User reflection on actions in ambulance telemedicine systems

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Published in:
Proceedings of the Tenth Danish Human-Computer Interaction Research Symposium

Publication date:
2010

Document Version
Early version, also known as pre-print

Citation for published version (APA):
Hansen, M. (2010). User reflection on actions in ambulance telemedicine systems. In M. Hertzum, & M. Hansen (Eds.), *Proceedings of the Tenth Danish Human-Computer Interaction Research Symposium: (DHRS2010)* (Vol. 132, pp. 19-23). Roskilde Universitet.

Proceedings of the Tenth Danish

Human-Computer Interaction Research Symposium

(DHRS2010)

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NOVEMBER 2010 ROSKILDE UNIVERSITY COMPUTER SCIENCE RESEARCH REPORT #132

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ISSN 0109–9779

Research reports are available electronically from:

http://www.ruc.dk/dat_en/research/reports/

DHRS2010:

Proceedings of the Tenth Danish Human-Computer Interaction Research Symposium

Roskilde University

18th November, 2010

Edited by

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Computer Science Research Report #132

Roskilde University, Roskilde, Denmark, 2010

Preface

Roskilde University is happy to host the *Tenth Danish HCI Research Symposium* (DHRS2010). The aim of the symposium is to stimulate Danish research in human-computer interaction by providing an overview of current activities and an opportunity for networking. To do this we adopt a broad definition of HCI research and encourage contributions that reflect the variety of topics, methods, theories, application domains and so forth involved in our research. Practitioners are encouraged to contribute reflections on industrial experiences with HCI work.

We received seven submissions for DHRS2010 and judged that this was too few to have the symposium. The submitted papers are published in these proceedings; the authors will be invited to present their papers at next year's DHRS symposium.

DHRS has existed since 2001. The previous symposia have been hosted by University of Aarhus (2001, 2006, 2009), University of Copenhagen (2002), Roskilde University (2003), Aalborg University (2004, 2008), Copenhagen Business School (2005), and IT University Copenhagen (2007). The proceedings from the symposia can be found online at the sigchi.dk website (www.sigchi.dk/sigchi/dhrs).

Morten Hertzum and Magnus Hansen

Roskilde University, November 2010

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Aging between places: supporting mobility for elderly

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ABSTRACT
Aging in place has become a key strategy when designing new care strategies for elderly. Shortage of trained personnel and the increased age of the population have created a challenge for society and a need for innovative strategies in this field. Many research initiatives are dominated by an assistive living approach, or an 'aging-in-place' approach, focusing on how technology can substitute for loss of physical abilities and allow for remaining at home. This paper argues that independence and well-being also includes the ability to maintain social relationships by preserving mobility. We study three elderly travelers using a mobile, location-based service in an airport. Elderly travelers have different ways of coping with traveling and different motivations for traveling. By applying a cultural view of mobility in our analysis, we get a better understanding of mobility among elderly travelers.

Keywords
Elderly travelers, mobilities, mobile technology, cultural view

1. INTRODUCTION
This paper aims at contributing to a richer perspective on the importance of mobility among elderly. Our study of mobility among elderly, origins in a location-based technology project focusing on supporting typical airport customers. Many projects in the area of urban computing or technology for navigation and way-finding are based on studies of young, urban business users [4], [5] and very often focus on how specific mobile technologies can ease location-oriented or geographical barriers for human activity [8]. We suggest that studies of elderly travelers should be broadened by looking at other cultures of mobility and other motivations for using technology when moving and traveling.

While much research in the area of urban computing defines the concept of mobility in narrow and technology-oriented terms aiming at supporting people in overcoming geographical constraints, Kakihara and Sørensen [10:1] define the concept of mobility in quite broad terms as manifesting "a transformation of our social lives combining new and old technologies". Also Dourish et al. [3] suggest a broader understanding of mobility including cultural perspectives on mobility.

