforce awareness of disaster prevention.*
- *Learners cultivate their judgment under difficult situations in disasters by being accustomed to think about the difficult situations.*

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THE VOYAGE OF THE DAWN TREADER – TURNING LEARNING TO M - ERA

Merja Meriläinen, Maarika Piispanen and Päivi Valli
Kokkola University Consortium Chydenius

ABSTRACT

Like in Narnia, a fantasy world of magic, today´s children will take a time travel to history every time they`ll enter the school buildings, classrooms and learning spaces. The school operation culture is still rooted in the Agrarian and Industrial ages, reflecting the educational needs of first-world nations in the 19th and 20th centuries. This is clearly seen, when entering most Finnish classrooms even today: straight lines of desks, students sitting alone in a row, teachers desk placed in front of the classroom, daily program split into four to five different lessons, etc.
One of the most significant current discussions in the field of education is the fact, that today´s students, as Prensky (2001, 2010) highlights, represent the first generation to grow up with a new technology. The rapid development outside the schools and the changing idea of learning calls for understanding of the new conception of learning. In school education, as Finnish National Plan for Educational Use of Information and Communications (2010) states, technology is still too focused on contents and knowledge based on command of facts as well as split into different branches. Education does not give enough room for solving authentic problems, multidisciplinary analysis, skills and the processes of doing things.
Recent research (Norrena, Kankaanranta &Nieminen 2011) argues that there has to be a significant pedagogical change in school routines and pedagogical operations to move teaching to learning and learning towards 21st century. So far, however, there has been little discussion about how this change will become true in Finnish school contexts –what are those pedagogical changes in the field of curriculum, planning and implementing as well as the roles of teachers and students? This research report will describe how the Contextual pedagogical approach to learning (Meriläinen, Piispanen 2012) will gather to gap between the society, children's everyday life outside the school and school to create a learning environment where everyone can learn from one´s individual basis honoring the informal learning skills the Y-generation can bring to formal learning.

KEYWORDS

Education, digital natives, Contextual Pedagogical Approach to learning, 21st Century learning, Teacher Education

1. MEETING 21ST CENTURY CHALLENGES

Today´s students are described to be anxious and ill-behaved in teaching and learning situations at school. In his earlier research, Tapscott (2009) defends this claim and describes them more open, broad-minded and less prejudiced than earlier generations which will cause chaos in rigid school system. These students has spent their entire lives surrounded by and using computers, videogames, digital music players, cell phones and latest tabloids –all the tools of digital age as Prensky (2001) remains us. We still believe that our students will learn the same way we use to –we use methods that were used when we were kids and we still believe they will work. According to Saine (2010), every third of Finnish comprehensive school student in year 2010 participate special education which was given at school during the school day. The number of special education need has grown rapidly in recent years –yet these children are able to learn enthusiastic in informal learning situations outside the school, concentrate on interesting learning areas, read blogs, hundreds of webpages, listen music and learn from videos. Is the gap between the formal and informal learning creating a generation who will drop out of the school system because they don´t fit in it?

The presentation is based on research project carried out in Finnish Teacher Education in Kokkola University Consortium Chydenius during the years 2012-2014. At this stage, research concentrates on framing and modeling the 21st century learning from curriculum to planning and implementing in Finnish

Primary School Teacher Education program as well as in Finnish Primary School Contexts during the practicums. The key questions are as follows:

- How can we support the educational and pedagogical change from traditional to transformational at the level of curriculum design?
- How is the curriculum used when moving learning from traditional to transformational?
- How is learning organized in transformational school context –from the teacher´s point of view and from the student´s point of view?
- How is modern ICT integrated in transformational learning?

With these questions we will explore what has to be done to ensure that the environments in which we work and learn become more challenging, engaging, relevant, supportive and experiential for our students and teacher to meet 21st century challenges.

The research foundation is based on O.E.D- model of transformational education. This model will help us to identify the central pillars of high-quality education and build a teacher education program to give pre-service teachers tools to move from traditional or transitional education towards 21st century transformational setting.

2. LEARNING IN AUTHENTIC CONTEXTS

2.1 Designing Curriculum to Meet the Challenges of a Changing World

Finnish National Core Curriculum is the national framework on the basis of which the local curriculum is formulated. According to National curriculum (2004) instruction may be separated into subjects or integrated. The objective for integration is to guide pupils in examining phenomena from the perspectives of different fields of knowledge, thereby elaborating themes and emphasizing general educational goals. In Finnish primary school teacher education –the curriculum is mainly separated in subjects –this is why teaching at primary schools is commonly very subject separated.

Media skills and communication is a cross-curricular theme in National curriculum. The aim is to improve skills in expression and interaction, to advance understanding of the media´s position and importance as well as to improve skills in using media. The school operation cultures are still more subject centered than integrated –even though the curriculum gives teachers the freedom to choose how to create learning situations at school.

Digital literacy is one of the key skills for learning in a modern world. It is time to find new ways to think how to use ICT as a tool for learning, instead of learning ICT itself as a subject or using modern tools to do the same things with new equipment as traditionally in school contexts.

In Kokkola University Consortium´s primary school teacher education program this issue has been recognized during the latest curriculum process. As Henry Ford quotes:”Coming together is a beginning; keeping together is progress; working together is success.” The curriculum renewing process came true in January 2012 – the subject centered curriculum was partly integrated transdisciplinary which has made it possible to negotiate the curriculum from the student´s interests and actual real life themes. When turning learning from subjects to investigating real life phenomenon already during the teacher studies, the school operation cultures will have a possibility to move towards transformational education when these students begin to work as teachers in primary school contexts. The use of ICT consist of everything from mobiles to Smart Boards will become a natural part of learning process. At this point we don´t spend time to think how to learn to teach for example Microsoft Word or Geocaching but how to use these tools for learning. The transdisciplinarity is a common thread from subject studies to practicum where the planning process begins with meeting the student´s interests about real life phenomenon.

2.2 From Subjects to Transdiciplinary –Phenomenon Based Learning Takes Place

As Drake and Burns (2004) states, in the transdisciplinary approach to integration, a teacher will organize curriculum around students' questions and concerns. The shift from standards of the disciplines, knowledge

based learning and one right answer culture to learning in real life contexts, many right answers and student´s questions allowing culture requires new ways to create student centered learning environments with the use of modern technology. The central challenge of the future pedagogies is the suitable use of the expanding learning processes and learning environments in general education, teaching and learning. The teachers' work and the development of teacher profession must be supported already during the studies so that one has ability and understanding to utilize different learning environments and modern tools easily and naturally in teaching and learning. Understanding the 21st century pedagogic and the knowledge and skills connected to it, are in a central part of the teachers professional development as Meriläinen and Piispanen (2012) argues in their report. In the phenomenon based approach, the reality is central instead of the doctrine contents and the welling problems from there. Instead of one discipline the examination is directed to the phenomena at transdisciplinary point of view. The learning is not restricted for the learning of one truth. With the dialogue between the curriculum and surrounding society, one will look for answers by thinking, by concluding and by examining – beginning to use collaborative ways of learning respecting the motivation, skills, earlier knowledge, interests and informal learning children have and will bring with them.

When examining the phenomenon based approach as Meriläinen & Piispanen (2012) highlights, it is not a question of a pedagogical method when using the concept "Phenomenon based approach". Within the phenomenon based approach to negotiating curriculum transdisciplinary, you naturally begin to use real world ways of doing things –when planning a summer horse camp as a ranch owner you can´t imagine to create a wonderful camp by sitting in a classroom alone, reading, writing and calculating things totally separated from each other. This is where the transdisciplinary way of reading curriculum comes into sight. When re-examining the curriculum from surrounding society´s point of views, negotiating curriculum from learner's interests and supporting learning in real life contexts, students will learn important lifelong learning skills as well as versatile ICT skills as a natural part of their learning.

2.3 Going Mobile –Contextual Pedagogical Approach to Learning in a Nutshell

If you look at students born in late 90s and early 2000, you can see a huge cap between the knowledge and skills students learn at school and the knowledge and skills they need in typical 21st century communities and work places. Today´s education system faces irrelevance unless we bridge the gap between how student live and how they learn. Moving from content knowledge to learning useful life skills is essential when training students to be successful in their lives after school.

Could the Contextual Pedagogical approach to learning (Meriläinen and Piispanen 2012) be a successful tool for teachers to move learning to meet the 21st century challenges? Could it help teachers to see the connections between the curriculum and real life more clearly and could the motivation and creativity among the students meet new levels when creating learning environments and learning tasks meaningful also from the students' point of views? According to Kauhanen and Lehtonen (2012, 57) the main characteristics or principles the teacher has to take into account in planning a contextual pedagogical learning process are as follows: interaction, collaboration, connecting phenomenon to curriculum (transdisciplinary approach to curriculum), opening the assessment criteria visible to students, making the learning process visible and connecting the new technology naturally to working. The Contextual pedagogical approach to learning as Meriläinen & Piispanen (2012) argues, connects teacher's pedagogical expertise and pupil knowledge to the content knowledge that will come from real life (outside the school context) expertise's. Planning and working together with partners, will move learning naturally to authentic environments –this helps pupils to see real life connections between the school contents and surrounding society. In the contextual-pedagogical learning environments learning:

- is problem based.
- connects the school and society in natural ways.
- is student centered.
- is flexible.
- is illustrative.
- takes into account students individuality and uniqueness.

Let´s look at the planning process closer –where to begin, how to find phenomenon that doesn´t exist in the curriculum? These questions rose from teacher students during the Pedagogical 8 ECTS credits practicum in October 2012. Flipping the sight from society to curriculum was harder than we had thought. The long

history of looking from curriculum to society prevented students' creativity. We had to push them to be creative and brave to build learning environments and tasks that didn´t remain traditional school tasks. Integrating ICT to study plans became natural when the school tasks begun to remain real life tasks as you can see in Table 1.

Table 1. Contextual-pedagogical study plan in a nutshell from the student's point of view (5th grade).

Topic	Students role	Task
Summer Camp in a Ranch	Ranch owner / Camp director	To create an enthusiastic camp program, marketing plan, web & mobile pages and radio/ television commercial.

The planning begins from the premise of individual student and his/ her skills, knowledge, interests and enthusiasm (Comparison to traditional planning where the planning is made to fit to the school constructions; timing, text books, classrooms, etc.). In this model, as Meriläinen and Piispanen (2012) states, the teacher mirrors the curriculum contents to surrounding world and connects the curriculum contents to real life phenomenon. The real life phenomenon studied at school will help students to understand and link the curriculum contents with the life outside of the school. Underneath you will see the curriculum contents related to topic as they turn up in real life contextual pedagogical plan for learning.

Task
To create an enthusiastic camp program, marketing plan, web & mobile pages and radio/ television commercial.
Connection to 5th grade curriculum content
The pupil will learn to justify solutions and conclusions by means of pictures and concrete models and tools in writing or orally
Cross-curricular themes:
Media skills and communication, Participatory Citizenship and Entrepreneurship and Technology and the individual

Mother tongue and literature:
INTERACTION SKILLS
- The pupil will learn skills of active listening and communication in various communication situations; they will feel encouraged to take part in discussions and will try to consider the recipients in their own communication.
- The pupil will learn to work with text environments in which words, illustrations, and sounds interact

SKILLS IN PRODUCING TEXT
- The pupil will learn to create a variety of texts, both orally and in writing

RELATIONSHIP WITH LANGUAGE, LITERATURE, AND OTHER CULTURE
- The pupil will gain a basic knowledge of the media and utilize communications media purposefully.

Biology and Geography
- The pupil will learn to move about in the natural environment and observe and investigate nature outdoors
- The pupil will learn to draw and interpret maps, and use statistics, diagrams, pictures, and electronic messages as source of geographic information

Music
- The pupil will build his/her creative relationship with music and its expressive possibilities, by means of composing

Arts

- The pupil will learn to evaluate their own and other´s visual expression and working approaches, such as visual, content, and technical solutions, and to employ the key concepts of art.
- The pupil will work independently and as a community member in art projects

Mathematics

- The pupil will learn to understand that concepts form structures

Outcomes

- A Marketing plan: When, what and where + budget
- Poster size A0 to inform and wake interest
- Web page to inform and contact (Wix & Go Mobile Wix)
- Commercial to YouTube & Podcast
- Facebook Group to connect participants
- Camp program
- Writing action plan to make the plan and implementation concrete and understandable

The teacher's challenge in today's education is to strengthen the pupils' natural ways to learn and produce information in new learning environments. The teacher acts as the construction worker of the bridges of the learning between a school and other learning environments. It´s her/his responsibility to make learning possible to diverse learners.

Quickly changing 21st century challenges teachers to see life outside the school and recognize not only the core subjects but also the key skills needed outside there. The report *Learning for the 21st Century* identifies nine types of learning skills, which are divided into three different key areas as follows: information and communication skills, thinking and problem solving skills and interpersonal and self-directional skills. In Contextual –pedagogical approach to learning the focus in learning is put to strengthen these skills. The curriculum contents will give the tools for teachers to create learning tasks that will support and develop 21st century skills when learning central content knowledge in authentic learning situations. Table 2 shows how these skills are connected to different tasks students will carry out during the learning process.

Table 2. Contextual Pedagogical approach to Learning and 21st Century Skills

Collaboration	The students are able to collaborate and co-operate with other students, teachers and topic related experts to create a successful production that will meet the set goals.
Knowledge Construction	The students will be active to absorb new or deeper knowledge. They will analyze and decode new information with the earlier knowledge and impression.
The use of ICT	Students will use modern information technology to support learning –not only for routine work. At its best, the tasks contain issues that are impossible to finish without the use of ict.
Problem solving and innovation	The task itself has many possible"*right answers*". At its best, the students are able to solve the task independently and apply it to real life context.
Self-direction	The tasks will contain multiple stages and they challenge students to plan and schedule working together. The assessment criteria will be visible from the beginning of the project.
Communication	Students will produce academic text combined to topic. The texts will contain arguments, hypothesis and conclusions. At its best the learning outcome is well structured and shows good understanding about the topic and the given tasks.

In Contextual-pedagogical approach to learning and teaching the assessment criteria will be visible to students from the beginning of the each learning topic. Students will know the expected outcomes and the level of expectation and have a possibility to achieve the goals at her/ his best. The self-direction skill will develop when the aim and criteria has made concrete to students and possible to achieve when working as expected. In transformational learning model, at the point of view of academic access, all students are successful at high levels. This is what findings in a recent study from Kauhanen & al. (2012: 129-130) supports as well. According to the study, students were devoted to given learning tasks and committed to accomplish them at their best –the earlier experiences supported the fact that weak outputs would come back like a boomerang –so why not try to aim the best if possible?

3. CONCLUSION

We are living in a time of rapid change where the world continues to flatten and become more connected. Our students today already live and learn in this globally connected world. Contextual-pedagogical approach to leaning expresses the "Wisdom of Crowds"- thinking, in which it is central that a group of people is able to produce a more intelligent idea faster than an individual human being. The school itself, teachers, pupils and expertise outside the school are an important part of this learning process. In this model of innovative teaching and learning manner it is crucial to get under way from student's interest, to broaden learning to real contexts outside the school and integrate modern ICT to all learning and studying**.** The use of modern ICT is not a self-meaning itself instead it enables to build student centered learning environments where both content knowledge and 21st century skills such as collaboration, communication, problem solving and self-direction can develop naturally. Turning learning from traditional to transformational, curriculum from interdisciplinary to transdisciplinary and working manners from analogical to digital must focus on students learning i.e. high quality and effective learning and teaching from curriculum to learning situations in the ways no child is left behind but supported to achieve ones best in all learning situations when ever whatever where ever.

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LEARNING CONTINUUM: AMBIENT LEARNING FOR UNIVERSITY STUDENTS

Hiroyuki Mitsuhara
The University of Tokushima
2-1, Minami-josanjima, Tokushima, JAPAN

ABSTRACT

In this paper, the author proposes "Learning Continuum" (LC) as an application of ambient learning. LC aims at continuously providing university students with learning opportunities by presenting learning materials tailored to them at public places (e.g., lounge, cafeteria, restroom, and building entrance). To realize this aim, LC uses digital signage, table-top interface, contactless student identification, social media, and gamification.

KEYWORDS

Ambient learning, digital signage, tale-top interface, contactless student identification, social media, gamification

1. INTRODUCTION

In the modern societies of sensor technology, human activities are drastically changing. Concerning how to get information, for example, smartphones with a GPS sensor will automatically provide users with tailored digital information (e.g., nearby restaurants and tourist spots) associated with their current locations and preferences. Even when being at home, people may be able to get tailored information from the home. For example, an RFID-based smart home identifies where people are now in the home and delivers information to the identified spot (room) through audiovisual equipments (Hsu 2007)(Satoh 2007). Like these examples, sensor-based computing automatically makes human activities easier on the basis of their situations. Such computing is often called ambient computing (or ambient intelligence).

Ambient computing can be used for various kinds of human activities. Learning is no exception and there has been ambient computing for learning, which is often called as "ambient learning", "ubiquitous computing", or "context-aware learning". For example, García et al. (2012) proposed a model of ambient computing for collaborative e-Learning, where learning communities supported by teachers are created and students can share learning resources and collaborate (communicate) with others. In this example, learning is not reduced or simplified, but learning opportunities (i.e., learning materials and learning peers) are provided. The author thinks that this concept of ambient learning is sound. This is because human beings may discard learning (knowledge acquisition) if accustomed to automatic presentation of knowledge associated with their locations and situations.

This study focuses on ambient learning for university students, that is, how to continuously provide them with learning opportunities outside classrooms―they can learn continuously wherever they are on university campus. In this study, such learning environment is called "Learning Continuum".

2. LEARNING CONTINUUM

2.1 Fundamental Idea

Human beings continue to learn from the cradle to the grave. In addition, they often learn in an enjoyable format. For example, students in the digital age will learn social customs while playing an online game. This example may indicate informal learning based on daily life (experiences), which are different from formal

learning in classrooms. The author thinks that although the two kinds of learning may be difficult to be assimilated, the informal learning can be seamlessly linked with the formal learning. Therefore, the author proposes "Learning Continuum" (LC) as an environment where human beings can learn wherever they are. Figure 1 schematically shows the fundamental ideas of LC.

At a preliminary stage, the author focuses on university students and university campus as LC's targets. This is because they are used to the two kinds of learning and university campus will potentially create an atmosphere of learning. Therefore, LC aims at providing university students with learning opportunities outside classrooms on university campus. LC focuses more on the break time between classes to seamlessly link the informal learning and the formal learning. In addition, LC attaches importance to sharing learning experiences (e.g., discussion, learning by teaching, etc.) with more students at the same time and place in the real world. This is because the author believes that such learning experience sharing is enjoyable and will be burned into their brains—their acquired knowledge will be more stabilized.

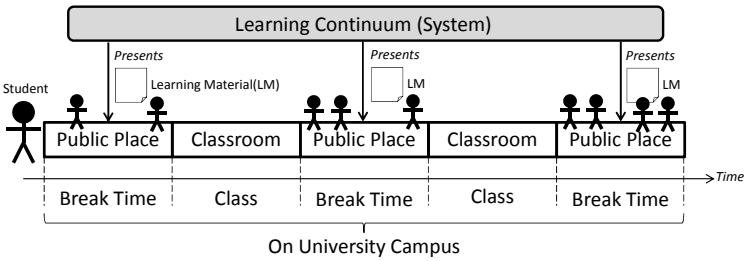

Figure 1. Fundamental idea of LC

2.2 Realization Approach

An approach to realizing the aim will be to use mobile computing technology. It is called mobile learning. Nowadays, many university students own a smartphone and can learn anywhere at any time by accessing the Internet through the smartphone. Although smartphones may be promising as a LC platform, the author will not realize LC as mobile learning. This is because smartphones are basically for personal use and still difficult to involve many students in the real world. For example, it will be difficult to share learning experiences on a smartphone's small display at the same time and place.

Fundamentally, the author realizes LC using ambient computing technology to involve many students in the real world. To be more precise, LC presents learning materials tailored to students being at public places on university campus, using digital signage, table-top interface, contactless student identification, social media, and gamification.

2.2.1 Digital Signage

Digital Signage (DS) presents information locally to a public place using a public display to enhance the value of information. If presenting learning materials (e.g., slideshow and video), DS enables students to share learning experiences at a public place. However, if the learning materials are one-sidedly presented, the students may not be motivated to share learning experiences.

The author's group has developed a DS system that presents learning materials on university campus (Matsumoto et al. 2009). This system focuses on one public place and presents learning materials without taking account of heterogeneous students—their characteristics (e.g., interest, knowledge level, and sociability) and profiles (e.g., major, grade, and classes)—at some public places. Therefore in LC, DS should present learning materials tailored to heterogeneous students being in front of the displays.

2.2.2 Table-Top Interface

Table-Top Interface (TTI), which is the fusion of table and digital technology, enables users to interactively view and operate digital objects displayed on a table. University students are used to learning at a table and there are many tables at public places on university campus. If a table becomes TTI for presenting learning materials, the students being seated at the table can share learning experiences.

The author's group has developed a TTI system that projects a learning material onto the corresponding paper (the corresponding page of a notebook) on a table and enables a student to move and rotate the learning material by touching to the paper (Moriyama et al. 2012). This system focuses on one student. Therefore in LC, TTI should focus on some students being seated at a table and take account of how to prompt their learning experience sharing in terms of learning material presentation.

2.2.3 Contactless Student Identification

In ambient computing, users are often identified unconsciously by contactless user identification. LC also should adopt contactless student identification not to bother university students. The author uses RFID (Radio Frequency Identification) as a fundamental technology for the identification. As a prerequisite for the identification, each of the students has to own his/her unique student card (embedded with an RFID tag). High-powered RFID readers, which are installed in public places on university campus, can identify the students without making them pass their student cards over the reader.

2.2.4 Social Media

Students will spend a lot of time together with friends on university campus. Nowadays, their friendships are becoming wide because many of them are using social media (e.g., Facebook and Twitter). For example, a social media user can trace a friend of a friend and find friends from many users.

To involve many students, LC should adopt social media where new friends can be found. To be more precise, LC examines whether there are friends among students being at a public place by using RFID and friendship database. Then, LC chooses which learning material is presented tailored to the friends.

2.2.5 Gamification

Recently, gamification has attracted attention as an approach to stimulating various kinds of human activities. Briefly speaking, gamification is to use game design elements such as ranking, time constraint, and clear goal in non-game contexts. Gamification can be applied to learning including e-Learning (Raymer 2011) and will be more effective when there are many students. This is because the more students, the more diverse and enjoyable their learning experience sharing will become. To involve many students, therefore, LC should adopt gamification that prompts competition among students.

2.3 Public Places for Learning

Many of university students will relax during the break time between classes. Favorably interpreting the recent findings in neuroinformatics (Rutishauser et al. 2010), human beings can learn more effectively (strengthen their memories) in relaxation. Therefore, the break time can be regarded as a potential learning opportunity on university campus even if it is short. In other words, LC should focus on how students can learn and share their learning experiences during the break time. Public places on university campus where students can relax during the break time are shown as follows.

2.3.1 Lounge

The students will often spend the break time together with friends in a lounge, which may have spaces for DS (a public display) and tables available for TTI. If DS and TTI are installed into the lounge, they can share learning experiences through the presented learning materials.

2.3.2 Cafeteria

At a cafeteria, the students spend relatively long time between classes while having lunch or coffee. The author thinks that the cafeteria is also suitable for installing DS and TTI. If those are installed, they can share learning experiences (e.g., long discussion) through the presented learning materials.

2.3.3 Restroom

A restroom is a sharable but extremely private place (space) and people will not spend much time there. Even if presented there, learning materials are inevitably short. However, the author thinks that short learning materials should be presented by DS at a restroom because the students will naturally stare at the front wall.

2.3.4 Entrance

The students who take classes shall go through an entrance of a classroom building. The author thinks that the entrance is a public place where they do not relax but can view short learning materials presented by DS.

3. SYSTEM OVERVIEW

3.1 System Composition

The author is now designing and partially building a prototype system of LC. The system recognizes students being at public places on university campus by RFID and presents learning materials tailored to the recognized students (their characteristics, profiles, friendships, etc.) using DS and TTI. The system aims at prompting them to not only acquire knowledge individually but also share learning experiences through the presented learning materials. Figure 2 shows the overview of the system composition.

To realize the aim, the system retrieves the recognized students' characteristics, profiles, and friendships from an LC database server on the Internet. The system equips a high-powered RFID reader, which covers about 18 square meters.

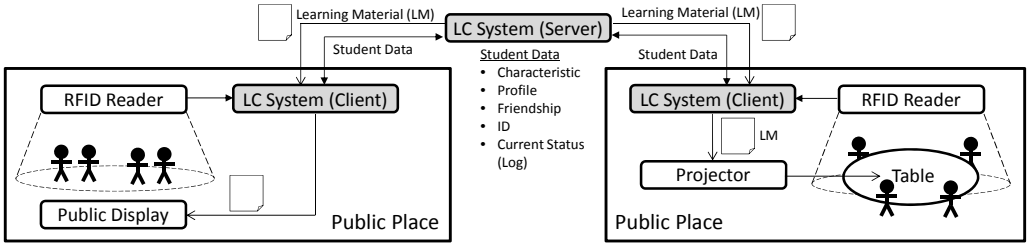

Figure 2. Composition of LC prototype system

3.2 Scenarios of Learning Material Presentation

To seamlessly link the informal learning (i.e., learning at a public place) and the formal learning (i.e., learning at a classroom), during the break time a learning material about the previous or next class should be presented. Based on this scenario, the system narrows down the candidates for the learning material. Then, based on secondary scenarios, the system finally chooses which learning material is presented.

Four possible scenarios of learning material presentation are shown as follows.

3.2.1 Presenting a Learning Material Tailored to Predominant Students

It is difficult to present a learning material suitable for all the students being at a public place. If the display area (of a public display and a table) is divided, some learning materials can be presented. In that case, however, the presentation size of each of the learning materials inevitably becomes smaller. Therefore, one of the scenarios is to present a learning material tailored to predominant students in terms of their characteristics, profiles, and friendships. For example, when there are three, four, and five students with interest in biology, chemistry, and physics, respectively at a public place, a learning material about physics should be presented for the five students. In another example, when the predominant students are friends in the same major, a learning material about a common class among the friends should be presented. In this scenario, more students will be able to share a learning experience through the presented learning material.

3.2.2 Linking with Some Public Places

Even if DS and TTI present a learning material suitable for a student, he/she may not view the whole of the presented learning material due to his/her schedule (e.g., next class). Therefore, one of the scenarios is that when he/she breaks off viewing the presented learning material at a public place and leaves there, the system enables him/her to automatically resume learning at another public place by presenting the learning material from where he/she broke off. Currently, this scenario assumes learning material presentation for one student.

3.2.3 Presenting a Learning Material Tailored to Latent Friends

The system knows which students are at a public place by RFID and with whom the students can be latent friends by retrieving the students' characteristics and profiles. Therefore, one of the scenarios is to present a learning material tailored to the latent friends. If there are unacquainted students who are eagerly viewing the presented learning material, the latent friends will note each other's presence―they may say, "Do you have interest, too?" In other words, the latent friends will become obvious in a natural way. In this scenario, more students will be able to make friends and share a learning experience with the friends through the presented learning material.

3.2.4 Presenting Student Rankings

If students can know their commitment for LC, they may be more motivated to view learning materials at public places. Therefore, one of the scenarios is to present student rankings (e.g., students who viewed learning materials many times). This scenario is based on gamification that prompts a student to be highly ranked in competition among students.

4. SUMMARY

This paper described "Learning Continuum" (LC) as an application of ambient learning. LC aims at continuously providing university students with learning opportunities by presenting learning materials tailored to them at public places (e.g., lounge and cafeteria) on campus and consists of digital signage, table-top interface, contactless student identification, social media, and gamification.

The author is now designing and partially building a prototype system of LC. The four possible scenarios of learning material presentation (described in Section 3.2) should be well integrated so that many students can receive benefit from LC. The LC system will be built in large-scale and need many equipments (e.g., public displays, projectors, and RFID readers). Although the current design may be changed due to issues of cost-effectiveness and spatial restriction at public places, the author intends to build partial prototype systems that fit to experimental settings to examine the availability of the prototype systems.