This paper first outline existing research on senior mobility. In the following section we present Dourish et al.'s [3] three perspectives on mobility that serves to broaden the notion of the concept of mobility. Next we present the design of the location-based technology project, SPOPOS, and the related tag-along service and how three different elderly travelers used this service. Finally, we discuss our design approach and perspectives on mobility needed when designing for elderly travelers.

Published in M. Hertzum and M. Hansen (eds.), DHRS 2010: Proceedings of the Tenth Danish Human-Computer Interaction Research Symposium. Computer Science Research Report #132, Roskilde University, Roskilde, Denmark, 2010.

DHRS 2010, November 18, 2010, Roskilde, Denmark.

2. RELATED WORK
Many aspects of elderly, mobility and social connectivity have been addressed in research of aging and well-being [13], [10], [12].

2.1 Mobility and Quality of Life in Aging
Many initiatives on supporting elderly independent living are dominated by an assistive living approach, or an 'aging-in-place' approach, focusing on how technology can substitute for loss of physical abilities [1], [11]. Such assistive technological solutions support independent living by reducing the need for human care. Only few initiatives focus on the importance of social interaction. Riche and Mackay [12] suggest that enhancing inter-personal communication plays an important role in maintaining independence and quality of life among elderly. Further mobility is important for maintaining social relations: "mobility is a requirement for social inclusion and participation in economic life" [6].

Urry [15] relates mobility to the social quality of elderly life. He claims that access and availability is closely related to mobility, and praise that society now realizes mobility processes as engendering social exclusion.

"While elderly users describe their journeys as 'just' for shopping, or just to 'pop into' the 'hub', our research indentified many other 'needs' that people had, to visit a spouse in a care home, to visit friends, to go to a café, to attend a community centre, art classes, to get to work, to go on a pleasure trip, to go a pub and so on. Thus the range of what it is that the otherwise 'excluded' to access may only be revealed through new infrastructures that 'realize' such latent demand." [15:193]. In our study of elderly travelers we are focusing on everyday mobility. Even if air traveling is usually not considered a daily activity, air traveling in our study is used to sustain everyday social relations.

3. UNDERSTANDING MOBILITIES
In this paper we attempt to broaden the view of mobility by shifting our focus to the people often overlooked due to their less frequent travel habits and lower consumption of technological artifacts. We base our analyses on Dourish et al.'s [3] assertion that urban computing has traditionally focused on the city as a site for consumption and the young affluent urban users. This dominating focus have shown to have crucial consequences on the applications designed and the understanding of the urban life in itself:

"While these applications clearly meet needs, they fail to take the urban environment on its own terms; they are based on the idea

that urban life is inherently problematic (…). Further, they fail to acknowledge the lived practice of urban life, and particular its diversity and the different urban experiences of different groups." [3:101]

We studied elderly travelers using a mobile service for way-finding and maintaining social contact during their stay in an airport (see subsection on the tag-along service). Inspired by Dourish et al. [3] we ask *how the tag-along service can provide a site for creating new forms of collective practice and meaning.* Dourish et al. [3] presents three perspectives that broaden the notion of the concept of mobility: *mobilities, finding more than your way,* and *mobility as collective.*

3.1 Mobilities

Dourish et al. [3] discusses the term mobility and questions if this term should be used to cover the wide spectrum of different people's movements. While most mobility and technology studies address business related studies on mobile and flexible work situations supported by technological solutions; mobility of urban travelers also includes other subcultures like retired people moving to kill time, homeless people using public transport for shelter, teenagers commuting for school, religious pilgrimages etc. These very different subcultures and motivations for moving suggest that we focus on *mobilities* rather than *mobility* [3:106] as also suggested by Urry [15].

3.2 Finding more than your way

Movement according to Dourish et al. [3] is not only about moving from one destination to another. It can have symbolic, cultural, social or even aesthetic significance and in order to understand the interplay between mobility and technology it is important to have this complexity in mind.

3.3 Mobility as collective

The notion of *mobility as collective* moves beyond the individual and concerns how patterns of movement can create larger collective spatial structures. Dourish et al. [3] exemplifies this with the individual undertaking a pilgrimage. This journey is not only given meaning by the individual experience but also through the historical patterns of previous journeys made by other religious pilgrims.

4. SPOPOS DESIGN FOR MOBILITY

In this section we present design aspects of a technological platform – SPOPOS – which we developed and tested for general airport passengers' use, but further used in our design for an everyday aging context to explore aspects of elderly mobility. Specifically, our observations explore elderly travelers' experiences of staying and way-finding in an airport.

4.1 The SPOPOS System

SPOPOS is a system that tracks people and objects indoors [2]. The project explores how passengers can be offered additional services by means of their mobile phone or by carrying RFID tags. An airport can be a challenging environment [9], [7]. Passengers may have positive as well as negative expectations, they may have some anxiety about delays, sudden change of gates and some may suffer from fear of flying. Frequent travelers need efficiency, and occasional passengers need security, the right information, and in general, peace of mind.

Infrastructure

The system deploys Bluetooth and RFID location detection to track passengers. Each detection method is able to show in which "zones" a passenger is located. A Web interface is combined with Bluetooth or RFID localisation. With each of the technologies, a prior registration is needed to match a given passenger's mobile phone number with a tracking ID.

Location-Based Services for Travelers

The design purpose of SPOPOS Gatecaller service is to ensure a smooth and efficient stay and transit of passengers by reducing uncertainty that passengers experience and make them less liable to miss their flight. The Gatecaller service sends information about boarding and departure changes directly to the cell phone of the individual passenger, who will no longer depend on access to information screens. Information and timing are based on the passenger's location and include estimated walking time to the gate.

The Tag-along service

The tag-along service allows friends and relatives to observe the traveler's movements between zones from a password-protected Web page. For instance, elderly parents or teenage children can be followed when they are airside. The interface is a map of the airport indicating the traveler's position and with a number of visual clues making remote guiding possible.

5. STUDY OF ELDERLY TRAVELERS

We studied elderly travelers in order to explore the relation between the tracking system, specifically the tag-along service, and the experienced mobility aspects in terms of mobility needs, wishes and dreams.

We did semi-structured interviews before the day of departure and observed the use of the tag-along service in the airport. Most interviews before traveling were conducted on the phone, since the participants were based in different geographical locations. On the day of departure we met the participants at the check-in counter in the airport. After check-in we provided them with an RFID-tag and gave them a small way-finding assignment. That could be to meet us at a specific café in the tax-free shopping area of the airport. The observation was finalized with a small evaluating interview, before the participant departed.

It was a challenge for us to recruit participants willing to participate in the observational study, probably because people do not appreciate being stigmatized as 'elderly' as also experienced in other studies with elderly participants [12]. Through a travel agency we sent out letters to 43 elderly people, who were traveling in spring 2009. Only three appropriate[1] travelers answered our request.

A consideration to make when recruiting participants for a study like this is that participants signing up are most likely the ones that have the extra energy it takes to participate in something new and unknown. This means that people, who find it difficult and maybe confusing to travel, will most likely not be the ones signing up for participation.

Below we present the elderly participants that participated in our study. The description of each of them illustrates different issues to consider when designing for different groups of elderly travelers.

[1] It was a criterion that the participants had to travel out of Copenhagen airport.

Tom[2]

Tom is a retired police officer. He is 73 years old and is traveling to Washington with his wife to visit their daughter and grandchildren, who live there temporarily.

Since Tom retired, he and his wife have traveled frequently all over the world, either to visit their children or with a group of friends. Tom is very dependent on his wife. He suffers from Parkinson's decease and is a slow walker. They complement each other well and despite his illness they are both very relaxed travelers.

He is not very technologically minded. He does not have a mobile phone and only rarely uses the Internet. His wife uses both and is the most open-minded regarding new technology. The potential they see in the tag-along service is for social connectivity. Tom's wife could well imagine their daughter signing up for the system just to see if they are on time when she is meeting them at the airport.