ACKNOWLEDGEMENT

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SEARCHING FOR A SUITABLE WAY TO TRANSLITERATE ARABIC INTO ROMAN LETTERS AS FOR A DEVICE IN ARABIC E-LEARNING SYSTEMS

MOSA Ahmed Ebrahim Mohamed
Japan, Tokyo, WASEDA University, Faculty of Science and Engineering, Computer Science Dept.
Egypt, Tanta, TANTA University, Faculty of Specific Education, Educational Technology Dept.
3-4-1 Okubo, Shinjuku, Tokyo 169-8555 Japan

KAKEHI Katsuhiko
Japan, Tokyo, WASEDA University, Faculty of Science and Engineering, Computer Science Dept.
3-4-1 Okubo, Shinjuku, Tokyo 169-8555 Japan

ABSTRACT

To develop a multimedia support for Arabic, we need phonics to help the students read and pronounce Arabic words by themselves. Here we present a basic way to transliterate Arabic words into sequences of Roman letters, in mirrored form, arranged from right to left along with Arabic writing. An educational experiment has been implemented in Japan with twenty five volunteers in different nationalities. The results suggest that the basic principle should be to transliterate each Arabic letter into a mirrored Roman upper case letter, in principle, and transliterate each diacritic into a mirrored Roman lower case letter, possibly as a subscript. And the best-fit font type for mirrored use might be "Decker font".

KEYWORDS

E-Learning, Arabic transliteration, Computer fonts.

1. INTRODUCTION

There is a strong desire to learn the Islamic culture and Arabic language worldwide. There are a huge number of tourists all over the world who prefer to visit the Islamic and the Arabian countries for culture and sightseeing, foreigners who want to work in the Arabian countries for many purposes, such as political relations, trade relations and culture exchange, and non-Arabic speakers who want to study the Islamic religion and the Arabic language in the Arabian countries especially Saudi Arabia and Egypt.

Multimedia has a great effect generally in the education for knowledge acquisition and skills development (Winn, W.1982). Also it has a good effect particularly in the languages teaching for introducing the basics, grammar and vocabulary, and developing the skills of the reading, writing, listening and talking.

There is no e-learning system with full multimedia support for Arabic learning. There is no educational method to make the very beginner students of the Arabic accustomed to read (pronounce) the Arabic text from right to left. There is no clear using of the Arabic transliteration in any current or available textbooks (Abdullah, A, 2006), (Kurdi, M, 2002).

We started our own project to develop an e-leaning system, for Arabic learning with full multimedia support. For its first step, we tackled with the issue of transliteration. There are lots of trials for Romanization of Arabic (Hassan, Heba, 2012), (Nagato, Y, 2011), but any of them fit for our desire (Ellis, M., 2012): we would like to show the transliteration just under its original Arabic text which runs from right to left; transliteration should also run from right to left. Here we present our new way of transliteration which should be in the Arabic e-Learning system with full multimedia support, as shown simply in Figure 1.

E-learning system will present the Arabic text, then the students should try read (pronounce) it if they have some experience in Arabic. So, they can press button for some helps such as showing the Arabic text as separated letters, showing the new transliteration in the mirrored form, showing the Arabic independent

letters with transliteration or not as his need during the learning. Then the students can press button for multimedia support to listen to the correct pronunciation or watch a movie on the human sound system during the pronunciation. There is a chance for the student to repeat any kind of help. Moreover, there is a chance for talking with the Arabic teacher or with the other colleagues to exchange the experience.

2. OBJECTIVES

What is the best way of Arabic transliteration into Roman letters to show it just under its source Arabic text? We want to show our transliteration to Arabic beginners students in order to be able to read (pronounce) each Arabic word written in an Arabic text. It is mandatory that the transliteration shall be written and read from right to left since Arabic texts are written and read from right to left.

Arabic way of scripting is as follows. A sentence is a sequence of words arranged from right to left. A word is a sequence of 29 Arabic letters, arranged also from right to left. Each letter shows a syllable with an accompanying diacritic. Basically each letter itself designates a leading consonant of the syllable. Each of the 10 Arabic diacritics designates whether the syllable consists only of that leading consonant, or the syllable contains one of the 3 Arabic vowels “a”, “i” and “u”, in one of the three ways: having the ending consonant “n”, doubling its leading consonant, or having no consonant modification. Every letter has a similar width for the independent form and for the 3 different forms depending on the position in a word, i.e., at the beginning, in the middle, and at the end.

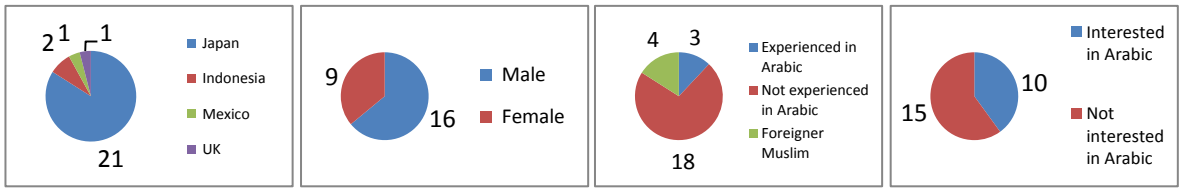


1. Arabic text
2. Asking help for Separated Letters and Transliteration
3. Asking help for Independent Letters and Transliteration
4. Asking help for Multimedia and Online help
5. Asking help for Repeating help

Figure 1. Intended usage of Arabic transliteration in an the Arabic e-Learning system

3. EXPERIMENT

Our experiment took place in a course of novice classes for Arabic in trial and error fashion. Students were 25 in all and they volunteered for our experiment. Students were mixture in nationality, age, gender, experience in Arabic and motivation as shown in Figure 2.



Nationality Gender Experience Motivation

Figure 2. The students’ categories

In each class our transliteration was used in phonics training and a test took place to measure their achievement in reading (pronouncing) Arabic words with help of our transliteration. Several ways of transliteration were tried in sequence to find out best possible one.

3.1 Simply arranging Roman letters from right to left

The first trial was that the normal Roman letters transliterating the Arabic text have been arranged from right to left, i.e., an Arabian greeting " **اَلْسَّلَامُ عَلَيْكُمْ** " was transliterated into "**.muk.yalaâ umaalõs.laA**", using "The Times New Roman" font in lower case letters and capitalizing only the initial of a whole sentence.

Some students complained that they tended to read the transliteration from left to right, and they suggested capitalizing the first (right most) letter in each word, to be like "**.muk.yalaÂ umaalõs.laA**" to indicate right-to-left direction.

We noticed that the form of Roman letters is designed for reading from left to right and students are all accustomed to read Roman from left to right. We judged that it would be better to put students in a situation as if they were in a world where everything looks reversed horizontally. We decided every Roman letters of the transliteration be mirrored in its form. We started experiments to check if this hypothesis works well.

3.2 Arranging mirrored Roman letters from right to left

We found a suit of fonts for Roman letters specially designed in mirrored form; they had names starting with "Kagamimoji", a Japanese word meaning "mirrored". For example, "Kagamimoji-pmin-h" font looks as (A, ɐ, B, b, C, ɔ, d, D, ɓ , E, ǝ, F, ɟ, G, ɡ, H, ɥ, ⋯).

.Aal.sõlaamu Âalav.kum

Kagamimoji-pmin-h font (Mirrored form)	ɐ	ɐ	ɓ	Ƨ	q
The Times New Roman font (Normal form)	s	6	b	2	p

Figure 3. Capitalizing the initial of each word

Table 1. Confusing between mirrored form and normal form

We asked students to read and pronounce the mirrored representation with capitalizing the initial of each word, as shown in Figure 3. Two tests took place to measure the time to come to pronounce a text consisting of two words; one followed the other after two hours. The results showed that the time spent in pronunciation has been reduced in the second time (After two hours), and most of the learners pronounced the mirrored Roman letters correctly and easily. It was confusing between the Roman letters in mirrored form and the Roman letters in normal form, as shown in Table 1. Also, some of the students suggested capital style.

We tried two ways, one for all in upper case, and one for all in lower case, as shown in Figure 4. using another font, e.g., "Kagamimoji-pgoth-h" looking as (**A, ɐ, B, b, C, ɔ, d, D, ɓ , E, ǝ, F, ɟ, G, ɡ, H, ɥ, ...**), and the similar tests took place.

.MUK.YALAÂ UMAALÕS.LAA	.Aal.sõlaamu Âalav.kum

Figure 4. Upper case and lower case

The results showed that the time spent in pronunciation has been reduced. Some of the students preferred the upper case writing style. Most of them preferred the lower case style, but they still find difficulty in reading (pronouncing) correctly, and there is confusion between the Roman letters in mirrored form and normal form, as shown also in Table 1. We noticed that there was little confusion between upper case letters. It looked better to use upper case letters in as many cases as possible. Our main purpose of introducing transliteration is to show pronunciation of each Arabic text in cases when students do not remember how to pronounce some words. It means that our transliteration is free from Roman way of writing. Considering the very nature of Arabic writing, we tried to use upper case letters only, but to use small sized ones for diacritics. Trials took place showing two ways of transliteration, all in same size and changing the size for corresponding to diacritics, e.g., shown in Figure 5.

.MUK.YALAÂ UMAALÕS.LAA	.MUK.YALAÂ UMAALÕS.LAA

Figure 5. Upper case for each Arabic letter (Normal size) and for each diacritic (Small size)

The results showed that the time spent in pronunciation has been reduced, and most of the students pronounced the mirrored letters correctly. Also, most of them said, it was easy for them to pronounce. Even some of the learners pronounced the modified letters correctly, but it was confusing about the differences in the font size, and it still takes some time to pronounce, with some wrong pronunciation. Moreover, most of the learners suggested avoiding the difference in the font size which representing the Arabic diacritics.

3.3 Upper case for Arabic letter, lower case for diacritics

It is welcomed transliteration, but confusion remained in lower case letters mutually mirrored to each other. Several fonts were tried and come to a conclusion. We tried to find out the best font and the suitable way to transliterate the Arabic diacritics in our transliteration. we used "Kagamimoji-pmin-h" font which is shown as (⋯ ،h ،H ،g ،G ،f ،F ،e ،E ، d ،D ،c ،C ،b ،B ،A).

Then, we asked the students to read (pronounce) the mirrored Roman letters with capitalizing the first letter of each word, as shown in Figure 6, (Time spent in reading has been calculated by Second unit) two times a week for three weeks.

The results showed that time spent in pronunciation has been reduced especially in the second time (After two hours), and most of the students pronounced the mirrored Roman letters correctly and easily. It was confusing between the mirrored form and normal form of the Roman letters, as shown also in Table 1.

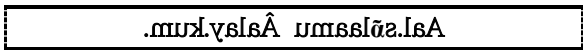


Figure 6. Kagamimoji- pmin -h font

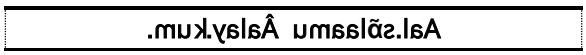


Figure 7. Kagamimoji-pgoth-h font

Also, some of the students suggested capitalizing all of mirrored letters. According to the previous proceeding, we decided to use another font, to avoid the students confusing, i.g., "Kagamimoji-pgoth-h" which is shown as (... ،h ،H ،g ،G ،f ،F ،e ،E ، d ،D ،c ،C ،b ،B ،A). Then, we asked the students to read (pronounce) the mirrored Roman letters, as shown in Figure 7. (Time spent in reading has been calculated by Second unit) two times a week for three weeks.

The results showed that the time spent in pronunciation has been reduced in the second time (After two hours), but they still find difficulty in the pronunciation, and take some time to read (pronounce), there are some mistakes in pronunciation. It was confusing between Roman letters in mirrored form and normal form, as shown also in Table 1.

Throughout the experiments, the students showed their adaptation to the mirrored world. Then we were in need to put the new transliteration in the mirrored style. Through the Microsoft software, by using Word art: 3D Rotation Option, we can put any Roman letters in the mirrored form to be represented from right to left.

We looked for the most suitable font as a multimedia application for the new transliteration phonetics as shown in Figure 8, we decided to use the "Decker" for representing the mirrored letters, as we found out that this font could be used as the best font for our tranliteration, as shown in Figure 9. High percentage of the students is satisfied with the Decker font, when we asked them. This because there is no confusing between the mirrored Roman letters and the normal Roman letters.

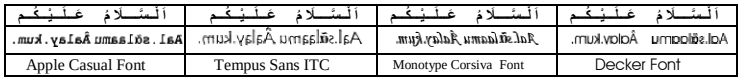


Figure 8. Fonts as a multimedia application



Figure 9. Decker font (Mirrored style)

According to these procedures, high persentage of the students prefered the mirrored form and the lower case for representing the Arabic diacritics ّ ، ا ، ُ . And mirrored Roman letters (Upper case) should be used to transliterate the Arabic alphabet to avoid the confusing between the normal and the mirrored Roman letters as mentioned in Table 1.

4. CONCLUSION

We propose that Roman transliteration for Arabic text shall run from right to left. Each Roman letter should be mirrored. Upper case should be used to transliterate each Arabic letter and lower case should be used to transliterate each diacritic. Font which used in the transliteration should be non-confusing figured especially in mirrored form. The most suitable font for the transliteration is "Decker font". It is propose to support and let students read (pronounce) Arabic words without teachers' direct help. So we need many experiments.

Current new Roman transliteration of each Arabic letter and each diacritic is shown simply in Table 2 and Table 3. The experiments results are shown in Figure 10, Which shows the box plot of time spent in reading

(pronouncing) the new transliterations for three trails (Weeks) through six times. There are no significant differences seen between nationalities and/or other characteristics which are the Nationality, Gender, Ability, and Motivation for Arabic.

We recommend this Roman transliteration to be used as a mechanism in the Arabic learning textbooks, courseware, and we will provide it with the multimedia support in our new Arabic e-language learning system, as shown in Figure 1.

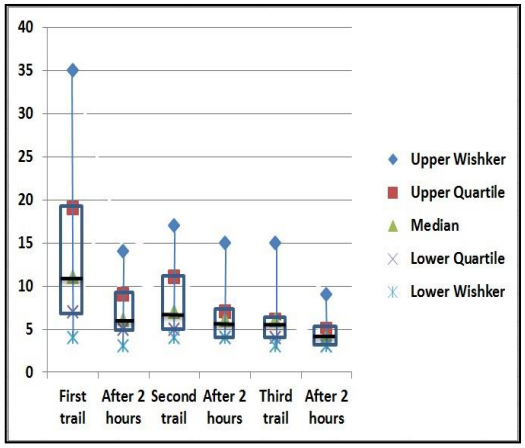


Figure 10. Box plot of times spent in reading (pronouncing) the new transliteration

Table 2.
Arabic letters transliteration

ALPH	MELUC	ALPH	MELUC	ALPH	MELUC
أ	A	س	ƨ	ل	⅃
ب	ꓭ	ش	Ϣ	م	M
ت	T	ص	Ƨ	ن	И
ث	Ↄ	ض	Ď	ه	H
ج	ι	ط	Ť	و	W
ح	Ĥ	ظ	Ƶ	ى	Y
خ	ǰ	ع	Â	ة	T
د	ↀ	غ	Ă	ء	A
ذ	ڎ	ف	ꟻ	ؤ	U
ر	Я	ق	Ọ	ئ	ı
ز	Ƶ	ك	⅄	أ	AA

ALPH: Arabic alphabet
MRLUC: Mirrored Roman letters (Upper case)

Table 3.
Arabic diacritics transliteration

AAM	MELLC
◌َ	ɒ
◌ِ	ı
◌ُ	∪
◌ْ	◦
◌ً	ɒ̦
◌ٍ	ı̦
◌ٌ	∪̦
بَّ	ꝺ
بِّ	ɪ
بُّ	∪̦

AAM: Arabic additional marks
MRLLC: Mirrored Roman letters (Lower case)

5. FUTURE WORK

We plan a long-span experiment to show our method of transliteration really promote students' ability to read (pronounce) Arabic text without help. We are developing an e-learning system incorporating our transliteration as a real-time multimedia support for students.

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WEB-BASED REFLECTION SUPPORT SYSTEM FOR REAL WORLD EDUTAINMENT

Jun Miyashita[1], Hiroyuki Mitsuhara[2], Keiji Miki[1], Takahide Sumikawa[1], Kazuhisa Iwaka[1], Masashi Konishi[3] and Yasunori Kozuki[2]
[1]*Graduate School of Advanced Technology and Science, The University of Tokushima, JAPAN*
[2]*Institute of Technology and Science, The University of Tokushima, JAPAN3*
[3]*Tsuda Junior High School, Tokushima City, JAPAN*

ABSTRACT

Learners should reflect on their learning activities to stabilize their acquired knowledge. It is no exception in learning through Real World Edutainment (RWE), which works on a tablet PC and enables experiential learning in the real world. We are now developing a web-based reflection support system for RWE. In the system, learners can reflect on their learning activities in the real world, which are visualized and shared on Google Map. We briefly evaluated the prototype system in an experimental use. The questionnaire results showed that the system was useful for reflection but should be improved in terms of usability.

KEYWORDS

Real World Edutainment, reflection, knowledge stabilization, web-based system, learning activity visualization

1. INTRODUCTION

Education has been diversified by the wide spread of ICT. For example, many people own a smartphone and can access the Internet to get multimedia learning materials anytime and anywhere. Nowadays, the fusion of education and computer game is particularly attracting attention and realized as Edutainment (or Serious Game). Edutainment aims at increasing learning motivation and effect in terms of fun by providing audiovisual, interactive, multimedia learning materials. Malone and Lepper (1987) said that fun is one of the important factors for increasing learning motivation (intrinsic motivation). High learning motivation will be a prerequisite for high learning effect.

We think that the conventional Edutainment is a promising educational approach but has a limitation. This is because the conventional Edutainment enables audiovisual learning in a virtual world (learning materials) but does not enable experiential learning through the five senses in the real world―VR-based Edutainment has been technologically advanced but still difficult to stimulate the five senses simultaneously. To remove the limitation, therefore, we focused on applying Edutainment to the real world. Then, we proposed Real World Edutainment (RWE for short) and developed an RWE system. RWE enables experiential learning from not only learning materials (e.g., image, video, quiz, etc.) but also real objects (e.g., creatures, artifacts, and human). The RWE system, which works on a Windows tablet PC equipped with a GPS sensor, an electronic compass, an RFID reader, and a web camera, presents learning materials based on a branched game story.

We conducted a preliminary experiment where university students learned earthquake disaster prevention through RWE (Noda et al. 2012). Although we obtained their positive feedbacks about learning motivation, we felt that it was difficult to stabilize their acquired knowledge afterward―learning effect would not be increased enough and kept over the long term. Our focus had been only on how to make learning in the real world (outside learning) more fun and effective. As noted by Ebbinghaus (1913), human will forget more or less after learning. It is no exception in learning through RWE. From this background, our focus is now on how to stabilize learners' acquired knowledge after learning through RWE.

2. REAL WORLD EDUTAINMENT

RWE provides story-based learning in the real world. In other words, RWE provides experiential learning through RPG (role-playing game) and AVG (adventure game) in the real world.

The RWE system recognizes learning scenes (described in a game story) from a learner's current location and direction (GPS) and real-object IDs (RFID), and then presents learning materials associated with the recognized scenes. In addition, the system accesses the Internet and sends his/her learning activities (e.g., his/her current location represented by latitude and longitude) to a database server at a regular Interval (Miki et al. 2012). The system is schematically illustrated in Figure 1.

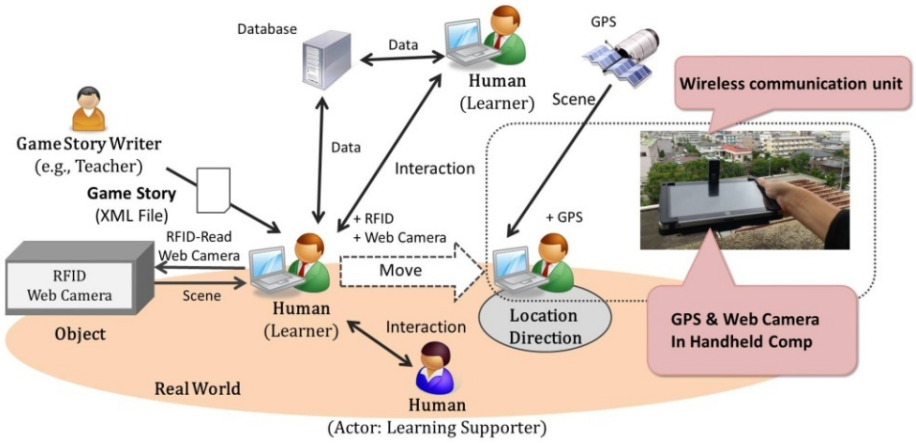

Figure 1. Overview of the RWE System

3. SYSTEM

Learners can stabilize their acquired knowledge by reflecting on their learning activities. However, RWE did not cover reflection. Therefore, we are now developing a web-based reflection support system that works in conjunction with the RWE database server and enables learners to reflect on their learning activities in RWE.

3.1 How to Support Reflection: Learning Activity Visualization

The RWE system recognizes learning scenes using GPS, RFID, etc. and presents learning materials associated with the recognized scenes. GPS will be most used because it is easy to use and covers the entire world. Therefore, first of all, we focused on reflection support for GPS-based RWE (location-based RWE).

An essential reflection support for RWE will be learning activity visualization because learners seem to be busy with their present task when learning through RWE. Especially for GPS-based RWE, panoramic learning activity visualization enables a learner to reflect totally on his/her learning activities. In addition, if viewing other learners' learning activities, he/she can reflect on his/her learning activities more objectively. Therefore, visualized learning activities should be shared with learners who learned in the same story.

Learners will be able to recall their acquired knowledge from the visualized learning activities. Knowledge recollection is needed for knowledge reflection and is the first step for knowledge stabilization. The followings are the current targets of the learning activity visualization.

(1) Learners' Routes

The database server stores every learner's current locations with respect to each game story. A learner's location data represent his/her route of learning in the real world. He/she will want to know his/her route as a learning activity—especially in a game story that deals with learning topics associated with locations (e.g., social studies).

(2) Learners' Answers

The database server stores every learner's answers to quizzes prepared in each game story. A learner can recall his/her acquired knowledge and/or figure out the answers from his/her past answers. In addition, he/she can reflect on his/her acquired knowledge objectively from other learners' answers.

(3) Learners' Comments

The database server stores every learner's comments with respect to each game story. A learner can recall his/her acquired knowledge, emotions, questions, etc. from his/her comments. In addition, he/she can find something new from other learners' comments.

(4) Learning Materials

The database server stores not only the above learning activities but also learning materials, and enables learners to view all the learning materials. A learner can reflect on his/her acquired knowledge from the learning materials that he/she has already viewed in learning in the real world. In addition, he/she can acquire new knowledge from the learning material that he/she has not viewed.

3.2 User Interface

We made the system's user interface simple so that various learners (e.g., elementary school students) can use the system easily. As shown in Figure 2, the user interface consists of Google Map (the left), Google Street View (the upper right), a learning material viewer (the bottom right part), and an operation panel (the bottom right).

To visualize learning activities, first, a learner selects learners in the same story by clicking on the checkboxes with their names on the operation panel. Immediately after that, the selected learners' learning activities are visualized and shared on the Google Map. The lines with a different color indicate their routes of learning in the real world. Markers on the lines indicate their visited learning scenes. When he/she selects (clicks on) a marker on his route, a pop-up window is displayed near the marker. The pop-up window shows his/her learning activities at the selected scene such as visited date, viewed learning materials (hyperlinks), answer to the quiz, and comment. When he/she clicks on one of the hyperlinks, the associated learning material (e.g., image and video) is presented on the learning material viewer. As a matter of course, he/she can view other learners' learning activities in the same manner. If his/her route is covered by Google Street View, the first-person view from the selected scene is presented to remind him/her of learning in the real world.

There have been many learning support systems that use GPS and a digital map for data gathering and reflection (e.g., SketchMap (Sugimoto et al. 2006) and LOCH (Ogata et al. 2008)). Our system highlights how learners reflect on their learning activities along the story.

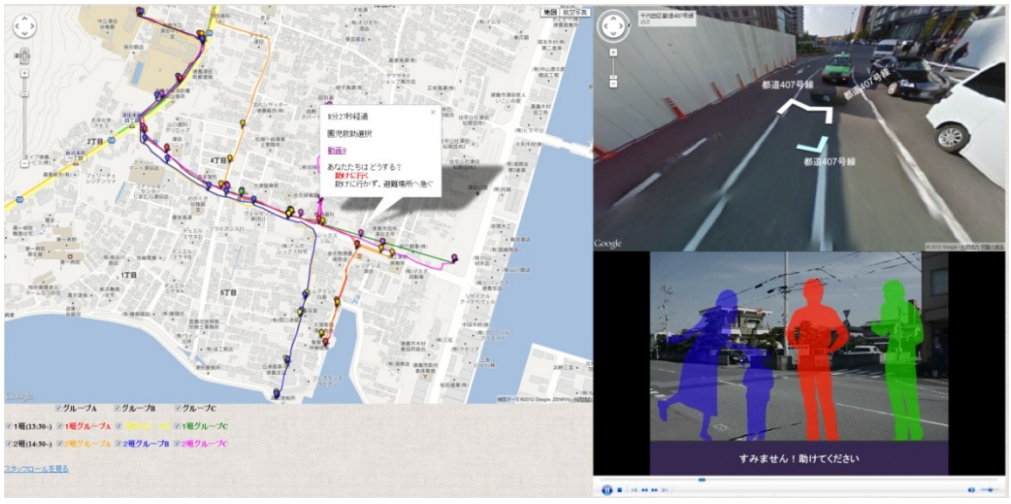

Figure 2. Snapshot of Web-Based Reflection Support System

Table 1. Questionnaire Results

Question	AVG	SD
Q1: Was it easy to view your (group) evacuation activities on the map?	3.85	0.82
Q2: Was it easy to view learning materials (videos) on the viewer?	3.65	1.00
Q3: Was the system easy to use in general?	3.68	0.73
Q4: Did you reflect on your evacuation activities successfully?	4.19	0.68
Q5: Did you compare your evacuation activities and others' successfully?	4.12	0.58
Q6: Was the system useful for your reflection?	4.23	0.58

4. EXPERIMENTAL USE

To briefly evaluate the prototype system's usability and learning effect (usefulness), we experimentally used it (without the function of Google Street View) in an RWE-based evacuation drill (earthquake disaster prevention education) for junior high school students—the drill can be regarded as learning in the real world and it is important to reflect on evacuation activities after the drill.

4.1 Settings

The students were divided into 6 groups (5 students in each group) and the drill consisted of two phases: evacuation and reflection. In the evacuation phase, a game story required them to evacuate from a coast to an evacuation site to escape from Tsunami caused by a large earthquake within about 30 minutes.

In the reflection phase, the students gathered at a computer room and were allowed to view their evacuation activities on the system. A teacher promoted their reflection by showing their evacuation activities on a front screen of the computer room. After the reflection phase, we gave them a questionnaire asking about the system's usability and learning effect.

4.2 Results

Table 1 shows the questionnaire results (the average and the standard deviation). All the averages will be regarded as basically favorable values. However, the averages of Q1 (3.85), and Q2 (3.65), and Q3 (3.68), which directly asked about the usability, should be improved in future implementation. We obtained the following feedbacks helpful for the improvement:

- "It was difficult to view the whole area because my computer's resolution is not high."
- "There were many markers on the map and it was difficult to click on one of the impacted markers."

On the other hand, the averages of Q4 (4.19), Q5 (4.12), and Q6 (4.23), which asked about learning effect by reflection, were more than 4.0 and indicate that the system can work as reflection support for RWE and contribute on knowledge stabilization. We obtained the following positive feedbacks:

- "I remembered why I did such evacuation activities and considered whether my activities were correct."
- "Although I had not cared time passage in evacuation, I reflected on time passage of my evacuation."
- "Others' evacuation activities encouraged me to reflect on my evacuation."

5. SUMMARY

This paper described a web-based reflection support system for RWE. In the system, learners can reflect on their learning activities visualized and shared on Google Map. From the questionnaire results of the experimental use, we think that the system is not still enough in terms of its usability but can work as reflection support for RWE.

Our future work is to improve the usability and evaluate the improved system under various conditions (e.g., learning topic and elapsed time since the end of learning in the real world) in a long-term comparative experiment.

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SMART CITY: MORE THAN TECHNOLOGY

Valentina Anna De Maria
Department of Statistics – university "Aldo Moro" of Bari
67th a denominarsi, 25b – Trani (BT) Zip Code 76125 - Italy

ABSTRACT

The first impression can be misleading with respect to the truth: innovation, ICT, broadband, low power consumption are just some of the keywords of a major "game" that our society must decide to face; the heart of all the possible changes depends more from the set of methods, technologies, awareness of use. Therefore, the expression smart city actually indicates an urban environment which acts proactively to improve the quality of life for its citizens, by helping them to implement projects and reducing the growing complexity.
As long ago as 1997 William Mitchell, professor and dean of the School of Architecture and Planning at MIT, described unintentionally smart city in his book "The City of bits. Spaces, places, and information highways "as a world of things that think and become smarter. His idea is based on an especially technology: global communication is based on relationships that are becoming increasingly important and an individual's life now is built around a coexistence of real and virtual.

KEYWORDS

Smart city, technology, digital citizen

1. INTRODUCTION

The smart city reconciles and meets the needs of citizens, businesses and institutions, thanks to the widespread and innovative use of ICT, particularly in the fields of communication, mobility and energy efficiency, developing a plan which implies a prudent management of resources and sustainable development.

Starting from the databases, which can detect changes in the lives of citizens, consumption, companies, the city takes decisions on the basis of current information, true and shared. Databases for all actors through the ICT tools that can scan information: municipalities, chambers of commerce, local agencies, police, utility companies, and citizens. The difficulty lies in the management of heterogeneous data that if integrated into a cross-model can provide insight into the knowledge, ensure the best balance between performance and cost, and reduce the response time, optimizing the available resources. It is a form of collaboration between citizens and the software / hardware where one side is necessary to develop interpretative models to access the data and perform simulations to test the effects of decisions; and on the other the open data allow collective intelligence to evolve and create innovation.

2. SMART PEOPLE AND SMART LIVING

The growth of a city is based on respect for its history and its identity and in this sense should be privileged reuse and enhancement of existing in a renewal that is based on conservation is a city where investments in human and social capital in the processes of participation, education, culture, new forms of communication fuel sustainable economic development and provide a different quality of life for citizens through a participatory governance.

The evolution towards Smart city also includes making "responsible" people of their choices, movements and daily activities. For example, if each of us did the first mile walk, he used the bike for just over distances

and then could take advantage of a network of public transport, there it will be all more intelligently, which means making the citizen self-conscious.

Speaking of smart living and smart people means: provide an environment adequate to promote creativity and encouraging innovation and experimentation in art, culture, entertainment; support a laboratory for new ideas; focus on the construction of a network is not hierarchical, but inclusive, in which the various stakeholders and their communities can have citizenship and voice; develop alliances with universities, but also with the training informal; give space to free knowledge and focus on all the ways in which knowledge is free and widespread.

To give substance to successful participatory processes, activities and projects undertaken should be comparable across indicators of achievement. Scientists at the Vienna University of Technology, in collaboration with the University of Ljubljana and the Delft University of Technology have developed a new tool for ranking that puts it under a magnifying glass, the medium-sized city with a population less than 500,000 inhabitants. The result is an interactive tool that initially points out the potential of 70 smart cities and that allows for the first time the comparison between them. The result: the medium-sized cities more "smart" are located in Finland, Denmark, Austria, Germany and in the Benelux.

Medium-sized cities were selected because they represent 40% of the entire European population lives in cities: often these cities are located in the shadow of the great metropolis and are underestimated their potential. In fact, thanks to their small size, they are better to be flexible and adapt to changes in vision "smart." Key indicators of smart people are: level of qualification; affinity to life long learning; social and ethnic plurality; flexibility; creativity; cosmopolitanism and open-mindedness; participation in public life.

Nations such as Denmark, Luxembourg and Finland dominate the rankings. With regard to the smart living we refer to: cultural facilities; health conditions; individual safety; housing quality; education facilities; touristic attractivity; social cohesion.

The training is not just about this size: indeed, if we look at the other four dimensions, we see that the factors and indicators such as the spirit of innovation, entrepreneurship, the ability to change, pollution, environmental protection, strategies, policies, transparency in government all depend on only a single large item, or the formation of our government and the education of those who live there.

3. THE RELATION BETWEEN TECHNOLOGY AND PEOPLE

The digital age has changed the way we work, we meet, and we organize knowledge: a set of digital elements held the environment with sensors, cameras and microcontrollers and manage the city's infrastructure; we monitor the condition of the environment, performing security applications. But when you spread the technology, it becomes almost invisible: thanks to the easy digital, the changing to this new reality will be easier than adapting to the impositions of the industrial era; in this way to apply the technology to daily use objects will be subtle and easily acceptable even for those less accustomed to their use.

To design a smart city, you have to focus on the concepts of energy efficiency seen as functionality and rationalization of resources and the direct involvement of citizens in the city and its economic development.

The approach must be practical: all projects are designed to give greater attention to issues related to energy and the environment such as the introduction of renewable energy, public lighting, monitoring of environmental impacts on air quality, mobility; issues related to social participation in an integrated manner so as to allow communication with the user.

Designing a smart city means first of all to reorganize the city in developing intelligent systems for resources on demand: the ability to provide service to the citizen when he really needs it.

This design provides a new balance between space, people and technology: citizens not only benefit from some services but also become the main actors in improving the efficiency of urban systems. The transformation process must revolve around a task force synergistic in which public bodies, companies, citizens, banks, research institutes; universities work together to define a new model of sustainability is based on technological interventions, but also on consumer habits virtuous. In this collaboration, one must be clear about its role: the government must have good project management skills, able to manage new technologies and build relationships with all stakeholders, should facilitate the implementation of interventions by streamlining the bureaucracy and establishing partnerships with private entities.

The role of politics in change is crucial: first technologies, you groped to all converge towards common goals and to try to retrieve the responsibility of mediation, which is to find a common ground of meeting between the potential and the needs of citizens. ICT must therefore ensure access to services and improving the quality of life in general, should make life easier for citizens.

In city management in smart key, it is essential to change the approach from a traditional "administrative" to a "management" model: in the center of the system there is no more public; in the center of the system there is smart city working with central agencies, private operators, institutions and partner and acting as hub interconnection to meet the needs of citizens in terms of safety, health, economy, environment, transport.

The local authority must consider not only manage the available resources at the local level, but will also be able to find such new order to give an answer to the various systems (safety, health, economy and environment). The first step is therefore to deal with the analysis and description of the dynamics of urban landscapes, made possible thanks to the large amount of information and data collected with digital technology. This is done not only by environmental sensors or small computers included in the urban environment, but also through digital devices such as mobile phones: you can pick up patterns of movement of people and vehicles through mobile phones with GPS devices to display using spatial and social development of streets and neighborhoods. Mobile phones are in the pockets and bags of everyone regardless of socio-economic classes and in all continents.

Each city must work on itself, setting strategic goals based on their personal starting conditions: to know the local situation, needs and weaknesses. For example, Italy is well aware that one of his main deficits is represented by the digital divide and moved in time to improve its performance.

This is a comparison between supply and demand: on the one hand demand understood as information about people, companies, the state of the buildings, and on the availability of municipal services, the safety of the road system, and second supply agreement as an interpretation of the database of heritage, environment, networks, accessibility, services, and urban system. Comparing the supply and demand determines a critical assessment and intervention policy to be adopted. In this first phase, an analysis of the characteristics of the territory, the expectations of business and citizenship, the estimate of what realistically can be achieved in a consistent time, the city will have to define a characterization of this and develop an operational strategy. Based on the strategy will be declined individual actions and identified projects that will bring the expected benefits.

From what emerges, at least in our country, there are many projects active smart but can not be said that there are many smart cities because it lacks an integrated organization at the central level. In this first phase of the directors must be supportive and stimulating the productive fabric, providing a correct address based on the characterization of the city. The second phase involves the development of a strategic plan and a road map: Objectives should be quantified and shared among all shareholders; we must identify a set of indicators to monitor the project, measure the components, taking into account the progress made of positive and negative feedback. The model outlined will proceed through a series of immediate, concrete solutions that lie in the strategic plan and staff that the City has developed in collaboration with the Province, the Region and other relevant institutions. Initially the solutions should be simple and able to realize in a short time with a limited use of resources of the results immediately verifiable by all.

The City will coordinate the activities and partners with the aim of optimizing the available resources and attract new ones: only after transferring the value of innovation to the area, you can improve the quality of life of the citizen, provide new services to businesses and acquire the general consensus.

4. THE INTEGRATED TRAINING

To support the smart city is training and integrated: it must be noticed that at present there are numerous cultural operational and procedural delays especially related to public administration. Comes the need to address this point through two approaches: the first consists in 'insert breaking elements such as young people, who bring new ideas and have a different way of analyzing and assessing the situation, a new point of view, the second more difficult it is to work for change on those who are already in the system and "train them." The focal point is the necessity, possibility, the need to use innovation to improve the quality of spaces and urban services: the means of achieving this goal is a strategic plan, which is shared by all the actors, a strategy that is subsequently hierarchical to have a guideline on what to take.

Training is without a doubt the main strategic lever to be used for the development of smart city: remains to be seen how, on what content to bet, where to turn.

First, the process must be integrated: coordinate and structure the various actions to be taken to prevent leakage, wastage, and to move away from the joint. The project must take place simultaneously to two different directions: on the one hand on the formation of new professionals who know how to guide and govern the processes of development of the smart city, and secondly to adapt the instruments of public and private enterprises to produce ad hoc advisory services for the realization of smart city programs. The initial situation shows that despite the city are active in the involvement and public awareness to educate them to behaviors and sustainable lifestyles, the results are still valuable: it is noted, however, a decline in public transport passengers, stagnation waste collection and air pollution still problematic. To change the state of things, the need to integrate environmental and urban sustainability under a single heading, cross with one goal, these policies must be provided with financial resources, but also human resources and knowledge to grow this social capital and adjust the bureaucracy to change. The public administration must be the first to take a step in this direction: in fact too often the development of a country is blocked by governance that does not reveal itself to the task. Main steps of this process: revision and simplification of administrative procedures and government, a suitable instrument; innovations to contribute to the modernization of public administration.

The public administration must pursue three objectives:

1. consolidate the organization of public and mains operation, fostering collaboration between business and state and ensuring continuity processes launched;
2. guarantee levels of expertise and professionalism appropriate so that also promote the integration of economic considerations and social environment;
3. support the growth of entrepreneurial initiatives can create job opportunities and income in the environmental sector by providing the right support and training other actors involved in the project.

To achieve these objectives, it's necessary a management training ad hoc formation of a specific professional sector, a form of assistance to the creation of smart city.

5. THE INFORMATION SOCIETY

The information society is a new environment, socio-economic, in which the ability to appropriately use information technology has become a necessary skill: nowadays, thanks to the spread of information technology, office work is greatly facilitated. This evolution has had unthinkable consequences: most of the information and knowledge on a subject can be generated or reproduced in a very short time and at low cost, timely and reliable information in the data base have led to a considerable simplification of the processes inside companies (CRM, ERP, MRP), companies can communicate with each gaining significant issues in terms of efficiency and productivity. The efficiency of this system is evident in the improvement of the activity in terms of increased productivity, cost control and assistance in corporate decisions. To achieve these goals, however, we must invest in technology in order to obtain an efficient integrated system, and know-how, since very often the user is not able to fully understand the capabilities of a new information system. In fact, the productivity gains or cost savings of time depends much on how users know how to use the tools, but also on how structure and re-organize their work because of them. At the base of all, however, there must be an awareness of the investor: you must understand the need to provide their own company, his own studio, advanced tools, updated, supplemented by considerable potential, those who decide to bear the costs of implementation, understands that these costs are fully justified and "amortized" over the years in terms of economic growth and structural stability.

The figures speak for themselves: the ICT sector is the biggest contributor to GDP; ICT intensive companies present rates of annual increases of above average productivity, the high proportion of IT investments made by businesses every year. Sectors such as banking, insurance, education, publishing, for which the production and management of information is vital, must invest more in ICT training of personnel. Here again, the data are helpful: according to research carried out by the EU, the training is very under-rated, leaving prevail self-directed learning and help to connect more "technical". ICT is not only an instrument of individual productivity, but it fits in companies at all levels: from mail management process of selecting a supplier, the computer should become a language comprehensible to everyone, because it allows you to

interact with the world and have everything we need in the pocket through our smart-phone, or briefcase through the PC. Unfortunately, spending on education does not produce immediate and tangible return on income for the period: companies do not prepare training programs for their employees, but, paradoxically, require that they should know how to use the tools. The same information even ignorance has a price: the lack of proper training can produce hidden costs in terms of lower productivity, failures and misuse of technological infrastructures. Inside the container smart city we hear a lot about technology, but little of the contribution of technology to the welfare of the citizen are often the cause of stress, anxiety, because it is wrong the initial approach.

As pointed out by Carlo Giovannella at the Smart City Exhibition in Bologna, we forget that the city is populated by people, individuals who do not believe that quality of life is reduced to the optimization of consumption: a citizen is smart as well as having learned the techniques of optimization, feels satisfied from many points of view because the smart city supports its needs and expectations.

6. CONCLUSIONS

The conditions of life of a city, small or large, depend not only from the physical infrastructure but also by factors such as environmental and cultural capital: these parameters are not measurable by GDP but which it has a strong parallel in the life daily. Globalization, the economic crisis would be more easily solved if we had behind us a competitive city, which pays particular attention to cohesion in the dissemination and availability of knowledge, freedom and quality. Innovation is necessary in times of crisis and the debate on technology must involve not only professionals, but also administrators to become the political debate for excellence. There is no universal model: we must develop innovative models cross, measurable, replicable and flexible, it is important to evaluate each situation and particular solutions. To achieve these objectives it is necessary to develop the parameters to measure the progress made; naturally to each area will be applied a set of indicators differently depending on the need. These protocols or standards will be adopted later by all the cities that wish to innovate, simply follow the path of best practices already in place.

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A DEPENDABILITY ANALYSIS OF SMART CARDS FOR BIOMETRIC AUTHENTICATION

Kensuke Baba and Serina Egawa
Kyushu University
Fukuoka, Japan

ABSTRACT

This paper conducts an analysis of dependability of smart cards for biometric authentication. Dependability is an important factor for evaluating social infrastructure systems, and suitable formalizations of dependability are required from various aspects. This paper formalizes a kind of dependability of smart cards for biometric authentication on the basis of leakage of confidential information. As an example of evaluation based on the formalization of dependability, this paper examines the effects of preventing leakage of biometric information from smart cards on accuracy of authentication with practical palmprint images. This evaluation gives a trade-off between dependability of smart cards and efficiency of the application system of smart cards.

KEYWORDS

Dependability, smart card, authentication, personal information, palmprint.

1. INTRODUCTION

Smart card has been an essential technology in many social infrastructure systems such as ATMs and ticket gates for transportation facilities. In addition to efficiency such as the processing time of smart cards, dependability is an important factor for evaluating such social infrastructure systems. In order to estimate dependability of systems, a suitable formalization and a quantitative evaluation are necessary.

A simple idea of dependability of smart cards can be defined by considering leakage of confidential information stored in a smart card. At the system LSI level, the difficulty to access a particular memory can be controlled by setting physical obstacles, applying scrambling or cryptography (Lie et al, 2000), and so on. However, applying such a measure to prevent information leakage might lead some inconveniences. For example, some researchers point out a conflict between this kind of dependability and the testability of circuits (Rosenfeld and Karri, 2012). We focus on the effects of preventing information leakage on the efficiency of smart cards at the application level rather than the system LSI level.

Personal authentication is one of the simple and essential applications of smart cards, and especially a combination with biometric authentication is expected to compensate some weaknesses of token- and knowledge-based authentication (Jain et al, 2011). We consider personal authentication with biometric images as the application of smart cards and the accuracy of authentication as the criteria of efficiency. The goal of this paper is showing the relation between the difficulty of information leakage and the authentication accuracy as an example of a trade-off between dependability and efficiency of a system.

In this paper, first, we formalize personal authentication by smart cards with biometric images and accuracy of authentication. Next, we define an idea of dependability of smart cards by considering the possibility of personal identification by leaked biometric information from the smart card. Additionally, we conduct experiments of authentication and identification with practical palmprint images. The relation between the two values can be regarded as a trade-off between dependability and efficiency of the system.

2. PRELIMINARIES

Assume that any biometric image corresponds to a person. Personal authentication with biometric images (called *authentication*) is verifying that the target person is a particular person. The input of authentication is a pair of an image and the name of a person, and the output is "accept" or "reject".

The players in authentication with a smart card system are a smart card, an authentication system, and the person who want to use the system. The smart card has a biometric image for authentication (called a *template*). The authentication system can capture a biometric image for authentication from the person. Then, the straightforward protocol of authentication is defined as follows.

1. The authentication system reads the template from the smart card and captures a biometric image from the person,
2. The authentication system compares the template and the captured image and judges "accept" or "reject".

As an idea of accuracy of authentication, we consider the standard error rates of verification. The *accuracy* of authentication is the difference of the equal error rate (EER) from unity.

3. FORMALIZATION OF DEPENDABILITY

The idea of dependability of a smart card is defined by the possibility of identification of the person by biometric information leaked from the smart card. Assume that the attacker tries to steal the template from a smart card and identify the person, and the identification is conducted with a list of pairs of a biometric image and the name of the corresponding person. That is, the input of the identification is an image and the output is the name of the person judged to correspond to the image. Then, the possibility of identification is the rate that the person of the output equals to the person of the input image. The output can be "null" if the image is judged to correspond to no person in the list. The *dependability* is the rate that the identification with a stolen image by the attacker fails.

4. AN EXAMPLE OF EVALUATION

The accuracy in Section 2 and the dependability in Section 3 are examined with practical palmprint images.

4.1 Algorithms for Authentication and Identification

We consider a matching of features extracted by Scale-Invariant Feature Transform (SIFT) (Lowe, 1999, Lowe, 2004) for the comparison of palmprint images. SIFT translates an image into a set of key points and each key point has a vector as its feature. The similarity of two palmprint images is defined on the basis of a straightforward matching of the key points as (Egawa et al, 2012). The samples of palmprint images were taken from PolyU Palmprint Database (http://www.comp.polyu.edu.hk/~biometrics/).

In order to define the amount of information that affects the accuracy and the dependability, we consider multiple biometric images conceptually instead of a single image, that is, we examine the accuracy for different numbers of templates in authentication and the dependability for different numbers of input images in identification.

First, we examine the accuracy of authentication with the palmprint images. For k templates, we consider two algorithms of authentication. The *at-least-1 algorithm* is

1. Compare the input image with the k templates;
2. Output "accept" if at least one similarity in the k similarities is larger than a threshold, and "reject" otherwise.

The *mean algorithm* is obtained by replacing the word "at least one similarity in the k similarities" in the process 2 with "the arithmetic mean of the k similarities".

Next, in order to examine the dependability, we consider two algorithms of identification for k input images. The *nearest algorithm* is

1. Compare the k input images with each image in the list, and find the image whose similarity is the largest in the list;
2. If the largest similarity is larger than a threshold, then output the person of the image, and "null" otherwise.

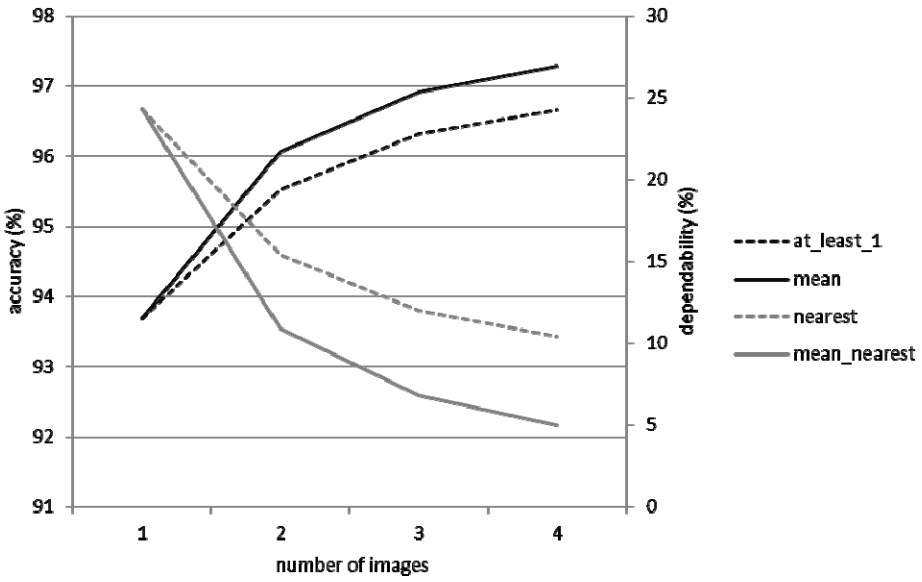

Figure 1. The accuracy of the at-least-1 and the mean algorithm where the number of templates is 1, 2, 3, and 4, and the dependability of the nearest and the mean-nearest algorithm where the number of input images is 1, 2, 3, and 4.

The *mean-nearest algorithm* is

1. Compare the k input images with each image in the list and compute the arithmetic mean of the k similarities;
2. If the largest value of the arithmetic means is larger than a threshold, then output the person of the image, and "null" otherwise.

4.2 Trade-off between Accuracy and Dependability

The sample set contains 1,200 images that consist of 150 persons with 8 images for each. We separated the sample set into two sets of 150 × 4 images. An experiment was conducted with one set for templates and the other set for input images, and repeated with swapping the two sets. Additionally, the number of templates for authentication and the number of input images for identification were respectively changed to be 1, 2, 3, and 4. Hence, for an experiment with k images, ${}_4C_k$ kinds of combination were considered. Therefore, any value in the experiments is the arithmetic mean of the results for ${}_4C_k \times 600 \times 2$ trials.

Figure 1 shows the accuracy with the two authentication algorithms and the dependability with the two identification algorithms. When $k = 1$, the accuracy of the two authentication algorithms was 93.68% and the dependability of the two identification algorithms was 24.27%. When $k = 4$, the accuracy of the mean algorithm was 97.28% and the dependability of the mean-nearest algorithm was 5.00%. Those results mean that by using a biometric image that equals to four palmprint images in the sense of an amount of information as a template, authentication with the accuracy 97.28% can be achieved, and an attacker can identify the person with the error rate 5.00% (on the assumption that the attacker has information that equals to the list of biometric images and the corresponding persons in the authentication system).

5. CONCLUSION

We formalized a kind of dependability of smart cards for biometric authentication on the basis of the leakage of confidential information. Additionally, we examined the effects of preventing the leakage of biometric information from smart cards on accuracy of authentication with practical palmprint images. By the results, we obtained a trade-off between dependability of smart cards and efficiency of the application system of smart cards. The results can be a factor to decide the kind and the strictness of the measure to prevent information leakage for smart cards. More detailed relation between the number of palmprint images and the accuracy of personal authentication can be obtained from (Baba and Egawa, 2013).

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SHOULD SOCIAL NETWORK USERS BE CONCERNED ABOUT PRIVACY ISSUES?

S. Srinivasan
Professor of Information Systems
Texas A and M International University
Laredo, TX 78041, USA

ABSTRACT

Social Networks have become very popular around the world. Young people overwhelmingly use Social Networks for their communications with friends and relatives. In the use of Social Networks the dominant consideration appears to be ease of use rather than any privacy concerns. The Social Networks themselves did not make it easy to monitor privacy settings. As far as the Social Networks are concerned their policies with regard to privacy seem to be still evolving and they have resorted to frequent changes to the way they treat privacy settings. Surveys have shown that users are unaware of the potential vulnerability that their personal information could be released accidentally. Such incidents have resulted in dire consequences, including death. Our analysis shows that technology solutions alone are not enough, users must be aware of how a break in security settings could happen. In this paper we address the vulnerabilities faced by users and how they could take proactive steps to protect their personal information.

KEYWORDS

Social Networks, privacy, security, personal information, trust, awareness

1. INTRODUCTION

Social Networks are widely used around the world. Today, Facebook alone has over a billion members around the world. There is a common perception that Social Networks are used extensively by young people overwhelmingly. In this paper we use the terms Social Networks and Social Media interchangeably. Even though a large number of people in this age group use Social Media, based on statistics from United States, the largest age group of Social Media users is 35-44 (Pingdom, 2012). In fact, an overwhelming number of Social Media users are over 35. For people in the age group 0 to 24, the percent of users is only 24. Another surprising finding from this survey is that there are more users in U.S. in the age group 55-64 who use Social Networks than the age group 18-24. Figure 1 provides further details on the age group decomposition of Social Media users in U.S.. However, the situation is vastly different in Europe according to comscore.com research (Comscore, 2012). In Europe, the age group 15-24 is quite dominant in the use of Social Media. They account for 27 percent and the age group 25-34 account for 24 percent. Thus, over 50 percent of Social Media users in Europe are very young. According to various surveys, the three most popular Social Networks are Facebook, Twitter and LinkedIn. An analysis of the user demographics for U.S. in these three sites shows that 61 percent of Facebook users are over 35 and the corresponding percentages for Twitter and LinkedIn are 64 and 72 (Pingdom, 2012). This statistics shows the alarming trend that even mature people do not consider the importance of protecting their privacy when it comes to using Social Media. Later in this paper we will focus on this aspect further to look at the reasons.

The well respected Pew Research Center's survey of Global Attitudes concerning the use of Social Networks in 2011 found that in developed countries 40 to 50 percent of people use Social Networks. This is particularly important for us to note since we are focused in this paper on the awareness and protection of privacy of information. Table 1 summarizes the percent of Social Network users in developed countries. The results in this table show that, except for India, countries in North America, Europe and Asia all have adopted Social Networks in a significant way. Even in the case of India the percentage is based on a very large

population and so the number of users is really significant. Given this fact it is important for Social Network users to be aware of the type of protection their personal information is afforded or lack thereof.

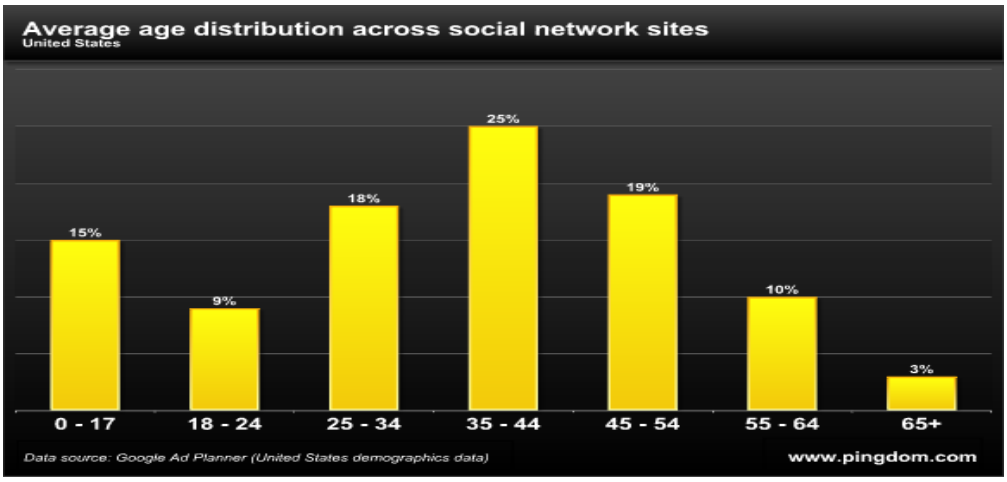

Figure 1. Age range for Social Network users
Source: Google

Table 1. Popularity of Social Networks by Country

Country	Popularity of Social Network
Israel	53%
United States	50%
Great Britain	43%
Russia	43%
Spain	42%
Poland	39%
Germany	35%
France	35%
Japan	29%
India	5%

We have looked into how users weigh heavily the ease of use aspects compared to security aspects. There have been well publicized incidents where some confidential information was released accidentally because of the use of Social Networks. For example, in 2012, at a leading institution in Texas two new members were welcomed to their musical group, the Queer Choir. There is an implicit meaning that one could easily attribute to the members of this choir based on the term “queer.” The President of Queer Choir introduced the two new members to his Facebook friends. An announcement that went out in this regard through Facebook reached the parents of both the two new students. The parents were shocked to find out that their children were gay/lesbian. In this case the two students had protected their sexual preferences from being known to others. Unfortunately, the notification aspect of Facebook reached beyond the immediate circle of friends and caused irreparable damage to the two students. This is a clear case of Social Network settings not providing the level of privacy protection that is expected of in all other types of communication.