George

George is a widower, 70 years old. He is characterized by his strong will and habitual behavior. He always eats his breakfast at the same restaurant in the airport. Twice a year George travels to Bogota in Columbia where he owns an apartment. The family of his late Columbian wife is living in Bogota. He has no fear of new technologies as such. Despite that he has no mobile phone, but uses the Internet regularly, especially for communicating with his brother when he is away.

George is overweight and suffers from sleep apnea. He is very aware of going to the gate as early as possible, since he is a slow walker. He prefers to travel through Charles de Gaulle airport in Paris because he is familiar with that airport. He does not trust the airport personnel to help him to the gate. He tells how he has walked all the way through Charles de Gaulle airport with his entire luggage because he didn't trust the shuttle busses to transport him to the right gate. Even though he is physically challenged and probably a candidate for the tag-along service he is very restricted by his own habits and lack of trust.

He cannot imagine himself using the tag-along service, since he wouldn't trust others to lead the way. Like Tom he considers the potential to be social connectivity rather than practical way-finding. George thinks that his brother might be interested in knowing that he gets on the plane properly.

Mary

Mary is divorced and 72 years old. She is flying to Florida to visit her daughter, son-in-law and their two cats. Mary has a mobile phone but is not a very strong user of the Internet. It has been a challenge for her to find all the right papers online that is needed when traveling to the U.S.

Mary represents a traveler who has experienced a reduction of her mobility after she divorced her husband, who used to organize their trips.

She has traveled to the U.S. several times, but still get anxious when traveling. She pays 2000 DKK (around 400 USD) extra just to have her stopover in Keflavík airport in Reykjavik she is familiar with that airport. Furthermore she visits Copenhagen airport days before leaving to see where she needs to check in and because she enjoys the atmosphere in the airport.

[2] Names of participants are made up for reporting purpose.

Mary mentions how she misses company when she is traveling. To Mary the tag-along service has both an assistive and a social potential. The system gives her a feeling of traveling with someone, which meets her social need. The assistive way-finding aspect enables use of cheaper connections, and the possibility to move more freely while in contact with peers during traveling.

5.1 General observations

Our study of elderly travelers indicates that the tag-along service is mostly relevant to single travelers. Couples supplement each other and find both support and social enjoyment in each other's company. Additionally to navigation, the tag-along service has a social potential for people traveling alone. Particularly Mary misses a traveling companion and the tag-along service could offer a subtle sense of having someone at one's side while being in the airport. Both Tom and George mention that it might be interesting for their relatives to follow them online.

One of the greatest challenges for the system is to follow the routines and rhythms of the different travelers. Riche and Mackay [12] also mention understanding of rhythms and routines as a key design aspect. Our small observational study shows that the combination of the navigation support and the social connectivity is important.

6. MOBILITIES AMONG ELDERLY

Using Dourish et al. [3] broadens the perspective of our observations of elderly travelers using our tag-along service: *how does the tag-along service provide a site for creating new forms of collective practice and meaning?*

Sociological and cultural approaches to mobility like Urry [15] and Dourish et al [3] make it clear to us that the understanding of mobility in many areas has been dominated by the urban computing tradition. In the following we discuss mobility aspects of our user studies in the airport by applying Dourish et al.'s [3] three perspectives on mobility: *mobilities, finding more than your way*, and *mobility as collective.*

Senior mobilities

Dourish et al. [3] suggest that we should think of *mobilities* rather than the singular term mobility, because of the wide range of different motivations for traveling and different subcultures of traveling.

We identified these 'sub-cultures' of elderly travelers and their very different motivations for traveling.

Seniors finding more than their way

The idea that movement is not only about moving from one destination to another is also seen in our observations. The suggestion that movements and traveling can have different cultural or social significance and different motivations helps us understand the interplay between mobility and technology in our observations.

Urry [15] explains social access as being dependent on the ability to overcome constraints of space to "gain access to the informal networks of work, leisure, friendship and family." [15: 193]. Both previous research and our own observations indicate that the airport space contains more complexity than just people transferring between places. For Mary the airport was an obstacle before the relaxing holiday atmosphere appeared, but despite her anxiety also a place of excitement and joy.