In the rest of the paper we will address privacy and security aspects and see how technological solutions can facilitate trust building in Social Networks. In this context we will look at some of the best practices that people could follow in the use of Social Networks.

2. PRIVACY AND SECURITY

People tend to provide personal information on a voluntary basis. The author has surveyed over an extended period of time several people in the age group 18 to 24 about their perceptions of privacy and security in the use of Social Networks. The author is noticing a slight shift in attitude towards Social Networks with regard to the possibilities and limitations on these networks. In a survey of 55 college students in November 2012 the author noticed that 75 percent were aware of the way to use the privacy settings in Social Networks and 85 percent of them used these settings effectively. This attitudinal change that is being noticed differs from the earlier observation that Social Network users paid more attention to ease of use rather than privacy protection (Srinivasan, 2012b).

Another issue to be dealt with in privacy protection is the level to which users would allow third party applications to run on their system. We present a typical scenario where carefully planned privacy settings could be thwarted. The user runs a third party application which poses an innocuous looking question: Which 70s movie reflects you? With or without the user noticing, this application would require permission to navigate all of the user's friends in order to find the answer to the question. In so doing the app has obtained access to the full list of friends which the user might have planned to restrict with their privacy settings. In the same vein, a posting such as "Five things about me that you might want to know" that a user posts for the benefit of friends could backfire as follows: The user might state "My cat is Myra" and "I attended Valley High." The chances are high that the user might have used these as answers to their selected questions in a bank web site. By releasing this information to others someone in the extended circle of friends could abuse this information and steal one's identity. Yet another security violation could occur when a user posts "I am looking forward to my European vacation next week." An untrusted acquaintance could use this information to note that the user will be away from home and could rob (Srinivasan, 2012a). These are not hypothetical scenarios. People have fallen victims to activities such as these.

Ease of disclosure in location information is another major source of both privacy and security violations. Many people use Social Networks on their cell phone and cell phones have their GPS feature enabled. When a user reaches a particular place, say a place of entertainment in the evening, all their friends get an alert that their friend is at this location. The good intent here is to let the friends know so that they all could congregate there. Unfortunately, the same feature could disclose that the user is in a red light district in a city causing embarrassment to the user. In this particular instance the real point to note is that Social Networks work with multiple third party services and there may be built-in ways that may be beyond the scope of the privacy settings that a user could control. Even though we have highlighted a problem with location information disclosure, many of the Social Network users extensively use this feature. Our survey does not show that users are seriously worried about this aspect.

3. TECHNOLOGY SOLUTION

Technology can provide many types of solutions to address some of the privacy and security concerns of Social Networks. One should not get into a false sense of security hoping that technology will provide the necessary checks and balances to protect individual privacy. For example, the distribution of location information could be limited to a select group of friends by a user instead of to all friends. In understanding the possibilities of technology solutions, we should first know how pervasive the deployment of user devices is and their capabilities. In this regard we analyzed the data on GDP per capita and the use of social networking worldwide. Even among developed countries the use of Social Networks varied significantly. The surprising statistic is that among the developing countries, India with a sizeable population of people with access to Social Networks, is not taking advantage of Social Networks. Figure 2 shows the use of Social Networks in various countries based on the GDP.

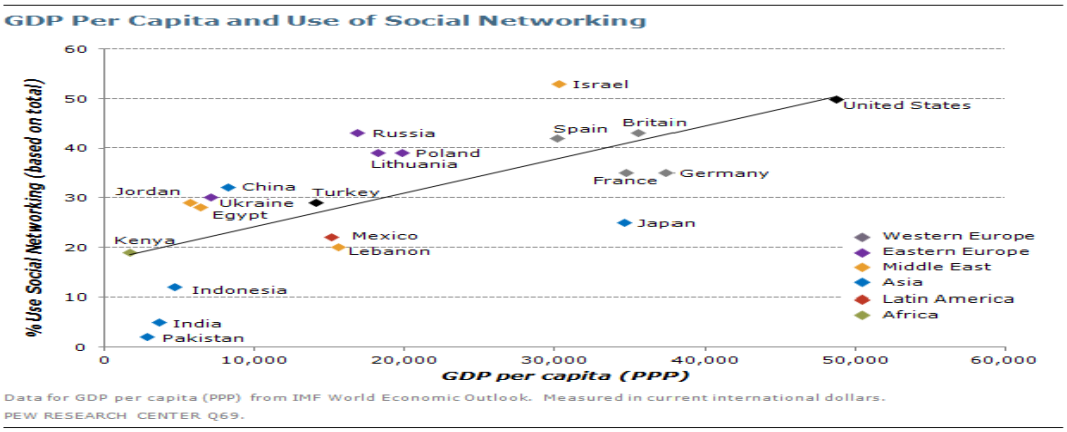

Figure 2. GDP Per Capita rate and Social Network Use across countries
Source: Pew Research Center

In a recent analysis of privacy issues arising out of Social Networks, IEEE Spectrum (Willyard, 2011) highlighted the experiences of a young doctor. The incidents cited in this report are typical of how information falls in the wrong hands. All users have the ability to protect such information through the use of passwords. A new trend has emerged among investigators, employers and academic institutions to demand from the applicants their Social Network userid and password. Afraid of reducing their chances for the benefit they seek, many consumers tend to share their Social Network userid and password with the organizations. This practice violates the basic ethical and moral principles. In Maryland, Illinois, California and Delaware legislations have been passed that prohibit this practice of demanding Social Network userid and passwords. However, people unwittingly open up their information through the use of devices such as cell phones and iPads. These devices support the 'always on' feature and users keep their accounts logged in. When such devices are left unattended or lost they expose their personal information without their consent. In this context a simple technological solution such as entering a PIN or a biometric authentication is within reach of today's technology and should become a standard feature on such devices.

4. BEST PRACTICES

Social Networks are here to stay. Their popularity is increasing among all age groups and their use is widespread. Given these realities, it is only prudent for users to follow certain best practices that would help protect their personal information. In this section we identify several such best practices. First and foremost people should exercise their option to befriend people on Social Networks. Users set their initial circle of friends and very soon this circle gets enlarged by constant requests from friends of friends. Many people feel uncomfortable to reject a request from a friend of a friend simply by the nature of the initial contact. This is at the root of many information leakage problems. Many people disclose personal information about themselves on Social Networks for the benefit of their close friends. Such information includes address, phone number, email, date of birth, marital status and employment. Some additional information such as political beliefs and sexual orientation come out of discussions that people engage in with their friends. When people closely monitor their circle of friends they can avoid embarrassment or harmful revelations. However, this is very difficult in Social Networks since a slip up by any one member in the circle of friends could compromise this chain. For this reason users should look for ways to check the reach of their communication. Social Networks such as Facebook and Twitter do not have an easy way to verify this for users among their close circle of friends. As these networks mature there would be a way to identify the list of people who would be part of any information distribution. Another option is to protect some of the information listed above. One alternative is to list the landmarks near the place of residence rather than list the address since the mapping software can still find such landmarks. In the case of date of birth, usually the year of birth is not that important to friends and so that could be suppressed.

One of the biggest problems faced by Social Network users is the sharing of photos. People are eager to share their good experiences with close friends. However, they lose control when others start sharing the photos available to them. Controls available through Social Networks should facilitate a person posting a photo to limit or restrict sharing. Such a control is not available today. When people unintentionally post a photo thinking that it is funny is actually putting at risk the future of someone shown in the photo. Many employers and governments are constantly checking Social Networks to see if there are any incriminating photos concerning an individual who might be an applicant for a position. Revelations on Facebook have derailed the careers of several people.

Two other best practices to note are that people should realize that relationships are dynamic. For this reason one not should feel pressured to accept requests on Facebook to let a friend of a friend join the circle of friends group. Each user must evaluate their familiarity with an individual before including them as a 'friend.' The author has noticed a common abuse in LinkedIn where spam emails go out to many users using the address books of several users. In this context the recipient would notice that the request to befriend came from a familiar person. Yet, the user has to weigh the risks before adding anyone to their network of friends. On many occasions users are duped by truncated web links known as obfuscated links. Instead of trusting obfuscated links users should be familiar with the process to verify the authenticity of such links using www.longurl.org or www.longurlplease.org .

5. CONCLUSION

Social Networks have simplified the communication capabilities among billions of users around the world. They have the great potential to make people happy with constant communication among friends and relatives. This capability has also become a bane to many users in that their personal information gets leaked to unintended users. We have highlighted the capabilities as well as the problems associated with Social Networks. Our discussion shows some best practices that users could follow in order to protect their privacy. Also, there are legal protections that are available that we have pointed out so that people are aware of their rights when it comes to protecting their privacy. The privacy protection is an evolving attribute and one way to gain greater acceptance by the general public is to educate the people about it. In the years to come as more people reap the benefits of this technological revolution more alternatives will also evolve that will facilitate protecting privacy.

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EXTENDED CROWDS WITH ADJUSTABLE RECEIVER ANONYMITY

Raphael Wigoutschnigg, Peter Schartner and Stefan Rass
Alpen-Adria-Universität Klagenfurt
Universitätsstraße 65-67, 9020 Klagenfurt, Austria

ABSTRACT

The loss of anonymity in modern communication systems is a major problem for many people. To escape the global tracing, protocols for anonymous communication were invented. Based on the Crowds system, a protocol for anonymous communication is presented, which has the characteristic that the initiator of a communication is able to affect the anonymity level of the receiver's identity. The virtual anonymous channel is built using the Crowds system and secret sharing techniques.

KEYWORDS

Crowds, Receiver-Anonymity, Secret Sharing

1. INTRODUCTION

The loss of anonymity in modern communication systems is a major obstacle for the acceptance and adoption of many services in the internet. Nearly every action leaves evidence on many places. Just think about the situation when you are searching for some diseases with your web-browser. No matter if you are using an "incognito" or "private browsing" mechanism, a lot of nodes on the internet notice your actions (e.g. by forwarding TCP/IP packets). If you are using one of the big search engines the site-operators know what you are searching for. Furthermore, browsing on websites that use plugins like "Google Analytics" or "Facebook-Plugins" also reveals some information about the user. Those plugins are loaded immediately and Google and Co. know at least your IP address and the website you are currently visiting.

One of the first protocols for anonymous communication was invented in 1981 by David Chaum [1]. His so called *Mixnet* system targets the problem that communication by email is far away from being anonymous. So he had the idea to use some kind of network-based mixing protocol to hide the sender (or also called *initiator*) from the receiver and of course from other curious subjects. His protocol uses public-key-cryptography to achieve this. As the central part, the initiator encrypts the sent data with the public keys of some chosen proxy servers (called mixers). Without passing all this mixers in the predefined order the data cannot be read and the receiver cannot be found because the routing information is also stored inside the encrypted packets.

The Mixnet system was later improved by M. Reed and P. Syverson and was published as the *onion routing protocol* [4]. In this approach the main idea of the Mixnet system remains the same, however Reed and Syverson addressed another use case. The protocol should not only be able to transmit emails like the Mixnet system does but also to transmit arbitrary TCP-streams. In contrast to Chaum's Mixnet, onion routing uses this protocol only for setting up a virtual channel. After the channel is established, data can be sent through it in both directions. One practical implementation of this idea is the TOR system [3].

Another approach was used by Reiter and Rubin to build an anonymity protocol [8]. The idea is to hide within a larger set of indistinguishable (in terms of behavior) "suspects" to achieve anonymity for the initiator of a communication. Data packets are sent randomly through the network until one of the involved nodes terminates the communication by sending the data to the receiver. A drawback of this system is the fact that the identity of the receiver is only weakly hidden.

The aim of this paper is to present a protocol, which is based on the Crowds system but provides adjustable receiver anonymity at the cost of higher network overhead during connection setup. This paper

does not cover in detail (packet definition, timeouts and so forth) how a virtual channel is being composed, but sketches the basic idea of the introduced concept.

2. NOTIONS

It is useful to emphasize the difference between a *sender* and *initiator*. An initiator is someone who starts a communication, whereas a sender is anyone who sends or forwards data packets. Every initiator is a sender according to this definition, but not every sender is an initiator of a communication channel. Moreover, the receiver is the designated the end-point of the communication.

An *anonymity set* (according to Pfitzmann/Hansen [5]) is the set of all possible subjects (e.g. a process, an individual or the like) which could have done a specific action (e.g. receiving of a message). Receiver/initiator (or sender) anonymity means that the receiver/initiator cannot be identified within the receiver/initiator anonymity set. *Unlinkability* means that for two items (objects or subjects) it is not possible to find any relationship between them. A node N_0 is called *predecessor* of N_1 if N_0 sends data to N_1. In this situation N_1 is called *successor* of N_0.

In this paper, we consider two different attacker models. One is the passive adversary which is an attacker who has the ability to compromise up to k of n nodes of the network. This attacker adheres to the protocol and tries to get knowledge about the receiver/initiator by processing the data in his possession. On the other side there is the active adversary, who is free in his actions and can actively change, create or delete packets.

3. CROWDS SYSTEM

The Crowds system was invented in 1998 by Reiter und Rubin [8]. The main idea was that the individual nodes (called *jondo* – John Doe) should hide within a larger set (*crowd*) of nodes. After setting up a virtual channel, a randomly chosen jondo will communicate with the receiver on behalf of the initiator.

To start the connection setup, the initiator I randomly chooses a jondo (potentially even himself) J_0 and sends the data peer-to-peer encrypted to this jondo J_0. The jondo J_0 throws a biased coin and sends the packet with a probability $0.5 < p$ (system wide parameter) to another randomly chosen jondo J_1 (also peer-to-peer encrypted) or with probability $1 - p$ to the receiver R whose identity is stored in the packet. The receiver R is not necessarily inside the crowd (e.g. a HTTP-webserver). Because of this path building mechanism, the initiator cannot choose the path. The path, beside the first jondo, is chosen by the network. Because every jondo decides with no prior knowledge by throwing a biased coin, the length of the channel cannot be fixed (limited) by the initiator and is a random variable. On average, the virtual channel consists of $1/(1-p)$ TCP-connections (the mean of the geometric distribution).

The Crowds system provides initiator anonymity because neither a jondo nor the receiver can decide if its predecessor is the initiator or just another intermediate node. On the other hand the identity of the receiver is only weakly hidden because every jondo that gets the data for retransmission has to know the identity of the receiver. Otherwise it would not be possible to finish the connection setup by sending the data to the receiver. Thus, if the virtual channel consists of only one attacker, the identity of the receiver is revealed. The probability of being successfully attacked depends on the network size and the number of attackers. In general both parameters are out of scope of the initiator.

4. CROWDS WITH RECEIVER ANONYMITY

In this section a protocol is given which uses the Crowds system to gain adjustable receiver anonymity.

4.1 Basic Protocol

The basic idea for this protocol was published 2011 by Rass et al. [6, 7] and will be improved in this section. This protocol uses the Crowds system and secret sharing mechanisms to achieve receiver anonymity at the

cost of a more expensive connection setup phase. The network consists of n jondos like in the Crowds system where the receiver is part of the network unlike in the original Crowds protocol. At first, the initiator choses $r + 1$ so called *routing jondos* ($R_0 = I, R_1, \ldots R_{r-1}, R_r = R$) where the routing jondos $R_1, \ldots, R_{r-1}$ are chosen at random. This routing jondos will be used to hide the receiver in a similar way as in onion routing. The initiator I is defined as the first routing jondo, because he acts the same way as all other routing jondos do. The same holds for the receiver. The initiator I sends data to the first routing jondo R_1. This data, including the identity of the next hop R_2, is not sent in one piece to R_1, but is split into $t + 1$ parts using XOR-sharing. All shares $s_1^{(0)}, \ldots, s_1^{(t)}$ are sent to R_1 using the Crowds system. After R_1 gets all shares, it can combine them to get the data $s_2^{(0)}$ and the identity of the next hop R_2. In the next step, R_1 sends the received data $s_2^{(0)}$ to R_2. The initiator itself sends t shares $s_2^{(1)}, \ldots, s_2^{(t)}$ that are consistent with $s_2^{(0)}$ to R_2, so R_2 again gets $t + 1$ shares and can proceed in the same way as R_1 did. This is done until the receiver R gets his designated shares (see Table 1). Using a special value (for simplicity the value *null*) for the next hop field the receiver knows that he is the addressee of the communication. Additionally, the receiver gets a certain amount of data d (payload). The way the shares are combined can be seen in Table 1. The virtual channel for further data transfer consists of the connections between the routing jondos.

Table 1. Forwarded Messages without Padding ($t = 1$)

Routing Jondo	Data retrieved
R_1	$R_2 \,\|\|\, s_2^{(0)} = s_1^{(0)} \oplus s_1^{(1)}$
R_2	$R_3 \,\|\|\, s_3^{(0)} = s_2^{(0)} \oplus s_2^{(1)}$
…	
R_{r-1}	$R \,\|\|\, s_r^{(0)} = s_{r-1}^{(0)} \oplus s_{r-1}^{(1)}$
R	$null \,\|\|\, d = s_r^{(0)} \oplus s_r^{(1)}$

Example 1: An example with $t = 1$ and $r = 4$ is given in Figure 1. The virtual channel is built up using the routing jondos R_1, R_2, R_3 and finally the receiver $R_4 = R$ (solid line). The dotted lines are crowd connections which are only used to transfer shares from the initiator I to the routing jondos and will be closed after this transmission.

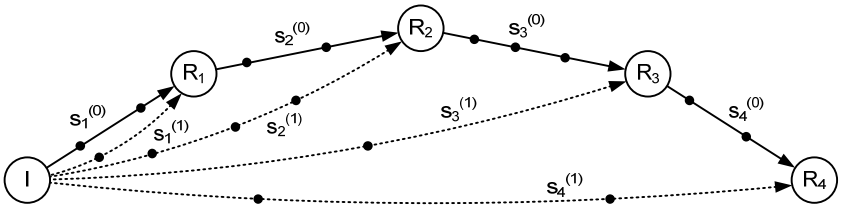

Figure 1. Connection Setup ($t = 1$, $r = 4$)

To avoid a decrease of the packet size caused by the omission of the next hop field, a special padding scheme is introduced. This padding can be computed by a pseudo random function $f(s_i^{(0)}, \ldots, s_i^{(t)})$, which depends on all incoming shares. For example, f can be defined as $f(s_i^{(0)}, \ldots, s_i^{(t)}) = s_i^{(0)} + \ldots + s_i^{(t)} \bmod p$, where p is prime and sufficiently large. The initiator is able to choose the additional t shares for the routing jondo R_{i+1}, so that the routing jondo R_{i+1} knows its successor R_{i+2}. Without the knowledge of all the shares that should reach R_{i+1}, it is not possible for an attacker to distinguish between the padding and random data. Because the initiator can forecast the contents of all shares a routing jondo sends to its successor, the initiator can simply choose his shares so that the routing jondos get the correct data after combining the shares. For an example, take a look at Table 2.

Table 2. Forwarded Messages without Pseudo Random Padding (t=1)

Routing Jondo	Data retrieved	
R_1	$R_2 \,\|\|\, s'_1 = s_1^{(0)} \oplus s_1^{(1)}$	
R_2	$R_3 \,\|\|\, s'_2 = s_2^{(0)} \oplus s_2^{(1)}$	$s_2^{(0)} = f(s_2^{(0)}, s_2^{(1)}) \,\|\|\, s'_1$
…		
R_{r-1}	$R \,\|\|\, s'_{r-1} = s_{r-1}^{(0)} \oplus s_{r-1}^{(1)}$	$s_{r-1}^{(0)} = f(s_{r-1}^{(0)}, s_{r-1}^{(1)}) \,\|\|\, s'_{r-2}$
R	$null \,\|\|\, d = s_r^{(0)} \oplus s_r^{(1)}$	$s_r^{(0)} = f(s_r^{(0)}, s_r^{(1)}) \,\|\|\, s'_{r-1}$

The identity of the receiver is hidden, because no routing jondo R_i knows if the next routing jondo R_{i+1} is the final receiver or only another routing jondo. The same holds for all other jondos that get shares for retransmission. To decide if a special routing jondo R_i is the receiver, an attacker has to get all shares that belong to R_i. This kind of scenario is possible but, depending on the setup, unlikely.

This protocol offers receiver anonymity against a passive adversary. Because an attacker has to get all $t + 1$ shares that belong to a routing jondo R_i for making a decision if this one is the receiver and the fact that the shares were forwarded randomly through the network (random walk), the probability of this scenario to get all this shares is about $p_A{}^t$ where p_A is the probability for a successful attack on one share (to get one share). An attacker gets one share, if he is part of the corresponding virtual Crowds channel. To lower the probability for a successful attack, the initiator has to increase the value t. A linear increase of t implies an exponential decrease of the probability for a successful attack. The value p_A depends on the number of compromised nodes and the network size.

4.2 Improved Receiver Anonymity

One mayor problem with respect to this protocol is the way of choosing the next-hop-field by the routing jondo that is vulnerable to an active attack (take a look at Danezis/Käsper [2]). It is easy for an attacker to decide if the next routing jondo R_{i+1} is the receiver. In place of choosing the next-hop-field like described in the protocol the attacker sets the field to $f(s_i^{(0)}, \ldots, s_i^{(t)}) \oplus A$, where A is the identity of one of the attackers compromised nodes. If and only if the next hop is the receiver, this node will send the data to A. This is because if the routing jondo sends the value $f(s_i^{(0)}, \ldots, s_i^{(t)})$ the receiver will get the value *null* as next-hop after combining all shares. When sending this bad next-hop field the receiver will get the value A and will send the packet to A. Thus, A can decide if the routing jondo R_{i+1} is the receiver.

Table 3. Forwarded Messages Improved Protocol (t=1)

Routing Jondo	Data retrieved	
R_1	$R_2 \,\|\|\, false \,\|\|\, s'_1 = s_1^{(0)} \oplus s_1^{(1)}$	
R_2	$R_3 \,\|\|\, false \,\|\|\, s'_2 = s_2^{(0)} \oplus s_2^{(1)}$	$s_2^{(0)} = f(s_2^{(0)}, s_2^{(1)}) \,\|\|\, s'_1$
…		
R_{r-1}	$R \,\|\|\, false \,\|\|\, s'_{r-1} = s_{r-1}^{(0)} \oplus s_{r-1}^{(1)}$	$s_{r-1}^{(0)} = f(s_{r-1}^{(0)}, s_{r-1}^{(1)}) \,\|\|\, s'_{r-2}$
R	$R_{rand} \,\|\|\, true \,\|\|\, d = s_r^{(0)} \oplus s_r^{(1)}$	$s_r^{(0)} = f(s_r^{(0)}, s_r^{(1)}) \,\|\|\, s'_{r-1}$

An attack is successful if the attacker can predict the value of the next-hop-field that the receiver will get. To avoid this problem, the protocol has to be changed in such a way that an attacker remains uncertain about this value. For that reason the attacker cannot change the next-hop-field in a way which leads to a successful attack. The packet format has to be changed. The new format includes the next-hop-field, a finished-flag and the payload. The finished-flag tells the routing jondo if he is the receiver. If the flag is set to *true*, the jondo does not look at the next-hop-field. If the flag is set to *false*, the jondo sends the data to the routing jondo whose identity is stored in the next-hop-field. To avoid the attack, the initiator selects the shares that he sends to the receiver in a way that the next-hop-field consists of random data (see Table 3). Without the knowledge of all shares which belong to the receiver, an attacker cannot manipulate its own share, so that the next routing jondo will send the data to a compromised routing jondo. All the attacker now can do is to manipulate a receiver to send the data to another unknown routing jondo (denoted by R_{rand}).

4.3 Reducing the Network Overhead

Another withdraw with respect to this protocol is the length of the virtual channel. Because the connection between two routing jondos consists of a Crowds system, the average length of the virtual cannel is $r \cdot 1/(1\text{-}p)$ TCP-connections. This can be reduced if the routing jondos R_i sends the packets directly to the next routing jondo using the Crowds system (this means $p = 0$). This should also be done by the initiator but with only one of the $t + 1$ shares he sends in the first step. The routing jondo R_{i+1} knows his predecessor but doesn't know if this one is the initiator (same reason as with the original Crowds system). The total length of the virtual channel reduces to r TCP-connections and can be controlled by the initiator.

5. CONCLUSION

This protocol gives an initiator of a communication the ability to hide the identity of the receiver by using the Crowds system and secret sharing mechanisms. This can be useful if it is of major interest that the identity of the receiver should stay unrevealed. This advantage is of course not for free. On the one hand, the communication effort in building the virtual channel increases, on the other hand the probability that the identity of the sender becomes known if the value *t* (number of shares sent by the initiator) increases. Due to the fact that the initiator sends more shares than the other jondos, this protocol is vulnerable to the so called *predecessor attack* (see Danezis/Käsper [2]). Especially the weakness against the predecessor attacks [9] has to be subject of further analysis to improve the protocol.

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RESEARCH ON TRUST MANAGEMENT MANNER FOR PEER-TO-PEER OVERLAY NETWORK SERVICES

Takeshi Tsuchiya[1], Tadashi Miyosawa[1], Hiroo Hirose[1], Masao Okuhara[1] and Keiichi Koyanagi[2]
[1]*Faculty of Business Administration and Information, Tokyo University of Science, Suwa, 5000-1, Toyohira Chino City, Nagano, Japan*
[2]*Faculty of Science and Engineering, Waseda University, 2-7, Hibikino, Kitakyushu City, Fukuoka, Japan*

ABSTRACT

In this paper, we propose and discuss the derived manner of trust quantifications among distributed environment on Peer-to-Peer Overlay Networks. It enables to provide several kinds of scalable and efficient services by collaborations of normal nodes without absolute servers. Telling more concretely, each trust of a node is derived dynamically by evaluations of interactions in some following viewpoints: quality, achievement, stability and so on. These results would be used as for trust-based peer selection or similar functions provided each services on overlay networks. As for the example of proposal manner, it is applied for routing on Chord, and clarifies its availability for node selections by simulation.

KEYWORDS

Node Trust, Distributed Environment, Routing

1. INTRODUCTION

The services constructed by distributed nodes such as P2P (Peer-to-Peer) would have some kinds of opportunities selecting some nodes for making service topology. Current distributed platform technology which composes logical spaces regards efficiency of service protocols importantly, and doesn't dispute their serviceability of each functions like status and ability of component nodes. The authors have been proposed the selection manner [1] for distributed platform technologies by integrative evaluations of component nodes based on the several kinds of factors evaluated system, network and load of each environments. Though our proposal manners calculates and make decision the selection of nodes based on the transient results from evaluations, there occurs following cases which don't select the effective nodes for services: One is selecting node which is unstable connection to networks or ambulate their environment time by time like mobile devices. The transient result only shows the status in that time. Another is selecting nodes based on the resemblances to ideal model calculated their ability and current load without importance of allocation and topology on logical networks. Therefore, selecting of nodes for service is not only the transient results of evaluation, but combination of transient one and continuative one like the history of received services. These combinations make node selection multilaterally, and make services efficiently.

This paper discusses and proposes the measurement manner for node trusty used on distributed platform technologies. The trust of nodes is measured following two steps: first is derived satisfactory of all interactions among nodes. And the next is measured node trust by compared total amount of interaction histories on each node. The histories of interactions would be one of important factor for the selection of nodes along with current transient evaluations.

The definition and satisfactions of node's interactions is difference demands on applied services and each node, for example, the selection policy for routing nodes as next hops and service management policy are so differ. And the satisfaction of interactions is also difficult. So that, service providers need to define interactions depends on their services, and all nodes related the service conform this definitions and policy. This way is notional and unrealistic way for distributed services and systems which don't have static absolute node. Therefore, the policy isn't taken into considering for satisfactions of interactions. Its satisfactions are only defined by achievement of interactions like its complement or interception. Each node cumulates these

satisfactions as history of interactions, and make them used as ”trust of nodes” by interactions. This manner only uses objective parameter, and would be made it generally. The trust of nodes is used for the node selections, and would be new continuative parameter for distributed platform technology constructed by the cooperation among nodes.

2. TRUST MODEL

This section discusses and define the “trust” for quantification of ”trust of nodes”. After that, this section clarifies the proposal manner in this paper.

2.1 The Definitions of “Trust”

The trust of a node from other nodes is defined and used in reference [3]. A well-defined semantics of trust is effectual for distributed service environment so that component user of service can avoid inconsistent and misuse use of node trust.

Here, the trust of node is taken in consider the distributed platforms, and it involves additional particular functions as follows. The derivation manner and mediation manner are important fundamentals for distributed environment among nodes. The trust of nodes would affect the service for this environment in composed by distributed nodes. However, the trust in performance is only taken into consider for distributed services firstly except for considering the trust in belief in this paper.

Quantification of node trust is categorized into three status of relationship characteristics from other nodes: ”trust”, ”untrust”, and ”dis-trust” (This state means the state of insufficient of node trust, unstable state). The transition probability among these states is denoted $\{\alpha, \beta, \gamma\}(\alpha + \beta + \gamma = 1)$.

2.2 Node Interactions

The trust of nodes would affect the service for this environment in the viewpoints of reliability and stability. The trust of nodes is composed following complexes factors: service continuously, service range, and service quality etc. The above mentioned the definition of “trust of nodes” is integrated and declares these complexes.

$$T_\delta = W_a * S_a + W_b * S_b + W_c * S_c + \ldots \quad (\because W_a + W_b + W_c = 1) \quad (1)$$

The reference [5] discusses the evaluation manner of complexes parameters between service providers and user agents such as network bandwidth and QoS (Quality of Service). And it cumulates “satisfaction” or “un-satisfaction” about each interaction. This cumulating makes the trust of node. Our proposal trust model takes this cumulating model of all evaluation results among nodes and services. The manner for trust degree proposed in [5] evaluates by cumulating results of communications, and derives total integrated trust degree. Its degree from different viewpoints are derived and analyzed by Bayes’ theorem. The trust of nodes are objectified the integration of node trust from fold nodes sharing same values on services. Therefore, the trust degree of node is derived following manner by cumulated results. All interactions among nodes are evaluated by eq.1, and these are measured the “satisfaction S” in factors $(a, b, c, \cdots)$. The integrated satisfaction of several factors would be evaluation of interaction. It is difficult to fixate them universally. These parameters of factors are impossible to be separated as the independent factors, and covered all factors by a few parameters. The extraction of typical factors by a few parameters from each evaluation enables to possible weights of factors among these important factors.

The trust of node δ derived by each interactions is quantified and shown as T_δ. The status of node trust is under any status mentioned 2.1 in this time. The threshold value of these status is defined as T_{upp} and T_{low}: the “trust-ed” state would satisfy $T_\delta > T_{upp}$. The “un-trust-ed” interactions would satisfy $T_\delta < T_{low}$. Though these parameters depend on service, the tune manners of parameters are required to preplan for each service, or learn on the services. This manner makes the evaluations correctly, and cumulating of evaluation histories.

2.3 Trust Degree of Nodes

The trust degree of each node is derived by cumulated evaluations of interaction on nodes. The trust degree of the node is calculated and derived following equations in this time.

$$\alpha = \frac{n_{tru}}{n_{total}}, \beta = \frac{n_{dis}}{n_{total}}, \gamma = 1-(\alpha+\beta) \quad (2)$$

These values $\alpha, \beta, and \gamma$ have same meaning in 2.1. n_{total} means total number of interactions on each node. And n_{tru} *and* n_{dis} mean total number of "trusted" interaction and "un-trusted" one. In case of interaction occurs and ends among peer, the evaluations of interaction are reflected each other. If the evaluation is estimated as "trusted", both n_{total} and n_{tru} are increased their value by 1, and update their reliability by (eq.2). Similarly, in case of the node estimated "dis-trusted", both n_{total} and n_{dis} are increased their value by 1. Moreover, estimated "un-trusted" nodes are only increased their n_{total} by 1, update their status of reliability.

2.4 Trust Degree of Nodes

In the case of increasing service user, service provider requires to expand itself without suspended. The node selection manner is executed and chosen as candidates of additional nodes from overlay plane. The trust degree of node 1 and 2 by cumulating interactions is exhibited as $\langle \alpha 1, \beta 1, \gamma 1 \rangle$ and $\langle \alpha 2, \beta 2, \gamma 2 \rangle$.

$$p_1 \in (\alpha 1, \beta 1, \gamma 1),\ p_2 \in (\alpha 2, \beta 2, \gamma 2) \quad (3)$$

3. APPLICATION FOR DISTRIBUTED PLATFORM TECHNOLOGY

This section discusses and clarifies the application manner of proposal node trust model for distributed platform technology , Fig. 1 shows the outline of Chord, which composes one logical ring by the collaboration of nodes.

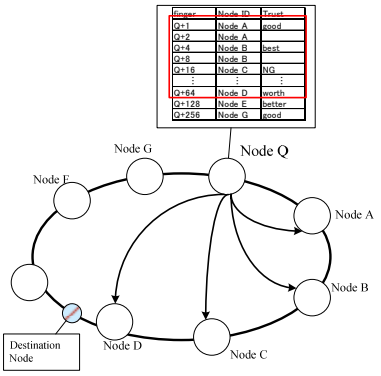

Figure 1. Selection of Last Hop Node

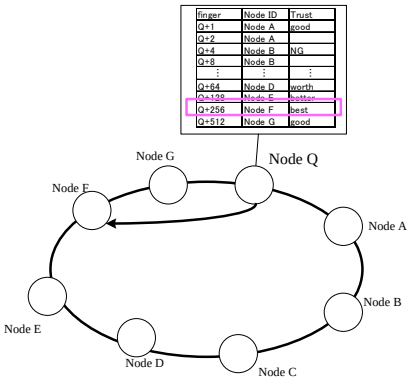

Figure 2. The Node Selections from Entries of Finger Table

3.1 Routings by Trust Degree on Chord

The Chord is one of overlay network cooperated by distributed platforms on nodes, and composed logical one ring shown in Fig. 1. The component nodes of ring are allocated sequentially by their node ID. Each node only manages large ID side of adjacent node information and pointer for connection. And last node which has largest node ID manages node information and pointer of top node, and make logical ring composed by these nodes. These nodes manage the finger table and pointer information as for routing information. Each finger table manages the fingers which means node pointer to node, and call "Stabilize

functions" periodically. These calls detect separation with un-expectations, and update the entries of managed fingers with adjacent node information.

3.2 Determination of Routing Node by the Trust

The each component node know node information of large ID side and some fingers as same as current normal Chord. However, intervals of fingers doesn't qualify exponential order, it depends on each service.

The node selection algorithm is divided following two phases: firstly, the selection of proximal node is as last hop to destination. If the node knows pointer information of destination node, it is easy to reach destination under pointer regardless to node trust. In the case of node doesn't know destination node, the node Q in Fig.1 selects a node within the range of node A to node D chosen from finger table (total number of nodes is indicated parameter K (K: small and static natural number)). Node Q selects most trusted node from these candidates, and node B is chosen as last hop for destination. This manner is named Trust-based Route Selection algorithm, and shown as TRS(K) in following. Another phase, node Q selects node by their trust without range. The candidate M (M: small and static natural number) number of nodes are chosen the node entries from top of managed finger table shown in Fig.2. The most trusted node is chosen as the next hop for routing. Node F is corresponded in Fig.2, and selected as for next hop of routing node.

Though the above mentioned both algorithms is postulated node trust by interactions, we could assume that node trust don't be used effectively and relatively caused by several kinds of case. For example, adjacently of starting the service, management similar trust nodes on a finger table and so on. Currently, the upper entry which has similar node trust on the finger table has priority for node selection. The derivation of node trust doesn't be evaluated and performed satisfactory, the number of interactions are increased their characteristic of generality by expanding targets of interactions.

4. EVALUATIONS

The proposal routing algorithms using node trust in previous section is evaluated by the comparison of current normal one, and clarify the improvements.

4.1 Scenario for Evaluation

This Evaluation is executed simulator on a following node, and it composes Chord networks by a thousand nodes. This simulation starts from the time 0 and ends the time 10^5 in simulation. The communications based on the periodical routing query are occurred randomly among component nodes in each time. The leaving-joining of nodes from Chord are occurred randomly in the range of time from 10^2 to 10^3. All interactions among nodes take the time randomly from 0 to 10^2 with delay in each interaction. Each nodes makes and manages the finger table which manages 128 entries for node routings. The simulation environment is shown in following Table.I .

Table 1. Specifications

Environment	Specifications
System (Hard) RAM 4GByte	Core i7 2.7Ghz Quadz,
System (OS)	Mac osX 10.7.3
weighted factors	(time, entries, delay)= $(0.2, 0.7, 0.1)$
Thresholds of State	$(T_{un}, T_{tr}) = (1.8, 2.2)$
Entries for Selection	$(K, M) = (8, 8)$

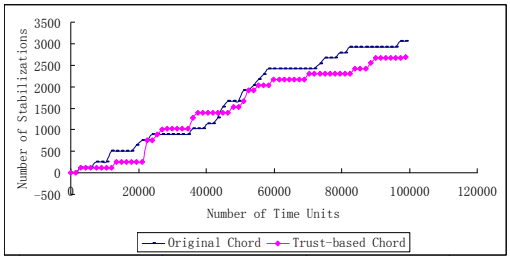

Figure 3. Comparing Number of Stabilizer Function

4.2 Results and Considerations

Fig. 3 show the comparing number of stabilizer function called in proposal Chord model and normal one with time series. The x-axis means the time in this simulation, and y-axis means the total number of call times stabilizer function from start of simulation. Both lines indicate the increment linearly of them. Especially, the proposal Chord model indicates the less of increment rate of stabilizer function than normal chord. This function is executed following two causes: one is periodical call for the detection of unprepared disappearance of nodes composed Chord ring. Another is the notification of the node migration for neighbor nodes, and makes advance the separation process. The proposal model provides service stability and less separation caused by the node selection based on their trust in the latter case especially. Therefore, the number of call times stabilizer function is less than the node selection based on the approximately. Through the evaluation, we think that next step defines and tunes the effective evaluation manner for the interaction among nodes, and clarifies the important factors and parameters for the node selections.

5. CONCLUSION

This paper proposes and discuses the measurement manner of “reliability of nodes” as for the parameter of node selections on distributed platform technology. Applying its manner to routing algorithm of Chord which is P2P overlay network manner, make the number of update information among nodes reducibly caused by the use and selection of high trusted nodes as for next routing hops. As the result, the proposal manner reduces the management load of routing information on each node. Therefore, the proposal selection manner by nodes reliability makes several kinds of services high efficiency and trustworthily applying to another distributed platform.

ACKNOWLEDGEMENT

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AUTOMATIC PEDESTRIAN LIGHT RECOGNITION SYSTEM DESIGNED TO ASSIST WALKING OF VISUALLY IMPAIRED PEOPLE

Hiroki Ogawa[1] and Osamu Uchida[2]
[1]*Graduate School of Engineering, Tokai University*
[2]*Dept. Human and Information Science, School of Information Science and Technology, Tokai University*
4-1-1 Kitakaname, Hiratsuka, Kanagawa, 259-1292 Japan

ABSTRACT

Currently, there are about 310,000 of visually impaired people in Japan. However, ways to assist walking of visually impaired people such as guide dogs and audible pedestrian lights are not enough. Then, in this paper, we propose an automatic pedestrian light recognition system. This system achieves over 80% of success rate of pedestrian light color recognition not only in daytime but also at night.

KEYWORDS

Intelligent Transport System, Pedestrian Light, Image Processing, Template Matching, Visually Impaired People

1. INTRODUCTION

According to the survey results released in 2008 (Ministry of Health, Labour and Welfare, Japan, 2008), there are about 310,000 of visually impaired people in Japan, and approximately 30% of them are total blindness. In recent years, the number of audible pedestrian lights that tell the color of light by a melody or a sound to assist walking of visually impaired people has been increasing. For example, there are 1,816 audible pedestrian lights in Tokyo, Japan in 2011. They are 11.6% of all pedestrian lights in Tokyo. However, according to the questionnaire that was conducted in blind school in Kyoto, Japan, 65% of respondents answered that the number of audible pedestrian lights are not enough. Moreover, there are about 4,700 people who want guide dogs (Higashiyama 2002). However there are just 1,072 guide dogs were working in Japan in March, 2011 (According to the survey by The National Federation of All Japan Guide Dog Training Institutions). In other words, even though it is difficult for visually impaired people to walk without audible pedestrian lights and guide dogs, both of them are not enough at present.

Because of these backgrounds, there have been some attempts to recognize the color of pedestrian lights. For example, Tsao et al. (2007) proposed a pedestrian light recognition method. However, their system uses a specialized hardware. The purpose of this study is to propose a system to recognize the color of pedestrian lights by using only a generally-used camera. This paper proposes the method to detect the regions of the pedestrian light and recognize its color from input image. Experimental results show that the proposed method is useful.

2. PROPOSED METHOD

2.1 Overview

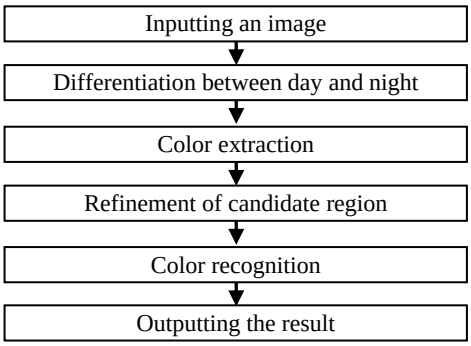

Figure 1. Flow of the Proposed Method



(a) An Image Taken at Daytime



(b) An Image Taken at Nighttime

Figure 2. Deference of appearance between images taken daytime and nighttime

Table 1. The Range of HSV Values to Decide Candidate Regions

(a) The range of HSV values (for daytime)

	H	S	V
Red	0~34, 350~360	80~255	60~255
Green	150~200	100~255	65~255

(b) The range of HSV values (for nighttime)

	H	S	V
Red	50~70	0~255	200~255
Green	140~190	0~255	205~255

Overview of proposed method is shown in Fig.1. An image of pedestrian light taken from opposite side of the way is treated as input image. At first, the system determines whether input image is taken in daytime or at night. Then, the system extracts red and green color regions from the input image. Next, the system selects candidate regions based on shape and size of regions. Finally, the system judges the color of the light by temperate matching for candidate regions and notifies the result to users.

2.2 Differentiation between Day and Night

The appearances of pedestrian light in images might change depending on the brightness of environment as shown in Fig.2. Therefore, the system detects the time when the image were taken. At this stage, RGB color space is converted into HSV color space first, and then V (brightness) values of all pixels are measured. If the average of V is bigger than the threshold value determined by preliminary experiment, the system performs a

process for day. On the other hand, if the average of V is smaller than the threshold value, the system performs a process for night.

2.3 Color Extraction

In this step, regions that have red or green pixels is extracted by using color filters. The ranges of HSV values of the filters are shown in Table 1, whose ranges were determined by the values of HSV of 400 pedestrian light images beforehand. Then, dilation and erosion are performed to remove noises. After performing binarization, remaining regions are decided as candidate regions of light (Fig.3 (b)).



(a) Input image (b) Extraction result

Figure 3. Extraction of the Region of The Pedestrian Light



(a) Red Light (Daytime) (b) Green Light (Daytime) (c) Red Light (Nighttime) (d) Green Light (Nighttime)

Figure 4. Template Images

2.4 Refinement of Candidate Region

Candidate regions might be still including regions that are not pedestrian light. In this step, the regions that are not pedestrian light are extracted and removed. The lamp part of pedestrian lights is square shape. Therefore, the region satisfied the following condition:

$$0.8 < \frac{b}{a} < 1.2, \tag{1}$$

where a and b are width and height of the region, respectively. In addition, if the region is too large or too small, it is excluded from the candidate regions.

2.5 Pedestrian Light Color Recognition

2.5.1 The Case of Daytime

From candidate regions remained after refinement, the region that is most similar to pedestrian light is detected and then the color of it is recognized. First, the average H (hue) values for each region are calculated to recognize whether the color of the region is red or green. For each region the color of which is judged red, template matching with the red template (Fig.4 (a)) is performed to calculate error value. The minimum error value is denoted by E_R. Similarly, the error values are calculated with the green template (Fig.4 (b)) for each

region the color of which is judged green, and the minimum error value is denoted by E_G. If E_R is larger than E_G, the color of the pedestrian light is determined as red, otherwise the color of it is determined by green. The size of template image is adjusted as the size of region. Error value is calculated by

$$E = \frac{\alpha H_E + \beta S_E + \gamma V_E}{P}, \tag{2}$$

where α, β and γ are weights $(\alpha + \beta + \gamma = 1)$, P is the area of region, and H_E, S_E and V_E are calculated by

$$H_E = \sum_{x,y} |H_I(x,y) - H_T(x,y)|, \tag{3}$$

$$S_E = \sum_{x,y} |S_I(x,y) - S_T(x,y)|, \tag{4}$$



(a) Example of Successful (Daytime) (b) Example of Successful (Nighttime) (c) Example of Failure (Daytime) (d) Example of Failure (Nighttime)

Figure 5. Experimental Results

Table 2. Recognition Success Rate

	Daytime	Nighttime
Red	80%	88%
Green	80%	84%

$$V_E = \sum_{x,y} |V_I(x,y) - V_T(x,y)|, \tag{5}$$

respectively. H_I, S_I and V_I mean H, S and V values of candidate region, respectively, and H_T, S_T and V_T mean H, S and V values of template image, respectively.

2.5.2 The Case of Nighttime

If the input image is taken at night, it is difficult to detect the color of regions to choose templates because appearance of pedestrian light is not clear in many cases. Therefore, both red (Fig.4 (c)) and green (Fig.4 (d)) templates are applied to every candidate regions for template matching to calculate error value. The region with minimum error value is recognized as pedestrian light region and the system outputs its color.

3. VERIFICATION EXPERIMENT AND DISCUSSION

We conducted the experiment to evaluate the reliability of the proposed method. For input image, the pictures taken by a digital camera OptioW80 made by PENTAX are used. The resolution of the camera was set to 4,000 × 3,000. However, we resized the size of pictures to 1,200 × 900 before the processes. We applied the proposed method to each 50 pictures of red light taken in daytime and nighttime, green light taken in daytime and nighttime, both of them are selected from 400 images randomly, and calculated the success rate.

The recognition success rates are shown in Table 2, and Fig.5 show examples of the lamp area detection results. The reason why the success rate at nighttime is larger than the daytime is thought to be due to that objects which are similar to pedestrian light are hardly appear in images at nighttime. In many cases of false

recognition, because of, for example by backlight by setting sun, the appearance of pedestrian lights in pictures were not clear. By applying another process specialized for early-evening, for example the smoothing of the histogram, the recognition success rate can be improved. Moreover, there were many cases that the system detected the car head light as pedestrian light incorrectly at night. Then, by removing the region whose shape is circular, the recognition success rate can be improved.

4. CONCLUSION

In this paper, we have proposed the method of pedestrian light recognition to help walking of visually impaired people, and verified utility by the experiment. To implement the method to smart phone or some wearable devices is an issue in the future.

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Reflection Papers

SMALL BUSINESSES AND ROMI – THE SOCIAL MEDIA DILEMMA

Iva Atanassova, Dr. Lillian Clark and Professor Colin Wheeler
Portsmouth Business School
University of Portsmouth
United Kingdom

ABSTRACT

With over 800 million active users per month on Facebook alone, it is clear that Social Media needs to become an integral part of any company's Marketing Strategy. However, it is also clear that development and management of Social Media campaigns require not just careful planning but also a level of expenditure which must be justified and monitored, as would any other Marketing expenditure, by measuring costs against projected revenue/cost savings/market share, also known as Return On Marketing Investment (ROMI). Social Media campaigns should be of particular value to SME's (Small-Medium Enterprises), where informal and open communication with customers is often at the heart of their business. But lacking the resources and long-term strategic planning capabilities of larger organisations, SME's are more sensitive to the expenditure required to develop such campaigns, making ROMI a particularly critical issue. In the case of Social Media marketing, even large organisations struggle to calculate ROMI. This has been primarily due to two reasons; a) misunderstanding of the actual costs involved in running a Social Media campaign, and b) confusion over what metrics should be used to measure success. While businesses are becoming increasingly aware that Social Media campaigns are not "free" but require resources to maintain and manage even a simple Facebook Page, there is still considerable confusion over how to assess and measure the contribution of that Facebook Page to the business. Simply counting "Likes" is not sufficient, as the value of a "Like" to the business is undefined, and this uncertainty over ROMI has been cited by many organisations as a significant barrier to Social Media adoption. A review of the literature has uncovered a number of approaches to Social Media ROMI, which need to be assessed in terms of their suitability to the SME environment.

KEYWORDS

Social Media, eBusiness, SMEs.

1. INTRODUCTION

It has become a cliché to state that the so-called Web 2.0 technologies are changing the nature of marketing. The popularity of digital offerings based on user-generated content such as YouTube, Facebook, and blogs has led to the fact that buyers, whether consumers or business, now expect not only customised products and services but co-creation of value and control over the commercial process (Constantinides, 2010). As Ferguson (2008) stated, "We are all marketers now – whether we realize it or not."

Social Media has become an integral part of consumer and business life. Facebook recently passed the 1-billion user mark (BBC, 2012), which represents one-half of the world's internet population (Turner, 2011) and is expected to rise to over 1.9 billion by 2015 (Nelson-Field & Close, 2010). In addition, it is estimated that the average person who participates in Social Media has on average 3 Social Networking accounts (Stelzner, 2012), demonstrating that people participate in multiple social platforms.

While there is still some argument as to the precise contribution of Social Media to a business (Nair, 2011), studies have shown that consumers who engage with organisations via Social Media are not only more loyal but also spend on average 20-40% more that other consumers (Barry et al, 2011). Other studies have shown that Social Media encourages the sharing of negative feedback on products, which in turn influences potential buyers (Lipsman et al, 2012). As a platform to engage, delight and retain customers, Social Media is not only of increasing importance to all types and sizes of organisations, but represents "…nothing less than changing the DNA of an organisation, ecosystem or industry" (Haque, 2010).

However, as with any marketing initiative, organisations of all sizes need to understand the scope of their investments in Social Media campaigns and how such campaigns impact their operating costs and revenue streams. This paper reflects on the issues inherent in applying this financial discipline to Social Media marketing, explains why these financial issues are a particular problem for Small-Medium Enterprises (SME's), and ends with a call for research that will specifically explore the strategic and financial implications of the SME approach to Social Media, research which will benefit enterprises of all sizes.

2. RETURN ON INVESTMENT AND SOCIAL MEDIA

Understanding the Return on Investment (ROI) for any type of expenditure is vital for the success of all organisations. Measuring expenditure against projected revenue and/or cost savings is the basis for any ROI calculation, and marketing expenditures should be no exception. Even if the assets produced by marketing initiatives are intangible – brand, customer relationships – these intangible assets can comprise on average 80% or more of the value of a company, and investment in such assets needs to be understood to ensure appropriate levels of expenditure (McDonald & Mouncy, 2009).

The temptation when measuring Return on Marketing Investment (ROMI) is to simply compare marketing expenditure against projected revenue and/or cost savings, however this is too narrow a view. Sales-based measurements often cannot capture whether customers become long-term customers, nor how exactly they engage with the organisation - for example, a customer who becomes an advocate and recommends the organisation is probably of more value than a one-time buyer. A common promotional tactic that recognises the value of such customers is the offering of financial incentives to existing customers in exchange for referrals (Trusov et al, 2010).

This concept of referral value has led some researchers to conclude that ROMI measurement should be based on understanding how much customers are worth, rather than how much they have spent (Fisher, 2009). Kumar et al (2007) developed two formulas to address this type of measurement; the Customer Lifetime Value (CLV) and the Customer Referral Value (CRV). The CRV is of particular interest in calculating Social Media ROMI as it attempts to quantify the contribution of sales generated from referrals by existing customers to new customers that would have otherwise not purchased from that organisation. However, calculating formulas such as CRV for Social Media requires a highly sophisticated level of knowledge of new customer behaviours and attitudes, which is only possible if a company can capture appropriate personal identifiers from Social Media activity and accurately connect that information to their customer databases to identify leads and conversions. Popular Social Media metrics such as "Likes" and "Page Views" can only tell an organisation if people are responding to a particular campaign, but not whether those people become consumers, long-term or otherwise (Ferguson, 2008). A number of sophisticated analytic tools exist to measure volume of Social Media activity, but their ability to capture sentiments is very limited (Barry et al, 2011).

Tying Social Media activity directly to sales presents difficulties, and an alternative approach to Social Media ROMI is to concentrate on the cost savings engendered by Social Media, particularly in the areas of customer services and research. Balanced Scorecard approaches, such as those recommended by Ray (2010), which monitors activity across financial, brand, risk management and digital activity, could address the issue of Social Media ROMI, but requires identification of appropriate metrics and targets for each component and objectives that are fitted to the brand's attributes. A related approach is proposed by Muller et al (2009) who argue that measurement of Social Media enterprise activity, in particular should focus on knowledge and information contribution, in effect the human capital, via metrics designed to track Return On Contribution (ROC). Li (2007) proposes another approach that estimates the ROI of key traditional media functions such as advertising, PR and word of mouth marketing, then transposes those costs to blogging activities in order to compare the costs between traditional media and social media. Building on from the above-mentioned CLV and CRV formulas, Kumar & Mirchandani (2012) have created a seven step framework that attempts identify and recruit influencers to engage in Social Media and promote WOM (Word Of Mouth). This framework includes a Customer Influence Effect (CIE) metric, which represents the influence of a social media user on another users, a Stickiness Index (SI), which measures the degree of WOM generated by a particular user, and the Customer Influence Value (CIV) metric, which can be calculated on a base CLV.

The proliferation and increasing complexity of the various approaches to Social Media ROMI has led to some practitioners arguing that "…adapting traditional metrics to fit social media would be akin to sticking a square peg in a round hole" (Alston, 2009). Industry experts such as Hoffman & Fodor (2010) contend that Social Media ROMI should not be driven by traditional ROMI measurements. Instead they argue that the approach to Social Media ROMI should be inverted, and that organisations should start with measuring the Social Media engagement customers are willing to make with a brand, and then defining the marketing objectives, platforms and investments accordingly.

Finally, adding to the confusion are managerial misperceptions of the actual costs of a Social Media campaign. Because Facebook does not charge for personal or product pages, this has led to even senior executives, such as the CEO of Proctor & Gamble, to famously declare that a recent Facebook campaign gave the organisation 1.8 million "free" impressions, despite the fact that the resources need to actually develop and run the Facebook campaign were estimated at $10-15 million (Thomases, 2012). Some senior executives are challenging whether ROI is even a valid concept for Social Media for example Ford's Social Media Manager asking, "What's the ROI of putting your pants on every day? It's hard to measure but there's negative consequences for not doing it." (Edwards, 2012, quoting Scott Monty).

Clearly, the measurement of Social Media campaigns has been and continues to be controversial for organisations of all types and sizes. A 2012 industry study of marketing managers points out that 83% of those interviewed believed that Social Media was vital to their efforts, but 40% also cited measurement as a "major concern" (Stelzner, 2012). Meanwhile, marketers are also noticing poor conversion rates from Facebook advertisements, while the concept of gaining "likes" is becoming increasingly devalued (Kunz, 2012).