It is important that the tag-along service supports the feeling of being independent. For anxious travelers the tag-along service enhances the feeling of independence by offering peer or family

related support that makes them independent of assistive services. Our participants emphasize the social aspect as relevant.

This has resemblance to the notion of *corporeal travel* introduced by Urry [14]. He talks about mobility resulting in "physical proximity to particular peoples, places or events and in significant ways this proximity is felt to be obligatory, appropriate or desirable." [14:258].

Mobility as collective experience of seniors

Our participants' journeys reproduce the spatial structure of the airport and are additionally affected by the spatial structure reproduced by travelers before them.

On a more abstract level traveling is an enactment of being free, enlightened and part of the global world. Tom and his wife are examples of this new collective experience of elderly exploring the world with a strong appetite on life inspired by other elderly in their situation. Being a traveling elderly challenges the stereotypic image of seniors as some that is nervous about traveling, ignorant about the world and physically challenged. A new collective mobility experience is shaping among seniors.

7. CONCLUSION

Can we – from the three perspectives on mobility – say that the tag-along service provide a site for creating new forms of collective practice and meaning? The small size of our study limits our answer. Navigation via own social network is an alternative to airport assistance. This is a step away from the current services that are offered, and associated with being dependent and physically challenged. The tag-along service has the opportunity to support elderly without removing the feeling of independence and at the same time providing the social feeling of traveling with someone.

Travelers represent a vast diversity of different reasons for, concerns about, physical challenges related to, and colorful expectations about traveling. This makes mobility – or mobilities – a much more complicated thing than usually thought of. Mobility is ambiguous and we should design for this ambiguity.

We studied elderly travelers using our tag-along service and identified many different ways and motivations for traveling. The same diversity could be identified in other social groups, but it demonstrates the necessity of applying a broader cultural view when designing for mobile living. Using the work of Dourish et al. [3] we have broadened the experience perspectives of a way-finding service in an airport, more specifically focusing on observations of elderly travelers.

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C-HUB: a communication and network platform targeting the Generation Plus and their social and care networks

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ABSTRACT
This paper presents an ongoing project that focuses on improving the quality of life for senior citizens by developing IT support for independent living in their homes. We introduce a concept that explores and supports coordination within a social and care community targeting elderly people. The paper reports on early project findings such as how elderly perceive a touch screen based interface and why a touch screen based interface might be favorable for this category of users in respect to a standard PC. Furthermore, This paper contributes to the societal debate on how IT may support ageing in place for the Generation Plus [2].

Author Keywords
Social and care network, touch screen interaction, iPad, communication, coordination, services, generation plus

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION
Pervasive Healthcare related research projects have to a large extent investigated HCI and technology mediated aspects related to situations where the user is also a patient. This is manifested in both hospital and home-based projects, where the idea is to, through pervasive technology support the cure, rehabilitation or the everyday management of a specific medical condition and to facilitate communication between patient and doctors. Examples of such projects are for example [4, 6, 9-10]. These projects introduce technology and/or novel use situations where technology assists patients and care providers in managing the condition at hand. In these situations it has been identified that private homes and their inhabitants, through their heterogeneous nature do challenge a successful implementation of such assistive technologies [11]. To introduce technology that e.g. can scale and adapt to novel care situation before a user becomes ill (i.e. a patient) or weakened by natural aging and hence might lack resources to apprehend new technologies is less investigated. *When* to introduce novel technology is indeed a concern with user groups that do not have a previous profound knowledge of computer technologies, such as for example some groups of elderly people. To introduce a technological system and infrastructure in time, and let people learn its use before weakened by for example sickness or age could help the users to apprehend and familiarize with the technology at hand. Indeed, to be able to use an installed infrastructure over a longer time, for example over 20 years of time, instead of during a one month 'sickness-period' also change the perspective on the sometimes high initial cost to install technology in private homes. Especially if we look at normally aging elderly people, rather than discussing healthcare technology, we could consider talking about 'whole lifetime management and support' technologies; systems that we can learn when we are resourceful and strong, and that can be useful for us in all phases of life.