3. THE SME DILEMMA

SME's make substantial contributions to national economies and are estimated to comprise approximately 80% of global economic growth (Julia et al, 2002, cited by Simmons et al, 2007). In the UK alone, 50% of GDP and employment is estimated to come from SME activity (Adderley, 2012). SMEs play a key role in most economies as suppliers, distributors, and consumers (Ndubisi & Matanda, 2011). This success comes despite the fact that SME's often do not have the requisite time, resources or training for strategic development, they struggle with implementing brand-building and communication plans and are not well organized to carry out marketing (Harrigan et al, 2011). SME's tend to engage in short-term tactical projects, but the lack of resources often hampers growth (Carson et al, 1995; Simmons et al, 2007; Harrigan et al, 2011). Despite these limitations, SMEs have successfully incorporated a number of digital platforms in their businesses, including operations (Seltsikas & Brown, 2006), internationalisation (Moini & Tesar, 2005) and CRM (Neilson et al, 2010). Small organisations are by nature flexible, adaptable to changing business environments, with effective internal communication and with strong innovation capability (Merrilees *et al*, 2011). Nonetheless, the lack of strategic marketing development is substantial for SME's (Simpson et al, 2012), and this is often reflected in their inability to properly measure the success of their marketing campaigns (Parrot et al, 2012).

In addition, SME's represent a diverse selection of industries, with complex relationships with suppliers and customers (Parker & Castleman, 2007). This causes SME's to rely on personal networking, relationship building and WOM, which can be costly and labour-intensive (Gilmore et al, 2007). However such personal networking is at the heart of the SME business – informal, open, of a mutual value to company and customer.

Consequently when it comes to Social Media, SME's have a particular dilemma. Social Media platforms should be eminently suitable to the type of personal networking and relationship building approaches practiced by these organisations, and SMEs have been increasingly using Social Media as part of their CRM activities, market research and even branding (Kim et al, 2011), but often as a supplemental promotional tool, rather than as part of a strategic plan (O' Dwyer et al, 2009). Moreover, SME's do not have a real understanding of worth of these activities to the business (Harrigan et al, 2011) or a clear idea of how to measure effectiveness (Michaelidoua et al, 2011).

SME's, by virtue of their size, have far smaller budgets to work with and have less tolerance for investments, whether in infrastructure or marketing, which do not provide suitable returns. While it is true that they are often more creative and flexible than larger organisations on how they source and allocate

resources to marketing initiatives, unfortunately the flexibility can make SME's even more vulnerable to the misperception that Social Media is a "free" resource, or an activity that can be managed by the owner in their spare time, or as part of a clerical job function.

4. A RESEARCH CHALLENGE

Understanding and quantifying ROMI for Social Media activities is a topic both academics and practitioners are starting to explore, but for the foreseeable future it will continue to be a challenge for organisations of all types. For both the academic and the practitioner interested in the SME environment, the challenge takes on another dimension - not simply to develop appropriate metrics for measuring and costing Social Media activity, but more importantly to understand how SME's can best leverage Social Media in their business activities and develop implementation tactics appropriate to SME budgets and operational styles. In addition, there are likely to be successful SME Social Media initiatives that could be incorporated into larger, more strategically focused organisations.

To meet this challenge, research needs to be done into how SME's are currently developing and funding their Social Media activities and how these activities differ from both accepted theories of Social Media marketing and industry practice. From this research, frameworks and guidelines can be produced to assist not only the SME in successfully managing such campaigns, but also provide new knowledge for digital marketing strategies in general.

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CONFLICT AND DISPUTE RESOLUTION IN THE AGE OF SOCIAL MEDIA

Irmgard Wetzstein and Peter Leitner
SYNYO Research
Vienna, Austria

ABSTRACT

In recent years, an increasing number of citizens have been participating in political discourses via social media, where conflicting interests then become obvious. It is argued then in this paper that social media might have the capacity to support dispute and conflict resolution processes in order to serve the societal and political needs of contemporary citizen-participatory conflict communication. Therefore, the combination of social media and online dispute resolution (ODR) is discussed and suggested as an innovative way of dealing with conflicts and disputes. Besides main concepts and definitions exemplary application scenarios are presented.

KEYWORDS

Conflict, dispute, social media, alternative dispute resolution, online dispute resolution

1. INTRODUCTION

Rising pluralism, heterogeneity, and the fragmentation within society are factors contributing to the emergence of opposing interests among groups in society, which can result in severe conflicts, if not handled constructively. Furthermore, policy-makers have to legitimise their plans and actions towards the public, which explains the necessity to listen to what citizens say and let them participate in decision-making processes. With the expansion of mass media and social media it has not only become more and more important for political decision-makers to know about public opinion, but also to estimate and handle potential conflictual situations and actions. Therefore, on the one hand, relevant information about public perceptions of critical issues has to be gathered. On the other hand, policy-makers should provide information transparently and fast, and stay in touch with the citizens.

Within social media suitable channels are offered, in which mutual communication is possible, information can be distributed widespread and innovative problem solving using the intelligence of the crowd is possible (for the concept of crowdsourcing see for example Brabham, 2008 and Howe, 2006). Since the end of the 1990s several social networks (e.g. Twitter, Facebook, and LinkedIn) have been launched (Boyd and Ellison, 2008). Social networks, discussion forums, blogs and micro-blogs give their users the possibility to share opinions and communicate effectively across borders.

Therefore it can be assumed that social media can play a crucial role in dispute and conflict resolution of societal and political issues, in terms of addressing masses of people, capturing their opinions and attitudes, and giving them equal opportunities of participation in dispute and conflict resolution processes and respective co-determination apart from usually elite-oriented decision-making discourses. These mentioned aspects clearly refer to social media analytics and respective tools, with which social media data, meaning mentions and conversations appearing in blogs, micro-blogs or social networks, are collected, aggregated, structured, analyzed and visualized. The connection of social media with established online dispute resolution tools, which serve either as support or as substitutes in dispute and conflict resolution processes, promises to make innovative contributions to the constructive handling of conflicts within web-based software solutions, especially in urban areas, in which diverse positions and interests usually prevail, and in which social media penetration is high.

2. MAIN CONCEPTS AND DEFINITIONS

The nature of disputes and conflicts, alternative and online dispute resolution, and social media potentials in conflict and dispute resolution are each complex concepts and topics, which are therefore discussed in a nutshell in the following sections.

2.1 The Nature of Disputes and Conflicts

Conflicts and disputes involve at least two parties having opposing positions and interests and can occur in any societal system, such as neighbourhoods, economy and politics. Several definitions do exist, but conflict and dispute are basically considered as distinctive concepts differing for example within their level of escalation and duration: While disputes are easier to solve, short-term and less escalated, conflicts are in contrast mostly long-term and more escalated, more complex and involve seemingly non-negotiable issues. Both concepts can appear on their own as well as connected to each other, for example if a long-term conflict contains several short-term disputes (Sprangler and Burgess, 2003). Conflicts are not per se destructive whereas the way they are handled can be, when resulting in violence and a widened gap between the political system and the citizens or among different societal groups. In contrast, if handled constructively, conflicts – and that is their dialectic nature - can also contribute to social cohesion and bring good debates to stimulate processes of societal change.

2.2 Concepts of ADR and ODR

The term online dispute resolution (ODR) derived from the concept of ("offline") alternative dispute resolution (ADR), which in a nutshell says that conflicts and disputes are not resolved through litigation, but privately, mostly through mediation or arbitration. Arbitration and mediation are again distinctive concepts, because arbiters normally take decisions and give authoritative judgment mostly with regards to labour and management whereas mediators seek to achieve consensus by providing a fair procedure usually without intervening in terms of making judgments (for further explanation see International Mediation Institute). While the conflict partners usually communicate face-to-face in ADR, ODR uses online technology, which can either replace or supplement the face-to-face process, depending on how complex and escalated the respective situation is (Katsh and Rifkin, 2001).

ODR is generally versatile and rather not a distinct type of dispute resolution but "is in fact potentially an approach available to and useful to all forms of dispute resolution", as the Association for Conflict Resolution states in their online dispute resolution section meeting in 2007. However, there are some critical voices towards ODR saying for example that not everybody has access to the WWW (digital divide), that ODR is impersonal and especially mediation processes need face-to-face contact as nonverbal communication plays a crucial role within conflicts and disputes (Goodman, 2003). Nevertheless, web-based ODR can also be assumed as a suitable solution for supporting the effective discourse between masses of citizens and political decision-makers, and for involving especially young people, who use the Internet on a regular basis (Seybert, 2011). Burke (2012) names concrete advantages of ODR by stating that a "growing number of cases are being resolved by online tools" as "impartial web-based systems" bring resolution "quickly and inexpensively" without being confronted with "overburdened courts", complicated appointment coordination and high litigation and travelling costs.

2.3 Clarifying Social Media Potentials

In recent years, marketing strategists, political decision-makers, NGOs, entrepreneurs and other groups have become aware of the information capacities arising from social media and demand for tools, which support them in overviewing the unstructured but valuable information generated by users in the "natural setting" of various social media platforms and of the blogosphere. Therefore a variety of social media analytics tools has been developed to manage, channel, aggregate and analyze user generated content. Established social media analytics tools, such as The ForSight Platform by Crimson Hexagon or Radian 6, have been used mainly for market research, business, reputation and brand management, but hardly ever in terms of dispute and conflict

trending and analysis as well as tracking of conflict and dispute resolution processes purposes (Aberdeen Group, 2008; Goldbach Interactive, 2011). However, recovering real-time and authentic moods and trends from social media mentions and conversations using social media analytics tools can be assumed to be applicable within dispute and conflict resolution, for example as a preliminary stage in ODR processes, or for the purpose of tracking progress and developments, accompany and give support in conflict and dispute resolution processes.

Besides tracking and analysis of conflicts and disputes or of efforts in their settlement with social media analytics, channels are offered with social media to distribute relevant information targeted and widespread. Respective social media distribution tools, such as Syncapse and Spredfast SCRM might be promising in dispute and conflict resolution, when fast distribution of relevant information is needed (Qiu, Li, et al., 2012).

Moreover, as people can connect easily via social media across borders, collaboration can be assumed as a main potential of social media channels. Fostering collaborative tools and social networking features is indispensable when focusing social media potentials for conflict and dispute resolution, as these processes need good teamwork and close cooperation (for collaborative tools see for example Dreyssig, 2012).

3. CONCEPT OF SOCIAL MEDIA IN DISPUTE RESOLUTION

Based on the previous explanations, a model suggesting social media in conflict and dispute resolution processes is introduced and respective exemplary application scenarios are addressed in the following sections.

3.1 Schematising the Combination of ODR and Social Media

Provided that dispute and conflict resolution needs participatory solutions involving citizens, social media, combined with established ODR solutions, are likely to enable equal participation, and the inclusion especially of young people using social media in political processes, which are normally rather elite-dominated.

The following figure suggests a procedure combining ODR and social media within dispute and conflict resolution software for collaboration, workflow facilitation purposes, and the detection and analysis of social media mentions and conversations pre-defined as relevant, being interposed between certain dispute groups on the one side, and concerned policy-makers and expert groups on the other side. The software solution is proposed to be embedded as an interconnection of the mentioned groups in the conflict discourse with regards to dispute analysis, supervision and collaboration based on social media and respective conversations, as well as active dispute resolution.

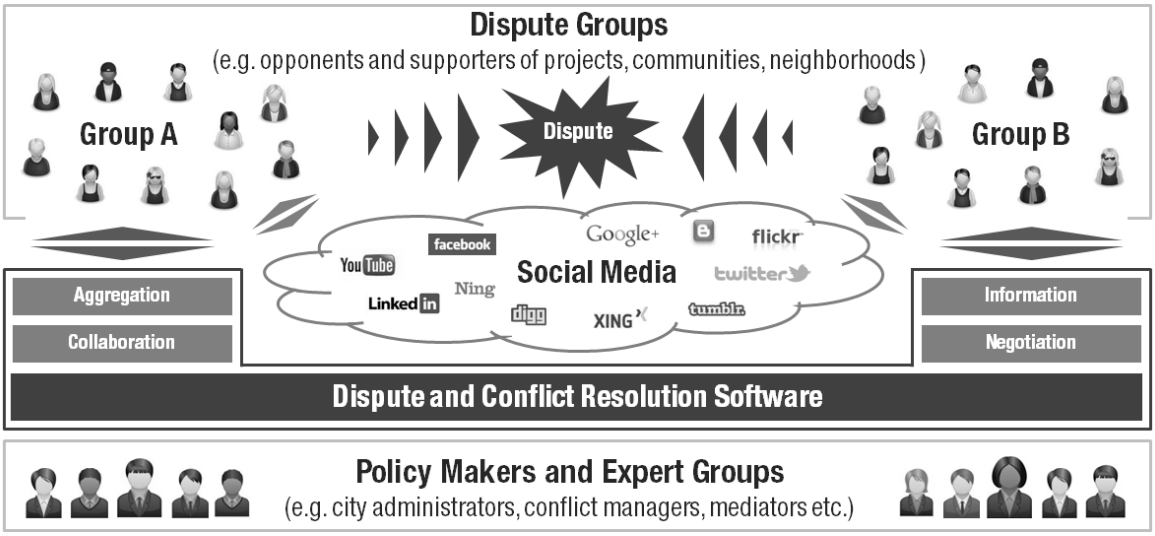

Figure 1. Scheme of dispute and conflict resolution procedure combining social media and ODR

Within the suggested web-based solution, policy-makers in cities and expert groups, such as mediators and conflict managers, are provided with intuitive dashboards offering specific trends, rankings, key figures, geo-location of social media mentions and conversations, and aggregated data based on defined issues of dispute. Besides tracking and monitoring features, city administrations and expert groups are provided with features for networking and engaging with citizens who are active in social media as well. In addition, lists of experts and expert networks are offered within the suggested software solution.

3.2 Exemplary Application Scenarios

In general, a solution combining social media and web-based ODR will be meaningfully applied in cases, in which several people participate in the respective discourse, for example a union of citizens or a whole societal group sharing the same interest (e.g. environmental protection), and in which issues of societal relevance (e.g. integration, education, environment, cityscape) are debated, such as the following:

Building project dispute

In a struggle over a city quarter enlargement, supporters emphasize infrastructural benefits, while opponents plead for environmental protection. Citizen protest movements emerge.

Potential application of dispute and conflict resolution software: Social media channels are used to identify people's opinions and fears about the project and track the development of the conflict, collaboration between concerned policy-makers and experts in conflict management and citizen-participatory processes is established, and relevant information is distributed.

Land-use dispute

A gravel plant plans a new urgently needed landfill site for storing construction waste. Citizens fear that the project will harm the town's image and destroy landscape and view. The responsible people at the gravel plant state that there is no better place to install a landfill site. A conflict between project-opposing local politicians and citizens on the one side and the project-proposing gravel-plant and supporting building constructors on the other side arises.

Potential application of dispute and conflict resolution software: Similar to the first case, social media channels are used to identify the involved parties' positions and interests, relevant information is distributed, and a settlement procedure starts (citizen-participatory face-to-face mediation process, supported by the software solution).

Conflict over the settlement of asylum seekers

In a vacant building in a town the government has decided to establish a refugee camp. Many citizens are sceptical towards this decision or against it. After the camp has opened, several citizens and local politicians see their prejudices against the refugees confirmed very fast. They complain that drug dealing and property offence has become daily routine since the asylum seekers have come into their town. In contrast, other citizens and politicians blame the police to take far too extreme action against the new inhabitants.

Potential application of dispute and conflict resolution software: Accompanied by an "offline" mediation process, social media channels are used to identify and track people's opinions, fears and attitudes, distribute information, and start communicating (opposing and shared) interests in order to prepare an agreement.

In all of those three cases, which are based on actual events, a web-based solution combining social media and ODR can presumably play a supportive role additionally to other measures, such as face-to-face mediation processes or the launch of information campaigns. With a meaningful combination of social networking features and ODR, policy-makers and expert groups are probably enabled to collaborate closely and distribute information.

4. CONCLUSION

A clear structure to overview dispute and conflict situations in favour of constructive resolution is indispensable, particularly if masses of people with diverse interests are involved which is the case especially within political disputes and conflicts in urban areas. Thereby, social media can play an important supportive role, and give citizens the opportunity to participate in political dispute and conflict resolution processes equally and actively. However, this concept is limited to political systems welcoming democratic and citizen-participatory approaches, and to areas with sufficient social media penetration, which, referring to the phenomenon of "digital divide", excludes people from conflict resolution processes if missing. In contrast, whenever access to social media and citizens' digital literacy, and liberal media policies rejecting media censorships are provided, the combination of social media and ODR promises to have valuable potentials in supporting dispute and conflict resolution (for the concepts of digital divide and digital literacy see Jaeger et al., 2012).

With their high and far-reaching communicative dynamics able to connect people across borders and distribute information widespread, social media might contribute to the acceleration of conflict dynamics, for example by spreading rumours. However, with their communicative dynamics, social media presumably have the potential to contribute to dispute and conflict resolution processes. A respective concept was suggested within this paper. In any case, research is needed to elaborate concrete social media capacities and application scenarios connected with online dispute resolution, including also in-depth stakeholder and workflow studies for embedding a respective solution meaningfully.

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HOW ICT CHANGE BORDERS BETWEEN PERSONAL LIFE AND PROFESSIONAL LIFE? UNDERSTANDING FOUR MODELS OF BOUNDARIES PERMEABILITY

Wafa El Wafi and Eric Brangier
Université de Lorraine – Faculté des Sciences Humaines et Arts - PERSEUS : Psychologie Ergonomique et Sociale pour l'Expérience Utilisateurs. BP 30309 Île du Saulcy - 57006 Metz (France)

ABSTRACT

Several studies have shown that the increasing use of information and communication technology (ICT) in the professional and personal life has largely contributed to the blurring of boundaries between these two spheres. This paper examines the reorganization of the boundaries between professional and personal life from the perspective of individual investment in relation to ICT. It present hypothesis of four models of relationships between personal and professional life, based on specific forms of ICT use: the segmentation model, the integration model, the hybridization model and the spillover model.

KEYWORDS

Permeability, personal life, professional, ICT use, symbiosis, patterns of interaction

1. INTRODUCTION

The information and communication technology (ICT) have drastically changed our relationship to family and work. Edley & al. (2004) showed that the effect of these technologies on work-life boundaries is paradoxical, since it makes the continuation of such boundaries problematic and provides supplementary resources to manage the transition from one sphere to another. More specifically, in his work on technologies such as cell phones or laptops, Edley noted that these technologies shape the borders through disorganization of times and places, previously assigned clearly, to work and personal life. Even though, the existence of large agreements and functionalities confuse the boundaries between work and personal life. But on this topic, there are few studies on the specific forms taken by these new mixed uses. How individuals and organizations use these technologies, both to segment and integrate work and personal life? What strategies or practices that individuals develop to deal with this phenomenon? What are the modes of regulation of the borders's permeability? How does permeability shape the relationship between professional and personal life? To deal with these questions, we begin by summarizing the theoretical framework, thus, we present our four models, its main variables and its functioning.

2. PERMEABILITY OF BORDERS AND ICT USE

2.1 Theoretical Background

2.1.1 The Theory of "Work-Family Boundaries"

Work and family are two different spheres that mutually influence each other. Working adults attempt to develop boundaries around their work and personal lives, which vary in strength. The strength of these boundaries influences the results of the interaction between professional and personal life (eg, conflict or work-family satisfaction). It emphasizes the importance of work-life balance, which refers according to Clark (2000) to the satisfaction and good functioning at work and at home, with a minimum of role conflict.

This approach of borders includes not only psychological borders, but also, the tangible borders that divide the time, place and people associated to work and to family. In the literature, there are three main types of boundaries: physical, temporal and psychological (Clark, 2000): (a) Physical boundaries like the walls of a workplace, an office, a store, or the walls of a house define the place where appropriate behavior on a particular domain must be kept; (b) The temporal boundaries, such as work schedules separate the time during which the work is done from the time when family duties can be accomplished; (c) The psychological boundaries represent the set of rules created by individuals and which dictate when the patterns of thought, behavior or emotions are appropriate for a domain and are not for another. The psychological boundaries are largely self-created, however, the physical and temporal boundaries can be used by individuals to determine the rules that constitute the psychological boundaries. In short, the theory of work-family boundaries chosen as the basis for our work proposes elements for understanding the implications of different ways of articulation between life's domains, it gives us some answers on various ways in which individuals create, maintain and modify the temporal, physical and psychological boundaries, to manage multiple roles in their lives. But its main limitation is that it does not have integrated ICT as a new determinant variable of the permeability of borders. Indeed, with ICT, individuals are connected everywhere and all the time. In every domain of their lives, individuals play one or more roles; employees, parents, consumers, students, spouses, players, etc., individuals don't have only to manage transitions between interfaces but also between their roles. On this point of view, we consider that the various practices of border management influence the experience of work-family conflict, which is considered as the primary source of stress at work. For this reason, several studies on the relationship between personal and professional life have been developed from a point of view more conflictual. The basic premise of this conflict model is that the resources that individuals have in time and energy are limited and must be invested in every role they perform. The conflict occurs when one's role requirements become incompatible with those of another role. There are three forms of conflict between work and non-work, each form is based on a particular element: the time-based conflict, the strain based conflict and the behavior-based conflict.

2.1.2 Theories of ICT Use: Resistance, Acceptance and Human-Machine Symbiosis

According to Brangier and Hammes-Adele (2011), different forms of technologies use have been conceptualized, but it seems possible to group them into three main models:

- The resistance to use: The technology is rejected by individual. This may be due to the fact that he has a very negative judgment about technology or that some social, cultural, cognitive reasons prevent the use of this technology.
- The technology acceptance: Acceptance reflects a kind of instrumental appropriation of technology; it consists to perform some tasks without changing the individual's ways of working. In this case, the use of technology by individuals can be either deliberate or forced. The acceptance is due to the fact that this technology involves some criteria of usability and usefulness.
- The human-technology symbiosis: The technology integrates naturally people's lives (work and life). This model reflects a full ownership of the technology in which the use is clear and frequent. Individual can no longer make a distinction between personal and professional technologies. Indeed, technology is an extension of himself and his abilities.

These three models of relationship to technology do up the graduation of permeability between humans and technology: refusal or perception of sealing; acceptance or perception of porosity; symbiosis or perception of fusion. The proximity between humans and technology, accelerated by current ICT that are more and more symbiotic, seems directly impact the permeability of border between professional and personal life. The use of technology allows individual to overcome the temporal and spatial boundaries of his different life's domains. The frequencies of interruptions from one domain to another become higher. These interruptions are permitted by the permeability of boundaries that has been exacerbated by the use of information technology and communication. It should be also noted that the type of technologies can influence the permeability of borders. Indeed, by its characteristics some technologies promote either the permeability of work borders, or the permeability of personal borders, more than others. For example, the use of mobile phone supports more permeability than other technologies.

2.2 Technology Adoption Models and Borders Permeability

The permeability of borders becomes a central question of good living of human and social relations, especially when technologies are more and more used. Given to types of technologies in his possession and its degree of perceived symbiosis, individual will have professional's and personal's borders more or less permeable in one direction or in another. This permeability will lead to different behavioral styles that reflect the emphasis on personal or professional life (Fig 1). The notion of style supports the idea that there is a continuum reflecting the degree to which work and non-work can be separated from one another or integrated into each other. More specifically, the permeability reflects the degree to which the individual can be psychologically and / or behaviorally engaged in one domain, but physically and temporally present in another. Consequently, the strength of the border is a parameter that allows us to identify different models of permeability; models that take into account current technology and are characterized as follows.

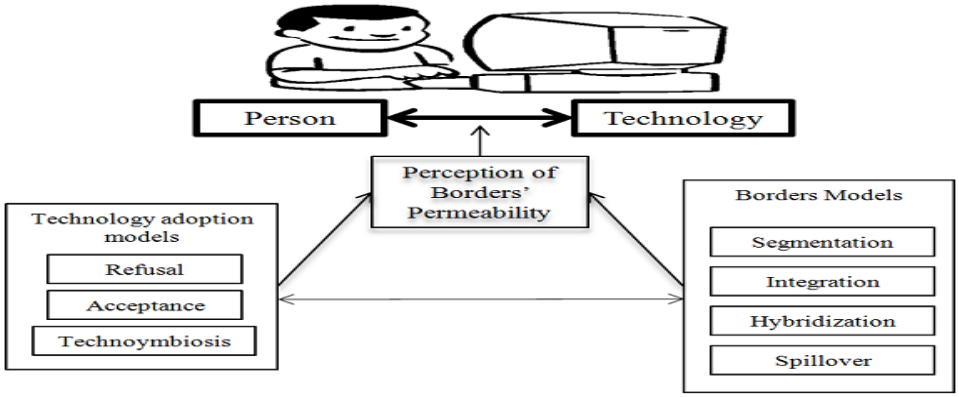

Figure 1. Relationship between technology adoption models and border models

2.2.1 The Segmentation Model

People who adopt this model prefer to keep their life domains as distinct as possible. They create boundaries or mental fences. They prefer to keep work at work, home at home and leisure and other personal activities in places and time allocated to. They tend to build physical, emotional and/or cognitive barriers, between these domains in order to keep them separate. These kind of individuals will develop practices of ICT use to help them to separate their life domains such as: turn off their phones once arrived at home, do not reply to professionals mails during weekends and holidays, do not use ICT at work for personal needs, do not use the same technologies in both domains, have distinct personal and professional mail addresses, assign specific ringtone to each contact to screen calls ... as if the individual give to the technology the responsibility of keeping the borders between these domains of life impermeable. Strategy thus described consists in giving technology the role of "keepers-borders" in the term of boundaries' theory (Clark, 2000).

2.2.2 The Integration Model

If the preference for segmentation reflects the desire to separate the personal from the professional life, the integration is entirely the opposite. The "integrators" prefer to adopt elements of both domains, essentially by increasing the permeability of their domain's borders. So, for this people, the boundaries become highly permeable. The individual integrate these different roles in a holistic experience.

2.2.3 The Hybridization Model

Hybridization is a very advanced degree of integration. Technology is used in personal life to deal with professional issues, such as responding to professional emails, planning business meetings. People eliminate the boundaries between their life's domains and mix their different facets. The technologies generate a kind of porosity that is harnessed by the user by increasing its symbiotic relationship. The opposite is also true, personal life penetrate professional life, technologies present in the workplace are also used for personal needs. Interactions are sometimes completely decontextualized. Telephone, mail, and other technologies are not connected to one specific domain or role, are never switched off or out of service. Users are provided

with more autonomy and flexibility while staying reachable by others. In this sense, the mobile phone number (example) becomes his fixed reference point providing him with connectivity and instant communication independently of his location. This is usually the case of individuals in high symbiosis level with ICT, at least we do the hypothesis: technology is an integrated part of their life, whether at work or at home. It increases his/her capabilities and assists him /her in all his activities. The use of technology becomes evident and the individual cannot live without.

2.2.4 The Spillover Model

The increasing use of ICT puts people in a situation of high connection. The temporal and spatial boundaries are blurred by the extreme and uncontrolled integration of work and personal life, leaving them with the feeling that their office is always present, even when it is physically distant and their families, friends, are reciprocally always present, even in the workplace. This overflow between work and non-work, mainly due to the use of ICT refers to the interpenetration of the two domains in each other. But in the difference of integration described above, the permeability of borders, in this case, is rather a sustained permeability or uncontrollably porosity. The individual has no control over the way he use technology to manage the boundaries of his personal and his professional life. Two cases may arise. The spillover of work in the personal life, this is the case of individuals who have a high workload, very low flexibility at work and high access to ICT. The second case, the most commonly encountered among women is the spillover of personal life in the workplace. This could be due to the fact that women workers retain primary responsibility for home and family matters. ICT is used at work to resolve personal issues. Contrary to the integration, the permeability of borders in this case can lead to frustration, stress and feelings of failure for individuals.

3. CONCLUSION

The difference between these four styles comes from a key moderating variable: the individual perception of boundary control. This is defined as the degree to which a person perceived that he maintains the control of how he/she manage the boundaries between his personal and professional life. According to the theory of symbiosis, technologies increase the capacity of the individual as a co-extension of him/herself. In the case of the relationship between symbiosis and style of border management, technologies increase the resources of the individual and the degree of perceived boundary control. This allows them to enact the boundary management style they wish and so, to find the desired balance between their two domains of life. The separators will feel that they will be able to focus on one role at a time without stigma. In the integration or hybridization model, person become able to multitask, they can, for example perform professional tasks and make a personal appeal from work to ensure that the child comes home, without penalty. In the spillover model, individual have a low perceived boundary control. Conjugated to high professional and personal responsibilities, as well as a high access to ICT, the permeability of borders become sustained and uncontrollable. Individual lose the control of the way he can use technology to manage borders between his life’s domains. The consequences of these different styles of border management will vary from the satisfaction and balance between work and personal life to the conflict and dissatisfaction, whether at work or in personal life. This will push people to reconsider their use of ICT.

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Posters

COMPARATIVE ANALYSIS OF DIFFERENT LECTURES USING ITEM RESPONSE THEORY FOR INSTRUCTIONAL IMPROVEMENT

Hitoshi Inoue[1], Takahiro Tagawa[1] and Takahiro Sumiya[2]
[1]*Research Institute for Information Technology, Kyushu University, 6-10-1, Hakozaki, Higashi-ku, Fukuoka, JAPAN*
[2]*Information Media Center, Hiroshima University, 1-4-2, Kagamiyama, Higashihiroshima, JAPAN*

ABSTRACT

Using online quiz function of course management system or learning management system not only helps students improve their comprehension but also helps teachers examine student behavior by accessing the logs stored in the course management system. From the viewpoint of instructional design, formative assessment is used for improvement of course material and teaching. In previous study, we proposed a unified method for evaluating classes and lectures on the basis of analyzing the results of online quizzes by item response (IRT). In this paper, we compare and analyze same kind of classes with different teachers over several years using our method.

KEYWORDS

Item Response Theory, Instructional Improvement

1. INTRODUCTION

To improve instructional methods in higher education, various practices have recently been under investigation; for example, designing a course, developing a syllabus, and creating course material are all themes of improvement while preparing for a class. In addition, teaching skills to improve class methods are voice training, writing on the blackboard, and managing the class, e.g., by leading discussions in the class (Brinkley1999). For improving education, it is important to evaluate teaching methods, course material, and learners' achievements objectively. Quizzes, comment cards, teaching evaluation questionnaire surveys, recording videos (Brinkley1999), and forming teaching portfolios (Seldin2004) are generally used for class assessment. Quizzes, comment cards, and teaching evaluation questionnaire surveys, which were previously paper-based, have now been directly incorporated into course management systems (CMSs) or learning management systems (LMSs) used in or out of the classroom.

Conducting a quiz at the end of the class is used for formative assessment. These quizzes help learners to improve their comprehension (Nakano2005), and teachers can examine student behavior by accessing the logs stored in the CMS. Data logged in the CMS has several uses and many studies have focused on analyzing and visualizing the data to identify a student's learning behavior (Zaïane2001, Costagliola2007, Hardy2007, Yamakawa2006, Yamakawa2007, Sumiya2009). Moreover, from the viewpoint of instructional design, formative assessment is used for improving the course material and teaching, i.e., in the evaluation of a course, we pay attention to whether the learners have achieved their learning goals. If the learners who are appropriate for instruction do not reach their goals, the instruction is considered to have problems (Gagne2006).

The objective of our research is to improve teaching methods by analyzing the results of online quizzes. In previous study, we proposed a unified method for evaluating classes and lectures based on analyzing the results of online quizzes by the item response theory (IRT).

2. PREVIOUS WORK

We considered a class to be evaluated based on the following three parameters:

- Difficulty in understanding the course content
- Level of understanding right after the lesson
- Level of understanding after review and reflection

If the course content is difficult but the learners understand it well, the course is considered successful. However, if the content is difficult and the learners' understanding right after the lesson is low, but their understanding after review and reflection and after referring to appropriate reference material is good, it can be said that the course content was reasonable but there was some problem in teaching. If the course content is easy to understand, but the learners' understanding both right after the lesson and after review are low, it can be said that there was some problem in the teaching and the lesson is considered unsuccessful.

In our study, learners are supposed to be asked to take an online quiz after the lesson. We then analyzed a class or lesson based on the above three markers obtained from a log data stored in CMS. We evaluated the difficulty of the course content by the difficulty level of the online quiz taken after the lesson.

The understanding level of the learner is expected to reflect in his/her ability to answer the quiz. We measured the difficulty level of the quiz and the ability of the learners based on IRT. We analyzed the difficulty level of the quiz and the learners' abilities independent of the quiz using IRT.

Using our method, we compare and analyze same kind of classes with different teachers over several years.

2.1 Targets of Analysis

We analyzed the lesson "Introduction to Information Processing" taught by one of the authors in the first semester of 2009 (Inoue2009). In this class, the learners took the quiz during the last 10 min of the class. The quiz was conducted on a CMS called Blackboard Learning System CE Enterprise. The learners were allowed to attempt the quiz an unlimited number of times until the next lesson. If a learner attempted the quiz more than two times, the highest score was considered as his/her grade. The result of the online quiz accounts for 30% of the learners' final grade.

2.2 Method of Analysis

We used the latent trait model (*ltm*) package in *R*, the software environment for statistical computing, to estimate the item characteristic curves (ICC) for the online quiz and learner ability. It is common to use a one- parameter (only difficulties), two-parameter (difficulties and discriminations), or three-parameter logistic model (difficulties, discriminations, and pseudo-guessing). For quizzes that contain multiple-choice questions, we should use the three-parameter model that includes pseudo-guessing. However, in our study, we used the two-parameter model because of insufficient data.

3. USE OF GOOD QUESTIONS FROM PREVIOUS LESSON

In this study, we analyze the same lesson "Introduction to Information Processing" but taught by *another* of the authors in the first semester of 2012. In this class, the learners took the quiz during the last 10 min of the class as same as the previous class. Moreover, the final examination was conducted on the CMS, and its questions were selected from good questions in the previous class. "Good question" means that the discrimination of the question is bigger. And good quiz (examination) means a collection of questions of various difficulties.

3.1 Result of Analysis

The following table is "estimated difficulties and discriminations", and the following figure is "item characteristic curves (ICC)" of the final examination which consists of eleven questions.

Table 1

Question	*Difficulty*	*Discrimination*
1	-1.932	1.754
2	-1.966	1.041
3	-1.642	1.152
4	-0.907	1.649
5	-0.819	0.352
6	-0.617	1.155
7	-1.596	6.223
8	-1.782	3.745
9	-1.229	1.493
10	-1.235	2.138
11	0.001	1.647

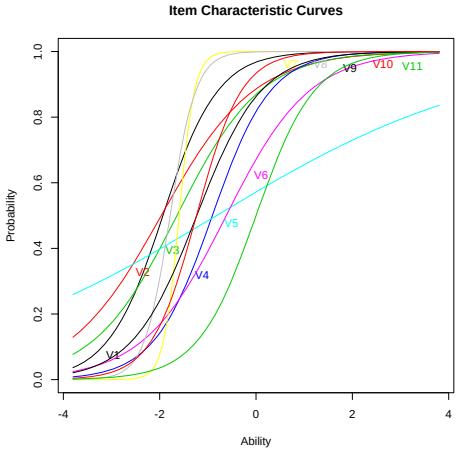

Figure 1

4. CONCLUSION

In this study, we performed an appropriate examination by using good questions from previous lesson. We only analyzed the final examination, so we think we should analyze all the quizzes and compare them with the previous lesson's quizzes.

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RELATIONSHIP BETWEEN SOCIAL PRESENCE AND COURSE EVALUATION RESULTS FOR EACH LECTURE OF AN OMNIBUS CLASS IN A DISTANCE LEARNING ENVIRONMENT

Hideya Matsukawa and Hiroki Iwai
Center for Education in Liberal Arts and Sciences, Osaka University
1-16 Machikaneyama-cho Toyonaka, Osaka, Japan

ABSTRACT

In this study, we tested the relationship between social presence and course evaluation results for each lecture of an omnibus class in a distance-learning environment. Using a questionnaire, we collected student responses to course evaluation and social presence items for each lecture. ANOVA results revealed that social presence differed across lectures, even though the lectures were delivered through the same TV conference system. Further, a correlation analysis among social presence score and responses to course evaluation items was conducted. The result showed that social presence score had strong correlation with student understanding of and satisfaction with course material and a medium correlation with course evaluations as a whole. Specific lecture results indicate that more difficult lectures might lead to low social presence scores or that social presence might be determined along quite different axes from those measured in course evaluation.

KEYWORDS

Distance Learning, Course Evaluation, Social Presence

1. INTRODUCTION

Social presence is quite an important notion in the information society, where mediated communication is usual. It is especially important in distance learning or e-learning, as previous studies have pointed out that higher social presence leads to higher satisfaction and higher perceived learning (e.g., GUNAWARDENA AND ZITTLE 1997 and RICHARDSON AND SWAN 2003). There are many definitions for social presence, but they can be classified into three general groups as follows (YAMADA AND KITAMURA 2010): 1) definitions focusing on features of media in use (e.g., SHORT et al. 1976), 2) definitions focusing on interaction and cognition among learners (e.g. GUNAWARDENA AND ZITTLE 1997, TU AND MCISAAC 2002), and 3) definitions focusing on the features of learners (e.g., GARRISON et al. 2000).

In collecting data on synchronous, bidirectional distance learning in a large classroom environment, the concept of first definition is useful, because the main direction of information flow is from teacher to learner, and rich interaction between learners is not expected. The social presence of first definition is basically measured by pairs of adjective, on the scale developed by GUNAWARDENA (1995). Research using this scale regards social presence as features of media in use and asserts that level of social presence through particular media is consistent across situations. Although, it might be natural to think that social presence varies according to teachers, contents, time and so on. Therefore, in this study, we testify to differences in social presence from one lecture to another. For that purpose we measure social presence in 12 lectures that are part of a synchronous distance learning course being conducted from a center in San Francisco for students at Osaka University using questionnaires employing 17 pairs of adjectives (such as dehumanizing-humanizing, cold-warm) developed by GUNAWARDENA (1995), and analyze the data with an ANOVA. Further we measure course evaluation items such as difficulty, satisfaction and understandability to identify the factors that affect social presence through correlations analysis.

2. METHOD

We collected data from a general education course called “World Affairs Now –From San Francisco” that is delivered from Osaka University San Francisco Center for Education and Research to the school's Toyonaka Campus in Osaka through a HD TV conference system (SONY XG80). This was an omnibus course in which 12 different teachers in various fields working around San Francisco gave lectures once a week from April to July 2012. The number of students was 231. Two lectures (the second and fourth) were conducted by the same teacher, while the eighth was conducted in a face-to-face environment without a TV conference system.

The questionnaire consisted of 17 ranges defined by pairs of adjectives, evaluated on a seven-point Likert-type scale (GUNAWARDENA 1995) and 12 course evaluation items on a five-point scale. Question items, originally in Japanese, were as shown in table 1. A total of 443 responses were collected for all students and classes.

Table 1. Questionnaire items and options

Concerning today's lecture, please choose your opinion.	Options
1. How was the difficulty of the lecture?	1. too easy, 2. easy, 3. average, 4. difficult, 5. too difficult
2. How was the volume of content of the lecture?	1. too small, 2. small, 3. average, 4. large, 5. too large
3. The teacher paid attention to enhancing your understanding, for example, by using quizzes, skill test, reports, submission of notebook, etc.	1. strongly disagree, 2. disagree, 3. undecided, 4. agree 5. strongly agree
4. The lecture was constructed systematically as outlined in the syllabus.	
5. The diction and the explanations of the teacher was clear.	
6. The way of presentation of the lecture contents was clear. e.g. Blackboard, OHP, PowerPoint, handout, CALL equipment, etc.	
7. The teacher paid attention to communication with students. for example by urging them to ask questions, organizing discussions, answering questions through Web-CT.	
How much time did you spare for preparation and review of the lecture within a week? (This question was omitted from the analysis, because the answer options could not be regarded as equal intervals.)	1. almost no time, 2. less than 30 minutes, 3. 30 minutes to 1.5 hours, 4. 1.5 hours to 3 hours, 5. more than 3 hours
8. I felt familiarity with the teacher.	1. strongly disagree, 2. disagree, 3. undecided, 4. agree 5. strongly agre
9. Overall, I could understand the contents of the lecture sufficiently.	
10. I achieved the expected learning outcome through the lecture.	
11. Overall, I am satisfied with the lecture.	
Concerning today's lecture, please select your impression.	Options
dull–stimulating, impersonal–personal, unsociable–sociable, insensitive–sensitive, cold–warm, colorless–colorful, boring–interesting, not appealing–appealing, non-interactive–interactive, passive–active, unreliable–reliable, dehumanizing–humanizing, non-immediate–immediate, difficult–easy, inefficient–efficient, threatening–unthreatening, hindering–helpful	e.g., cold 1 2 3 4 5 6 7 warm

Cronbach's alpha values for all response were high enough to be regarded as one axis (α=0.942), so we calculated the average score across the 17 pairs for each case and defined it as *social presence score*. Then, a one-way ANOVA was applied; the independent variable was the order of lectures and the dependent variable was social presence score. Further, Pearson's product-moment correlation coefficient was calculated between social presence score and response to course evaluation items.

3. RESULTS AND DISCUSSION

ANOVA results showed significant differences in social presence scores at the 1% level ($F(11,431)=4.09$, $p<.01$). Multiple comparisons using Tukey's HSD test revealed that the social presence score for the sixth lecture was higher than that for the second lecture, while the score for the seventh lecture was lower that for the third, fifth, and sixth lectures. The social presence score for each lecture and the average across all lectures are as shown in figure 1. The most interesting point concerning social presence score is that the score for the eighth lecture, in a face-to-face environment, was not necessarily the highest.

The result of the correlation analysis is as shown in table 2. Overall social presence score had strong correlations (more than 0.6) with understandability and satisfaction, and medium-sized correlations with social presence score, except quantity of content and lecture difficulty. Therefore, efforts to improve the skills related to these items may lead to improved social presence scores.

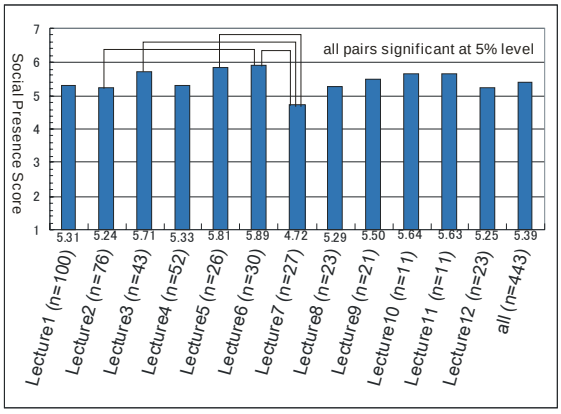

Figure 1. Social presence for each lecture

In the seventh lecture, which had the lowest social presence score, this score had a moderate negative correlation with difficulty. The average score for difficulty in the seventh lecture was 3.73 on a five-point scale, while the average for difficulty of all lectures was 3.04, making the score for the seventh lecture the highest. This result implies the possibility

that difficulty might lessen social presence. Further, the sixth lecture, with the highest social presence score, showed low correlations with most of the course evaluation items. Ceiling effects might be one factor in this low correlation, but it is also possible that social presence above a certain level might be determined by quite different factors from those used in the course evaluation. We need further study to validate these hypotheses.

Table 2. Correlation between social presence and course evaluation items. (The number at the column header corresponds to the question number in table 1.)

Significant at 5% level * 1% level **	1. difficulty	2. quantity of content	3. attention for better understanding	4. compliance with syllabus	5. clarity of explanation	6. presentaion of information	7. attention for better communication	8. familiarity with teacher	9.understandability	10. achievment of expected learning outcome	11. satisfaction
L1 social presence	−. 227*	−. 241*	. 383**	. 406**	. 529**	. 208*	. 413**	. 490**	. 447**	. 487**	. 656**
L2 social presence	. 168	−. 013	. 362**	. 416**	. 596**	. 467**	. 318**	. 613**	. 671**	. 712**	. 758**
L3 social presence	. 077	−. 290	. 546**	. 006	. 299	. 257	. 430**	. 568**	. 517**	. 654**	. 600**
L4 social presence	. 015	−. 130	. 387**	. 543**	. 622**	. 474**	. 222	. 485**	. 517**	. 582**	. 445**
L5 social presence	. 156	. 183	. 277	. 234	. 482*	. 754**	. 312	. 641**	. 630**	. 751**	. 782**
L6 social presence	−. 237	−. 014	. 070	. 072	. 203	. 291	. 100	. 254	. 366*	. 021	. 149
L7 social presence	−. 487**	. 192	. 466*	. 400*	. 497**	. 595**	. 572**	. 612**	. 522**	. 648**	. 611**
L8 social presence	. 214	−. 044	. 641**	. 642**	. 757**	. 519*	. 679**	. 647**	. 760**	. 667**	. 708**
L9 social presence	. 033	. 241	. 714**	. 420	. 651**	. 264	. 723**	. 725**	. 608**	. 678**	. 773**
L10 social presence	. 529	. 259	. 648*	. 842**	. 757**	. 911**	. 730*	. 617*	. 943**	. 757**	. 911**
L11 social presence	. 020	. 438	. 636*	. 625*	. 570	. 660*	. 465	. 473	. 325	. 499	. 416
L12 social presence	. 289	. 312	. 419*	. 304	. 684**	. 754**	. 417*	. 647**	. 841**	. 779**	. 841**
All social presence	−. 100*	−. 045	. 429**	. 416**	. 588**	. 400**	. 429**	. 591**	. 622**	. 630**	. 672**

4. CONCLUSION

In this study, we confirmed that social presence differs across different lectures even when they are delivered through the same medium. We also revealed that social presence score has a strong correlation with students' understanding and satisfaction and a moderate correlation with most course evaluation items. The result implies that improving skills relevant to the course evaluation questionnaire may enhance social presence. Further, correlation analyses for each lecture implied that high difficulty might lessen social presence, and in addition that social presence above a certain level might be determined by quite different factors than the items used in our course evaluation.

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SOCIAL NETWORKING FOR THE CONSTRUCTION OF COLLABORATIVE ELEARNING ENVIRONMENTS

Timothy Arndt
Dept. of Computer and Information Science
Cleveland State University. Cleveland, OH, USA

ABSTRACT

Post-secondary students are increasingly receiving instruction by eLearning. This mode of instruction can result in the students learning in isolation, with bad results in educational outcomes. The same type of isolation can occur for part-time students and those who are working while taking classes. In such circumstances, we believe that it would be beneficial for instructors to facilitate the formation of small collaborative learning communities. One mechanism that can be exploited for this purpose is social networking, given the popularity of this phenomenon among the student population. We are currently developing innovative approaches to building collaborative learning communities for eLearning students using social networks. As a preliminary step in this research, we have conducted a survey of our target student population. In this poster paper, we present the results of our survey and our reflections on the how the results will guide our future work. We also will present in the poster the results of our latest experimentations, which will be carried out in January and February 2013 on the use of social networking for Collaborative eLearning environments.

KEYWORDS

Social networking, learning communities, collaborative learning.

1. INTRODUCTION

In order to support students in eLearning as well as part-time students, we are committed to building a system for developing learning communities among such students. Research has shown that a shared learning experience is vital for student success [1, 2, 3]. Our intuition is that social networking sites can be leveraged for such purposes due to their widespread acceptance among the target students [4, 5, 6]. In order to affirm our intuition, we performed a survey of the target students. The results of the survey and our comments are presented in the following section.

2. STUDENT SURVEY AND COMMENTS

In order to justify our research in using for distance learning with social networking , a survey of the target audience – students in a traditional Masters degree program in Computer Science was carried out. The survey was meant to gauge their interest in using social networking as part of their study routine, as well as preferences for such use. 15 students replied to the survey. The comments on the results follow the survey results shown in Table 1.

Table 1. Survey of Students

1. In general, which type of class organization would you prefer?		
Traditional, face-to-face. 80%	Distance learning. 7%	No Preference. 13%
2. Do you use social networking services (e.g. Facebook, Twitter, Google+, LinkedIn, etc.)?		
Yes, often. 67%	Yes, seldom. 33%	No, never. 0%
3. In preparing for exams, understanding homework, etc. what is your predominant study mode?		
I study by myself. 87%	I study in a group with other students from the class. 13%	
4. If you answered "I study by myself" to the previous question, would you study with other students in a group if there was a convenient way to do so online?		
Yes. 69%	No. 31%	
5. If you answered "I study in a group with other students from the class" to question 3., estimate the typical size of the study group.		
1 other student. 25%	2 other students. 50%	3 or more students. 25%
6. If you answered "I study in a group with other students from the class" to question 3., do you also typically interact with members of the study group using a social networking service?		
Yes. 50%	No. 25%	Not sure. 25%
7. Do you currently use social networking services as part of your study routine for classes (e.g. exchanging information about a class with another student in the class via Facebook)?		
Yes. 20%	No. 80%	Not sure. 0%
8. Would you be interested in using social networking services as part of a study routine for classes in future?		
Yes. 47%	No. 33%	Not sure. 20%
9. As a platform for using social networking services as part of your study routine for classes, would you prefer an existing system (e.g. Facebook, Google+ or Twitter) or a service created specifically for that purpose?		
Existing service. 27%	New, specialized service. 53%	Not sure. 20%
10. If using an existing social networking service as part of your study routine for classes, which would you prefer?		
Existing account on the service. 50%	New account on the service dedicated to classes. 43%	No preference. 7%
11. If you answered "Existing account on the service" to the question above, would you be willing to grant an application access to your data on the service in order to better allow class interaction to be supported?		
Yes. 44%	No. 44%	Not sure. 11%
12. If an experimental system for using social networking services for study was available, would you be willing to use it?		
Yes. 73%	No. 13%	Not sure. 13%

The students who completed the survey were all enrolled in traditional (not distance learning type) Master's degree-level Computer Science classes. This is reflected in the response to question 1, where the respondents overwhelmingly prefer traditional, face-to-face classes. The respondents also overwhelmingly study by themselves, however, in responses that are promising for this research, they all use social networking services, and they are interested in studying in a group online, if there was a convenient way to do so. Most students who study in groups do so in groups of 2 or 3, and a fair number of those who do group study using social networking services to interact. The respondents demonstrate a certain amount of reluctance to mix personal and study use of social networking as only 27% would prefer an existing service over a new specialized service and only 50% would want to use an existing account of a social networking service rather than a dedicated one. The remaining questions are promising, in that students do not currently integrate social networking services in their study routines, but would be interested in doing so if a system was available, at least on an experimental basis.

3. CONCLUSIONS AND FUTURE RESEARCH

This work presents initial research in incorporating social networking into an approach to customized eLearning. The motivation for this work is the observation by several researchers in distance that students in perform better when they have a shared learning experience providing a support group of colleagues. Thus, our previous approaches, which aimed at producing a customized learning experience for each student, based on a user profile containing preferences, as well as information on the device used has been modified. Now an approach which provides a customized learning experience for a compatible group of students (with the size of the group being a parameter which can be chosen by the instructor) is being adopted. We are currently planning a pilot implementation of this project for early 2013, and the results will be featured in the poster to be presented at the conference.

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LINKED DATA FOR ACCESSIBILITY: FROM TECHNIQUES TO USERS

Chaohai Ding, Mike Wald and Gary B. Wills
School of Electronics and Computer Science,
University of Southampton, United Kingdom

ABSTRACT

The advanced characteristics of Linked Data drive the dramatic growth of accessible public data. With very few accessibility research projects applying Linked Data , this paper reviews the challenges of accessibility and proposes the approach to use Linked Data to link the user preference and real-time environment data to address issues like user focus, data integration and isolated systems. Further research on Linked Data for accessibility would not only benefit people with disabilities but also contribute to the development of smart cities.

KEYWORDS

Accessibility, linked data, semantic web

1. INTRODUCTION

Most research currently related to accessibility is focussed on separated areas, such as social science, laws and information technologies, which would lead to the unmatched mapping between user experience and standards or guidelines. User focus and personalized usability should be the significant research approach for enhancing accessibility due to the gap between the user experience for disabled people and technical accessibility guidelines (Cooper et al. 2012). Disability is a complex social and medical issue. Accessibility requires providing the data and services for people with disabilities or special needs within their expected cost and time constraints. Current approaches to address the accessibility issues are focussed on accessible services such as accessible web content, authoring tools, user agents and assistive technologies regardless of environment data and user preferences in the real world.

Linked Data is creating the relationships from the data to other sources on the Web. These datasets are not only accessible by human beings, but also readable for machines. As an additional layer to the current Web, Linked Data has some particular beneficial features, namely separated data format and presentation, knowledge sharing and accessing, real-time linking, metadata annotation, openness and standardization (Bizer et al. 2009). The growth of Linked Data has been dramatic, rising from approximately 95 in 2009 to 295 datasets in 2011 in the Linked Open Data Cloud. These datasets could also be classified in groups: Media, Life Sciences, Geographic Data, Cross-Domain Data Sources and User-Generated (Bizer 2009). This paper investigates the use of Linked Data to model the user preferences and profiles to link with real time accessible environment data to address the accessibility issues.

2. RELATED WORK

The dramatic development of the Web brought several accessibility challenges. As there is no global solution to address these issues, researchers are exploring the advanced features of the semantic web and proposing some innovative approaches, namely: semantic metadata, semantic modelling and accessibility frameworks.

Accessibility Common (Kawanaka et al. 2009) provides a flexible approach of metadata integration, storage and sharing for web accessibility. The essential features are similar to the Linked Data mechanism, such as URI and element addressing, semantics knowledge sharing and management. The challenge to

support many metadata formats would be addressed by the feature of document format standardization (RDF) in Linked Data. The Social Accessibility (Takagi et al. 2008) is focused on semantic metadata authoring using the collaborative approach to provide accessible metadata for people with disabilities. However, this system could not address the linking issues among different metadata resources, which meant that each group of metadata annotations was isolated from other resources.

Semantic modelling approach mainly proposes the modelling of user profile and preference, environment data and assistive technology. User profile and assistive services are two major components for semantic modelling (Ghorbel et al. 2007). Ghorbel et al. explored users' location and environment data as well as profiles to generate better assistive services. Similarly, Semantic Matching Framework project (Kadouche et al. 2009) involves the Web Ontology Language (OWL) for modelling and reasoning people's profiles and environment data to improve the interaction mapping between users and real world facilities.

AEGIS project (http://www.aegis-project.eu/) has investigated the use of ontology for accessibility situations research. It has developed ontologies to map the interactions between the disability conditions and devices. Nevertheless, the high level modelling of special interactions leads to the complexity of ontologies modelling and reasoning. Semantic User and Device Modelling Framework (Ackermann et al. 2012) proposed an adaptive User Interface of Web2.0 applications based on their own vocabularies and WAI-ARIA annotations to model devices and user's preferences. User-oriented services for monitoring users' health, social care and emergency situations has been proposed (Tektonidis & Koumpis 2012)**.** These projects could benefit from applying Linked Data, because of such characteristics as standard format data and resources, large scale linked data cloud, real-time reasoning and linking.

3. RESEARCH OBJECTIIVES AND APPROACHES

Approaches associated with the semantic web would improve the accessibility in different ways. However, there are a few challenges faced during development, which include the difficulty of accessing public datasets related to accessibility issues, complex rules for ontology reasoning and mapping between disability requirements and accessibility data (Li et al. 2012). Therefore, this section will explore approaches to address these problems.