BDSI (Brugerdreven Sundhedsinnovation/User-driven Healthcare Innovation) is an innovation consortium that focuses on improving quality of life for senior citizens by developing IT support for independent living in the home [5]. The innovation consortium includes partners from academia, industry, public healthcare organizations, and senior citizen associations.

This paper presents an ongoing BDSI project called the Communication Hub, or simply the C-Hub. The aim of the C-Hub project is to develop, through a Participatory Design process, a system that can support collaborative tasks, coordination and facilitate contact among resourceful elderly people, their relatives (e.g. their adult children and grand children) and different care and service providers such as the municipality. C-Hub is a distributed, networked application running on the Apple iPad that allow the above mentioned users, being physically distributed but indeed familiar with each other to coordinate and communicate activities, relations and memories.

GENERARION PLUS AND THEIR IT USAGE
Seniors, 'the grey gold' or generation plus – there are certainly many ways to address the generation who may still be active in labor market or recent retirees who are ready to dedicate time and actively engage in new activities. According to the Danish newspaper Kristelig Dagblad, 78 % of Danish citizens between the ages 60 and 69 are actively using the Internet on a daily basis, which is an increase of 26 % since last year [3]. Furthermore, the article continues by stating that 15 % of the people above the age of 55 have a Facebook account which they typically use for activities such as following friends' children or sending messages to their grandchildren. Indeed, during three month in 2009, women over 55 was the largest growing age-group

on Facebook [1]. Despite the large number of Internet users, this age-group group is not a homogeneous one from an IT perspective. One the contrary, some seniors may due to their previous career choices not have been exposed to and been familiarized with the use of information technologies. Others may be retired computer scientists and thus experts in the use and handling of keyboard, mouse and GUIs. In C-Hub we address both the 'want-to-be' users that currently lack computer skills as well as the more experienced users by providing an interaction paradigm based on a touch screen computer, namely the Apple iPad.

ASSUMPTIONS BEHIND THE STUDY

The C-Hub project is a collaborative project between Logica, a software house with an interest in healthcare services and Ældresagen, a senior citizen association that safeguards the interest of elderly citizens and the Computer Science Department at Aarhus University. In such collaboration there is indeed a fine balance between expected industry interests and outcomes while targeting relevant and interesting research agendas. The C-Hub project partners have chosen a pragmatic stance. Rather than launching the project with an explorative, open-ended design study, the project was initiated based on a set of assumptions from the industrial partner such as:

- The target user group for the developed system and services are active, rather resource strong people from the age of 60+.

- A touch screen interface is easier to use for seniors compared with a PC, especially for those without prior computer experiences. The partner company also had a will to explore how they could implement health and care related services on a touch screen-based device such as the iPad.

- Three known services respectively 1) a calendar, 2) a picture sharing tool and 3) a post-it bulletin type board would be relevant to compile in an integrated whole and would represent a minimal subset of services relevant for the intended target group.

One may argue that the assumptions are relatively qualified as both services and the choice of target group are informed by earlier BDSI consortium activities and know-how from the non-research project partners. Hence, we did not perform dedicated pre-activity analysis, but rather tried out the assumptions coming from mainly the participating company. Even if unorthodox, we embrace this approach as a welcomed opportunity to be able to test the actual services as a type of reflective boundary object [8], and we aim to better understand how a strong commercial/industrial interest influence a participatory design process throughout this work. Even though the project until now is mostly built on assumptions with a technology-centered perspective, early findings from workshops with the seniors do support that the concept has an interesting potential. The concept embeds potentials from a HCI perspective, from a business perspective and in correspondence with a research agenda related to PD methodology development. Furthermore, the project investigates how-to successfully develop services that do not only support the creation of a relevant care network for seniors with no prior computer knowledge but that also can help us as researchers to better understand how to successfully implement products and services in the seniors private homes.