Accessibility Data is the data related to accessibility, which could include Open Accessibility Data (OAD) and Closed Accessibility Data (CAD). OAD mainly presents the accessibility information in public datasets, such as public transport stations, hospitals, supermarkets and other public facilities. However, there are some problems for OAD. The published tube stations data related to accessibility does not provide enough information for developers to use and some public datasets are not of high quality or in structured formats (Li et al. 2012). There are three kinds of accessibility datasets. Firstly, the accessibility dataset requested by users does not exist or is not accessible. Secondly, data related to accessibility is of low quality and poorly structured or in various different formats. The third type is datasets that have been published as Linked Data, but with no accessibility information provided. There are three suggested approaches for access to OAD on Linked Data: completing accessibility data for the existing dataset published in Linked Data through social authoring tools; transforming unstructured datasets into high quality and well-structured datasets and suggesting the data publishing organizations publish the datasets associated with accessibility data or develop a framework to use ontology based extraction to find accessible data from the current Web of documents. CAD is related to private properties, such as private houses information, private devices data and other personal data. These datasets are 'access controllable' and only open to trusted users or services. For disabled people, CAD provides anonymous access to the information and services.

User Modelling normally describes the user's profile as a data model and contains user's preferences, disabilities and capabilities data. There are some challenges for profile modelling, such as the classification of disabilities and capabilities, interactions description and access control. It is felt that it would be advantageous to offer a classification that has sections that could be divided into several subsections based on the capabilities. For instance, visual impairment includes blindness, low vision and colour blindness. There are huge differences in the way those who have these impairments will access materials and services. However, there are only a few popular ontologies related to the classification of disability. Therefore, ontology matching is a suggested approach to use to link these ontologies as well as access control attribute. Interactions description is also a challenge for user modelling due to the complex activities between users and

environment factors. Categorised interactions based on the type of disabilities could benefit the user modelling and ontology reasoning (Ghorbel et al. 2007). A suggested approach to use interaction description as an attribute of user profile associated with impairments would reduce the complexity of user modelling and ontology reasoning.

User and Accessibility Data Mapping is the main challenge after modelling the user's profile and environment. Due to the complexity of real world conditions and limited accessibility environment data, the mapping of profile and accessibility data could transform to the mapping of accessible environment data and interactions associated with impairments. The interaction description would be the bridge to connect users and environments or assistive technologies. Therefore, the classification of interaction attributes leads to the quality of mapping and ontology reasoning. A proposed classification is based on the daily life of people with impairments, which includes travelling, eating, drinking, learning, clothing and housing, as well as shopping and Internet accessing. Each section would include several subsections related to normal daily living activities. This daily living activities based classification of interactions would be examined and demonstrated in further work. The use of social software is recommended to provide feedback on accessibility data and mapping mechanism to improve the mapping accuracy and data quality. A Linked Data based approach would also drive the updating and mapping of real-time accessibility data, such as updating the availability of accessible seats on a user's preferred bus.

4. CONCLUSION

With the fact that the dataset scale of Linked Data has been increased dramatically, the power of information gained through linked data should not be underestimated. At present those who wish to learn more about the accessibility of their environment, technologies and services often find data that is out of date, lacks useful content and is not suitable for their needs. Linked data could provide a personalised service, which is appropriate to a user's skills and environment. The next stage of the research would explore a framework for completing and publishing accessibility data, interaction classification as well as reasoning rules to address the mapping issues. A Linked Data approach could integrate the accessibility data from different isolated systems or projects. As a result, the research of linked data for accessibility would not only benefit those with disabilities but also contribute to the development of smart cities.

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Doctoral Consortia

TRAVELLING FOR ALL

Chaohai Ding, Mike Wald and Gary B. Wills
School of Electronics and Computer Science,
University of Southampton, United Kingdom

ABSTRACT

Travelling is listed as the top difficulty for people with limitations, impairments or disabilities in their day-to-day activities. This paper demonstrates the barriers people face when they are travelling and reviews the current approaches or projects that are trying to enhance travelling for people with special needs. After exposing the limitation of these approaches, such as the lack of universal standards and methodologies, various isolated data and barriers of data achievement, this paper demonstrates the advantages of a linked data approach, namely dramatic data growth, domain specified data integration and automatic linking and reasoning to other resources. Therefore, it proposes a possible solution to build an accessible travelling service application to benefit travelling for all people.

KEYWORDS

Accessible travel; linked data; inclusive society

1. INTRODUCTION

According to the statistics of Family Resource Survey 2010/11[1], there are more than 11 million people with a limiting long term illness, impairment or disability in Great Britain. And most of them have some difficulty in day-to-day activities due to low income, inaccessible public services, poor educational qualifications, economically inactive and harassment or hate crime (Improving the Life Chances of Disabled People 2005)[2]. They are facing the problems of housing, transport and working, and the most affected capacities are mobility, lifting or carrying and manual dexterity (Disability Prevalence Estimates 2010/11)[3]. According to the examples stated by Equality Act 2010, the day-to-day activities include leaving home without assistance, walking a short distance, travelling in personal cars or public transport and visiting an unfamiliar place. The social research concerned with people with disability could be divided into a social model and a medical model (Office for Disability Issues)[4]. The medical model which is no longer supported is related to people's medical condition or impairment. The social model which is recommended by the Office for Disability Issues and benefits an inclusive society includes the environment, attitudes and organisations. However, nearly 43% of disabled people in the US participated in less than one daily social activity due to the difficulties and barriers they are facing (Taylor & Hodapp 2012). The ICF (CAD 2001) states that all people have the equal right to be involved into social activities, no matter what kind of the limitations, impairments or disabilities they have. They are strongly encouraged to go out of their home and get in touch with the other people in the society, which would benefit their health.

Most public facilities are required to be built as accessible as possible due to the Equality Act 2010. However, there are still some problems and barriers disabled people face during their travelling, such as personal assistance, travelling time or delays and accessing public transport services and other travel information. Accessible travel information is not only important for people with disabilities, but also benefits all travellers, such as the passengers carrying heavy luggage or a baby carriage. Due to the complexity of interaction between individual and transport services, such as functional limitations, individual's need and various transport conditions, accessible travelling for people with a disability should involve people's profile

[1] http://odi.dwp.gov.uk/disability-statistics-and-research/disability-facts-and-figures.php#gd
[2] http://www.disability.co.uk/sites/default/files/resources/Improving%20Life%20Chances.pdf
[3] http://odi.dwp.gov.uk/docs/res/factsheets/disability-prevalence.pdf
[4] http://odi.dwp.gov.uk/docs/res/research/involving-disabled-people-in-social-research.pdf

or special needs. User profile modelling, travelling service information, real time public data and complex interaction, are significant characteristics that should be involved in the accessible travel information base. This paper reviews the current approaches that are trying to enhance travelling for people with special needs and also demonstrates the advantages and challenges of linked data approach as well as the possibility to build an application that could benefit travelling for all people.

2. CURRENT APPROACHESAND PROBLEMS

The dramatic development of information and communication technologies (ICT) brought the benefit of knowledge spreading and sharing, which makes information available for the people around the world. With the openness feature of the Web, people could access the desired information at home via their Internet-based devices. However, the current Web is still not accessible for all people. Although a few research studies related to accessibility have tried to improve the Web and make it as accessible as possible, such as web content accessibility, effective assistive tools and web browsers, it is still inaccessible for some scenarios. For example, if a wheel chair user wants to plan a journey with some advice on accommodations, price comparison of different plans, traffic levels and accessible facilities information such as parking or step-free stairs of both public transport services and planned visiting places, he needs to search several websites to check as some information might not be available online or even inaccessible. It is also not easy for him to find nearby accessible facilities during the trip. In order to achieve accessible travelling, there are a few related approaches and projects described in this section.

User sensitive inclusive design is one mainstream approaches for achieving accessibility in both the web and real world. Semantic User and Device Modelling Framework (Ackermann et al. 2012) proposed a semantic framework based on user's devices and preferences for Web2.0 application developers to create adaptive user interfaces. User-oriented design is also applied to the project (Tektonidis & Koumpis 2012) to manage and monitor user's health, social care and situations based on the personal sensor data, which aims to enhance the daily independent life activities of disabled people. There are some projects using a semantic metadata and ontology driven approach that aim to improve web accessibility. Accessibility Common (Kawanaka et al. 2009) proposed the web based approach for metadata integration, storage and sharing of accessibility related annotations. The Social Accessibility project (Takagi et al. 2008) demonstrated the social collaborative method to create and manage semantic metadata for application developers to benefit to the people with disabilities. However, these projects are facing the challenge of various data formats and linking among different metadata resources, thereby leading to the isolation of metadata and other resources. The Semantic Web Application framework (Kouroupetroglou et al. 2006) exposed the advantages of semantic web and role-based classification to contribute to application developers. The problems for this project are domain specified vocabularies and automatic annotating. There are also other projects trying to address the accessible challenges of day-to-day activities for the people with limitations, impairments or disabilities. OASIS (Open architecture for Accessibility Services Integration and Standardisation) is a project aiming to integrate accessibility related ontologies and semantic services, which could link all services from different specific domains and benefit aged people with their daily life. AEGIS project investigated the use of semantic web for accessibility and developed ontologies to map the interactions between the disabled people and different devices or assistive tools. Nevertheless, the high level modelling and special interactions lead to the complexity of ontologies modelling and reasoning. Semantic Matching Framework project (Kadouche et al. 2009) applied the Web Ontology Language (OWL) into modelling and reasoning people's profiles and environment to improve the interaction mapping between the users and their house facilities. Similarly, another project based on the Location Based Services used semantic modelling of user preference and assistive services as well as environment data (Ghorbel et al. 2007). ASK-IT (Wiethoff & Sommer 2007) proposed the approach to improve accessibility of people's social activities and travelling based on user's preference and the functional limitations. This project combines the action and active theory and ontology driven user modelling to understand a user's special needs for both pre-travel and on-travel information.

The primary challenge for these projects is how to achieve and interconnect the large amount of accessibility travelling information, such as public transport services, real time services, hospitals, shops and other related travelling data. How to model, map and automatic reason the interactions between the user's

profile and these data is another challenge due to the lack of the universal methodologies or standards, although some projects and approaches described above have already done some relevant research.

3. LINKED DATA : OBJECTIVES AND METHODOLOGY

Linked data is a large scale platform for linking the data to other relevant or related sources on the Web. The advantage of linked data is not only it is machine readable, but it also integrates all domain data into a global space. The development of datasets in Linked Data Cloud is dramatic with it rising from nearly 95 datasets in 2009 to 295 in 2011, which covers a few domains such as media, life sciences, geographic data (Bizer 2009). As the additional data layer to the current web, linked data exposes the advanced features, like standard data format and presentation, domain specified knowledge management, linking and sharing, openness as well as real-time reasoning (Bizer et al. 2009). All these characteristics provide the solutions to address the problems stated in the previous section, namely achievement and linking of the large amount of accessibility travelling information, global data integration as well as automatic mapping and reasoning.

For the problem of data modelling in linked data for accessible travelling, there are some existing ontologies for transport information and people with limitations or disabilities, such as the World Health Organization-ICF Ontology[5], ASK-IT ontology, OASIS Ontology Repository for Assistive Technology (ORATE) and Ordnance Survey Topographic ontology. Nevertheless, these ontologies are focused on different domains. ICF ontology is describing the general classification and functionality of disability, while ASK-IT ontology demonstrates a different classification of functional limitations and user actions (Bekiaris et al. 2007). ORATE is constructed for assistive technologies and Topographic Ontology is presenting the geographical data of Great Britain. Therefore, how to integrate these different domain ontologies and conduct a general way to describe the user's profile, special needs and his surrounding environment is the first issue to overcome. The ontology matching proposes the essential method to address this issue. An effective matching method would improve the quality of user modelling as well as data integration and reduce the time consumption for reasoning.

Data achievement and publishing is another challenge for developing a travelling service application for all people. As an advantage of linked data, the UK government has published certain public data as open data and free access for everyone, including the transport data, hospital data and other public data, such as National Public Transport Access Nodes (NaPTAN)[6], Accessibility Statistics[7] and National Travel Survey[8]. These data are published by government departments or statistics organizations, which are well structured and in good formats (XML, CSV or JSON). Some of these data are published in EXCEL, HTML and PDF, which needs to be converted into a standard format (RDF) and published as linked data. This problem is also existing in RailGB (Li et al. 2012), a linked data driven mobile application using its own ontology to publish existing London tube station facilities data to benefit tube travelling for people with disabilities. Moreover, it also indicates that some accessible data is not available as open data or linked data (DBpeida, Ordnance Survey et al.). Therefore, creating and publishing both new and existing data into linked data is the second step to achieve accessible travelling for all. One suggested approach for creating and updating new data is to use a social collaborative application to involve the individual.

Semantic mapping is an advantage of linked data approach, which provides the automatic reasoning between different resources. Mapping and reasoning is also a challenge, which could be divided into the rule layer for ontology (Semantic Web Rule Language et al.) and the rule on query language (SPARQL et al.). For example, RailGB has developed a query agent implementing the mapping rules in SPARQL to get the information based on a user's requests. It is difficult to write the rules to map and reason the interactions between users and complex transport services condition. Therefore, using a method to involve the rules in mapping and reasoning is the third step for implementation of the travelling service for all people.

[5] http://bioportal.bioontology.org/ontologies/1411
[6] http://data.gov.uk/dataset/naptan
[7] http://data.gov.uk/dataset/accessibility_statistics
[8] http://data.gov.uk/dataset/national_travel_survey

4. CONCLUSION AND FUTURE WORK

With the dramatic growth and advanced characteristics of linked data, it provides the innovative way to address the issues of accessible travelling and benefit to all people. Although there are still some challenges such as essential metadata, versioning and provenance to overcome (Goodwin et al. 2008), the power of information achieved and shared though linked data should not be underestimated. Travelling is one of most difficult barriers faced by the people with limitations, impairments and disabilities. Currently, those people who want to know more about the accessible information of their surrounding environment, assistive tools and service for their travelling often find that the data is out of date, and useful content is missing or not suitable for their needs. People with limitations or disabilities also have to spend extra money and need more information about special diets, travelling costs and special clothing. A linked data approach would not only benefit accessible travelling for all, but also brings a possible way to integrate the accessible data from different domains and isolated systems into a global space. The future research work would expose an application for creating and publishing related data into linked data as well as rules for mapping and reasoning. Asocial collaborative methodology (such as social networking) is also considered into the application to contribute to the updating of accessible data as well as feedback for evaluation. As a result, the proposed linked data approach for enhancing accessibility in the real world would not only benefit those with disabilities but also contribute to the development of smart cities.

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UNPACKING THE NOTION OF CYBER COMMUNITY USING THE CONSTRUCTIVIST LENS

Ronan Guanzon Zagado
Media Discipline, Faculty of Humanities and Social Sciences
The University of Adelaide, South Australia

ABSTRACT

This paper presents a constructivist framework for investigating the integral role of information and communication technologies (ICT) in the organization of modern community.

KEYWORDS

Constructivism, Cyber community, ICT, Ethnomethodology, Structuration

1. INTRODUCTION

This paper is a meta-analysis of existing literature and theories that aims to look into methods that can be used to unpack the role of information and communication technologies (ICT) in the organization of modern community. By ICT, I am referring to the new generation of information technologies (Flor, 2001), characterized by or operated through the use of digital or electronic means, such as the Internet. I look at ICT in this paper however not from a positivistic but from a constructivist point of view in that the technology is viewed here as no mere tool or conduit for information dissemination, but as a social construction and part of the organization of human life in the modern society (Giddens, 1991; Jones, 1997; Moores, 2000).

Drawing on this assumption, the question that this paper particularly seeks to address is how the notion of community or social organization is constructed in view of the advent of ICT. Commentators call this emerging phenomenon as cyber community. How it is to live in a cyber community? Do people still live the same pattern of activities, or observe the same rules of organizing and accomplishing their everyday lives? How do ICTs influence their actions and views, and generally their sense of community? Due to the novelty of the topic, it is also the interest of this paper to look into methods for studying the said phenomenon.

2. VIEWS OF CYBER COMMUNITY

Various scholars have attempted to analyze the existence of this emerging phenomenon. According to Rheingold (2000), cyber community is a 'social aggregation' that emerges from the Internet, or a 'new culture', or a 'conceptual space' within which people gather through 'collective goods'. Collective goods, according to Marc Smith (as cited by Rheingold, 2000), are valuable things that people can gain by banding together. Like in traditional community, people in the cyber community also function within the gemienschaft type of social relationships (Rheingold as cited by Jones 1997). 'One can drop in, have a friendly chat, receive some advice about a problem, argue politics, and interact with other people who might otherwise remain strangers.' It establishes and observes some norms (Rheingold, 2000: p. xvi). Nowadays, people rely on 'abstract systems'. Abstract systems, according to Giddens (1990), refer to the technical accomplishment or professional expertise that organize large areas of the materials and social environment in which we live today' (ibid). Giddens' classic example of abstract system is riding a plane or simply sitting in the house. Some risks are associated with any of the activities yet we do them out of 'trust and faith' (ibid).

Moreover, Jones avers that cyber community is a 'central construct in thinking about the way how humans organize their lives' (Jones, 1997: p. 55). It is not fixed, exclusive, and monolithic (Schuler 1996 as

cited by Jones, 1997: p. 10) as that of the traditional concept of community. But it is an 'ongoing story' (Moores, 2000: p. 38), or a 'narrative' that is socially constructed and reconstructed (Jones, 1997: p. 37). Garfinkel (1964) calls this nature of circumstance as 'reflexive', which means that 'any account defines reality and at the same it is the reality' (Handel, 1982; p. 39). Giddens also discusses this dualitistic nature of reality in his Theory of Structuration. He stresses that 'the structural properties of social systems are both medium and outcome of the practices they recursively organize' (1984: p. 25). Moreover, Jones reveals the 'transformative' nature of virtual community (p. 56), stressing that it is a space 'where social structure and meaning exist, and where actions spring forth'(p. 52). Not only could the world be transformed, but one's self and identity could also be formed as a result of this mediated community (Moores, 2000: p. 38; Jones, 2007: p. 42).

Therefore, I argue in this paper that the notion of cyber community cannot be merely seen from an electronic perspective or as one being run through the mediation of electronic technologies, and understood through its pre-envisaged functions in the society. It is an 'ontological' (Jones, 1997: p. 37) and epistemological' account.

Ontological in the sense that it describes and forms the world (p. 56). Giddens (1990) in his Theory of Modernity asserts that the modern society has been greatly defined and formed by ICTs. He argued that contemporary places have become 'phantasmagoric', or have been stretched out across space irrespective of time (Moores, 2000: p.106). Unlike before, the concept of space today is no longer time-bound and geographically constrained. This time-space distanciation, as Giddens calls it, characterizes the emergence of a new reality called 'global village' (Jones, 1997; p.36) where human action is facilitated via cable wires and other electronic means. One can travel, communicate, or transact business 'across vast geographical distance, resulting in the disembedding of social system' (Moores, 2000: p. 37). The 'concept of disembedding' as espoused by Giddens allows people's day-to-day lives to be lifted out from their locale and be touched and influenced by social forces and happenings from far away (p. 106).

By epistemological, I mean that cyber community is a form of knowledge whose meaning and impact is context-bound or is grounded in people's everyday life (Rheingold, 2000: p. xvi; Moores, 2000: pp. 9 & 39). Giddens in his Theory of Modernity argues that the meaning and impact of the ICT phenomenon must be grounded and understood from a certain experience or social context, or must be investigated through what he calls as phenomenological or experiential analysis (p.36). By phenomenological study, Giddens stresses that the 'large-scale institutional and technological transformation are bound up with small details of personal experience and self-identity' (ibid). Moreover, in conducting a phenomenological study about ICT, Moores suggests that we must 'look at the nature of articulations between the local and mediated experience in the day-to-day routines and biographies of the social subjects' (2000: pp. 37-38). In other words, the meaning of cyber community is not somewhere or embedded in the technical logic of the technology, but it can only be determined by understanding how it is lived in the people's everyday life.

3. STUDYING CYBER COMMUNITY

While there are already quite a number of empirical studies done evaluating the impact of ICT on society, most of them are carried out focusing on the ICT functions using the functionalist and positivistic approaches. By functionalist and positivistic, I mean that the studies are conducted based on the presumption that ICTs are tools that have pre-envisaged functions, and that the studies are carried out to determine whether the ICT intervention is effective or fit for its intended clients. Less in-depth analysis that uses the constructivist framework has been done. The constructivist framework assumes that reality is multiple and subjective (Creswell, 2007). To view cyber community using this lens invokes that its meaning is not singular or defined based on standard parameters, but is multiple and socially constructed. To understand a social reality, according to Ethnomethodology, is to understand its underlying structure or how it is structured (Handle, 1982: pp.45&51), or to investigate what is 'account-able' (referring to people actions and procedures) for making it (Have 2004; p.19). I call the process of 'accounting' in this paper as 'sense-making' (Handel, 1982; p.50), which means a production of social structure that people recursively reproduce in accomplishing their everyday lives. Giddens (1984) defines social structure as follows:

> Social structure is 'a set of rules and resources recursively reproduced and organized as properties of social system' (p.25). Rules here refer to techniques or generalizable procedures applied in the enactment or reproduction of social practices, while resources refer to structured properties of social systems drawn upon and reproduced by knowledgeable agents in the course of interaction (*e.g.*, language, metaphors, grammar, and social norms that are drawn upon in interaction).

Informed by ethnomethodological principles, I argue that to study sense-making one has to look into people's everyday lives. By everyday life, I am referring to a periodic 'orientation' or pattern of 'commonsense' events characterized by practical, fluid, and loose actions, which are 'not based on standards of traditional logic' (Handel, 1982; pp. 42&51). It is in these ordinary, locally situated, and time-bound activities or what Garfinkel calls as 'indexical expressions' (1964) that we understand the natural rather than the objective construction of reality. Ethnomethodology asserts that any everyday situation is composed of accounts that are characterized by three forms of structures, such as reflexivity, indexicality, and let-it-pass:

> *1. Reflexivity* refers to the premise that 'all accounts are part of the situation that they organize' (Handel, 1983; p.51). 'An account that is reflexive means that it defines reality and at the same time it is that reality' (p. 39); 2) *Indexicality* means 'dependence of an account upon the context in which it occurs for its meaning (Handel 1982). By indexicality, 'Garfinkel denotes local, time-bound and situational aspects of action' (Have, 2004: p.20). This is based on the 'axiomatic premise that any account is only part of the total account of a situation; we act on it based on information available to us; every account is incomplete; is technically loose or indexical' (Handel, 1982, p.43); 3) *Let it pass* refers to commonsense knowledge or practical actions that are not based on standards of traditional logic. This is based on the 'assumption of commonsense reasoning that world exists with characteristics imposed independently of our definition' (Handle 1982; pp. 46-47). 'When confusion arises, when events appear ambiguous, the commonsense belief is that there is some determinate truth to the matter' (p. 46).

Based on the conceptual framework above, cyber community can be assumed to be a reflexive phenomenon with an 'incarnate property' (Have, 2004: p. 19) in that 'it defines reality and at the same time it is that reality' (Handel, 1982: p. 39). In other words, I assume that people's meaning-making process is reflexive to the meaning of cyber community. To understand people's sense-making process is to understand the meaning of cyber community. Hence, it can be inferred that the people's sense-making process is constitutive of the cyber community phenomenon. Moreover, I claim cyber community as an everyday account that is indexical in nature embedded in people's loose, local communicative expressions. Its meaning is time- and context-bound, and is defined by people's local language. Lastly, to study cyber community is to look into people's 'commonsense attitude' or actions. Commonsense attitude refers to the people's practical actions, such as their mechanisms in coping and accomplishing their everyday lives.

Another theory that can be useful in studying the cyber community phenomenon is the Theory of Structuration by Anthony Giddens. The theory argues that the relationship of human agency and social structure is constitutive of the society. Giddens defines human agency as 'people's capability of doing things' (1984: p. 9), while social structure as mentioned earlier refers to 'a set of rules and resources recursively reproduced and organized as properties of social system' (p.25). Influenced by this theory, I believe that cyber communiy as a social reality is a product of the recursive interaction between human agency and social structure (Giddens, 1984). The term interaction here does not imply a cause-effect or functionalistic role of cyber community, but rather it assumes the mediating property of the phenomenon. 'According to the notion of the duality of structure, the structural properties of social systems are both medium and outcome of the practices they recursively organize' (Giddens, 1984: p. 25). The term medium here does not refer to a tool that one uses, but an active agent that 'constrains and enables' (Ibid) the emergence of reality. The construction of cyber community as a medium and outcome means that it constrains and enables social realities in people's lives, and in the course of this mediation process it is building up and defining itself.

One important social reality that has to be likewise investigated as it is considered inescapable and highly associated with the study of modernity and cyber society is the formation of identity and selfness (Gauntlett, 2002: p.96; Giddens as cited by Moores, 2000: p.38; Jones, 1997: p. 42). I assume selfness here as neither

inherited nor static, but it is an ongoing, symbolic project that is shaped and re-shaped in the course of interactions (Moores, 2000: p. 38). 'It is not found in one's behavior nor in the reactions of others, but in a capacity or process of keeping a particular narrative ongoing' (Giddens 1991 as cited by Gauntlett, 2002: p .99). Hence, to study the cyber community phenomenon is to surface how people shape and re-shape their identity in the course of their interactions with others. Self-identity should not be viewed as an 'objective description' (Gauntlett, 2002: p. 99) of one's biography, but as a processual accounting of what constitutes a modern individual. Moreover, in studying self-identiy, it is imperative to look into what Michel Foucault calls as 'technologies of the self'. Technologies of the self refer to the 'specific techniques that human beings use to understand themselves (Foucault, 1988). Matthews (as cited by Gauntlett, 2006: p.125) defines 'technologies of the self' as the "ways or 'mechanisms employed by individuals and society, which perpertuate the public consumption and regulation of individuality'. To investigate one's identity in cyber community doesn't mean investigating truthfulness about it, but as a strategy of making sense of the modern life (Foucault as cited Gauntlett, 2006: p. 128).

Another potential area of study in cyber community is the emergence of social spaces. Social spaces refer to the 'arrangement in the social world' (http:// www.answers.com/topic/space-2013) as a result of cultural and ideological encounter between the farmers' culture and ICTs (Pigg, 1992: p. 492). In addition, social spaces 'can be defined and manipulated using material culture and people's experiences... and can be structured in terms of power, gender, and social relations' (http://www.answers.com/topic/space-2013). Equally important to the study of the emergence of social spaces is the study of social positions. In the course of ideological or social encounters, Giddens stresses that individuals tend to position themselves (1984:p.83) or strategically find their place in the emerging social scenarios. Giddens defines social position as:

> "a specific intersection... or a specification of a definite 'identity' within a network of social relations... It is best understood as positioning, which involves many subtle modalities of bodily movement and gesture, as well as more general motion of the body through the regional sector of daily routines. The positioning of actors in the regions of their daily time-space paths, of course, is their simultaneous positioning within the broader regionalization of societal totalities and within intersocietal systems whose broadcast span is convergent with the geopolitical distribution of social systems on a global scale." (1984: pp. 83-83)

Analyzing social spaces and social positioning is based on the assumption that the construction of cyber community can serve as a 'map' (Pigg, 1992: p. 492) that pinpoints social positions and a compass (p.499) that allows individuals to orient and position themselves in the emerging social spaces not only in the local but also in the national or global setting.

4. CONCLUSION

To sum it up, this paper contends the importance of the use of constructivist paradigm as a method of inquiry in unpacking the integral role of ICT in the organization of community in the modern days. The methodological tools as well as research areas identified provide a comprehensive platform of how cyber community must be studied. Claims of this paper, however, are yet in the theoretical level. Empirical studies have to be done to strengthen said claims. It is but also worth mentioning that the proposed framework in this paper is not something that is fixed and restrictive but it is flexible with an iterative character. It may be modified or added with along the research process depending on the nature and complexities of the data analysed.

ABOUT THE AUTHOR

Ronan Guanzon Zagado is doing PhD at the University of Adelaide under the aupices of the Adelaide Scholarship International. He is working on a project that explains the pervasiveness and use of texting in agriculture in the Philippine context. Specifically, he aims to qualitatively account for how texting has become relevant in rice cropping. In his project, he will also the address the emerging discursive issue of why

farmers instead of consulting with their local agricultural extension workers would rather text their farm queries to distant knowledge provider. His supervisors are Dr Michael Wilmore (Media Discipline) and APrf Andrew Skuse (Anthropology and Development Studies).

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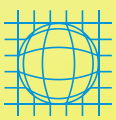

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