THE C-HUB CONCEPT: BACKGROUND

On a daily basis, the generation plus might need aid from their next of kin to accomplish some of their daily tasks. These tasks include shopping, buy medicine, make an appointment with their doctor, gardening, etc. There may be also the need for support the other way around, i.e., when their adult children need aid from the seniors, e.g., for taking care of their grandchildren some hours during a day. Communication between the elderly and their next of kin is needed in order to accomplish these tasks. This communication can be, and is in many occasions done, for example by using post-it notes, sending an e-mail, or by telephone calls. Some of these communication channels introduce IT technologies, allowing the users to be in different physical places and still be able to communicate. This is a very important aspect for the communication as normally the generation plus and their next of kin are not in the same physical place on a day to day basis. However, many of these communication and coordination technologies are vertical solutions that do not offer one aggregated view. Many different instruments and strategies are needed to get a coherent overview.

In this case, a simple and easy to use communication and overview channel between the actors involved is needed, this communication should also be possible to do remotely, with the use of IT technologies to support the actors involved.

Internet is nowadays used as a communication channel and situation overview instrument for coordination of these tasks, normally with the use of personal computers. However, a PC can be a rather difficult tool to use by the elderly people that like to perform these coordination activities, because of its complexity and lack of portability. For elderly people without prior PC use experience the technology itself can create a barrier and add complexity to the task at hand. These facts raise the need for a simple and easy to use system that can be easily portable.

Studies conducted by e.g. Holzinger [7] show that touch screen systems are simple and easy to learn for the elderly, where the iPad is just one example of a commercialized touch screen based system.

The Apple iPad is a tablet computer. With 242.8mm x 189.7mm x 13.4 mm (width x height x depth) dimensions, 730g weight and network connectivity, the iPad offered a well-supported and stable development platform when the project started in June 2010.

THE C-HUB CONCEPT: SYSTEM

With the C-Hub, each of the users has his/her own iPad, where he/she can interact with the system. The information is shared through a C-Hub server that contains all the system data, which then propagates the information to the interested users as shown in Figure 1, top.

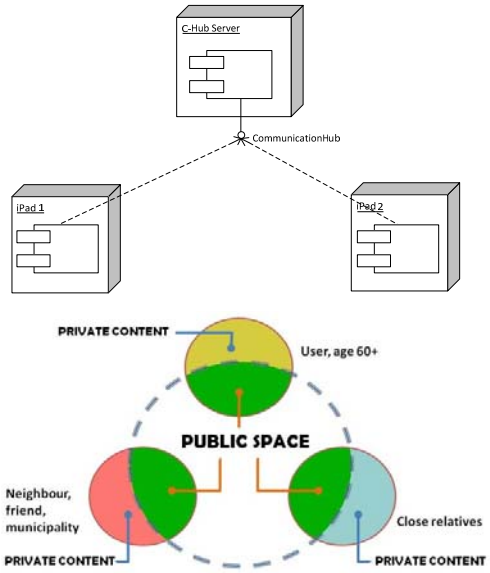

Figure 1. C-Hub runtime diagram and user privacy model

Furthermore, each user has one private 'desktop' and one public. All information placed in the public area is immediately shared with the rest of this particular users' network (see Figure 1, bottom). The C-Hub application provides three different services to the users, namely;

Figure 2. Creation of notes

The Notes service

The C-Hub provides a very simple service that uses the post-it notes metaphor, allowing the users to write notes and organize them in stacks of notes, i.e., the user can create a stack of notes related to their kitchen, in this stack the users can write notes related to this subject. Figure 2 shows us the user interface for creating notes.

The Photos service

The photos service allows the users to share photos with their next of kin. Users can create photo albums and add photos to it. This interface can be seen in Figure 3, left.

The Calendar service

The calendar service allows the user to schedule appointments, i.e., a consultation with their doctor, setting up reminders for these appointments. The user interface is shown in Figure 3, right.

Figure 3. Photo Album and calendar user interface

These three services are a starting point for our user studies, where we observe the user's interaction with the system and get feedback from the existing functionalities, as well as possible new services to our C-Hub platform.

USER WORKSHOPS

Two workshops have been held together with 5 senior users. Three of them had some or good previous knowledge of computers and two had no prior computer knowledge. The two workshops were both three-hour workshops held at the premises of the involved company. The purpose of these workshops was two-folded. First, to facilitate a shared discussion among the invited users (three users in WS 1 and two users in WS 2), the industrial partner, GUI designers and the project researchers about current praxis and let the participant 'beta-users' try and get familiar with the prototype. Secondly, to perform usability studies on the prototype and jointly work on areas of improvements related to the applied interaction modalities and the embedded functionality (i.e. the services within our application).

The participant users were invited by the project partner Ældresagen. Three of them, one man (74 years old) and two women (62 and 64 years old) had previous computer experiences acquired for example at work. Indeed, the man was an 'expert user' as he teaches computer skills to elderly people. These three users participated in the first workshop. The other two were invited to the second workshop as novice users, but that had identified a need to start using computers (see Figure 5). Indeed, they had both signed up for an 'Introduction to PC' course.

Figure 5. Users at one of the workshops.

Preliminary insights from the workshops

Early findings from the workshops suggest that services that are improving current ways of doing or replacing current known services have a potential if the GUI supports the users' perception of a no-risk and potentially limited-choice interface similar to how they perceive their mobile phones and allows for a relatively effortless and easy to master interaction. Moreover, the option of keeping information such as appointments, photos and other important data in a 'cloud', where it would be safe even if they lose their iPad seems to appeal to this particular target group. Indeed, both the computer novice users at the second workshop described a fear of losing or accidentally deleting information with a computer. Something they did not fear when using for example a mobile phone. In the evaluation of our prototype, they perceived the iPad more as a 'screen' then a computer and did not raise the issue of accidently deleting data due to the complexity of the device.

DISCUSSION

It is clear that the development and the trails carried out with the users until now have had a large focus on one device, on one interface. However, it is important to acknowledge that the iPad in our project is not a standalone device, but rather an interface, a gateway to some shared functionality. While we have decided to start with a minimal subset of possible services (i.e. notes, photos and calendar) we hope to understand the value of these services for the Generation Plus and to understand, once our users have got more familiar with the device, what other services they might need. I.e. we like to investigate what emergent needs can be identified during use of our system. Furthermore, will the users start to envision now use-scenarios for our services? Can the photo service be used for more than 'just' to show pictures of the grandchildren and vacation-memories? Will our users for example start to use photos to communicate and share problems in their everyday lives? and Will they use for example the picture service to take a photo of a broken lamp or a bush in the garden that needs to be removed? Our future work will among other more technical issues investigate these aspects. Therefore, we plan to extend our observations to the user's home, giving us a more valuable feedback of the daily use of the C-Hub, as it is being used and evaluated in the wild. These trails will naturally include other members of the seniors' network, such as their adult children to enable a full test of the social and care network possibilities. With respect to the C-Hub application we will also investigate the possibility to develop it as a web application, being then supported by a large range of system platforms (e.g. Android and other mobile screen devices). This will also enable next of kin to use existing computers to interact with the elderly user through a standard web-browser and/or his or her mobile screen.

ACKNOWLEDGMENTS

We would like to thank the participating users and BDSI.

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Frustration: A Common User Experience

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ABSTRACT
The use of computer applications can be a frustrating experience. This study replicates previous studies of the amount of time users – involuntarily – spend trying to diagnose and recover from problems they encounter while using computer applications such as web browsers, email, and text processing. In the present study, 21 users self-reported their frustrating experiences during an average of 1.72 hours of computer use. As in the previous studies the amount of time lost due to frustrating experiences was disturbing. The users spent 16% of their time trying to fix encountered problems and another 11% of their time redoing lost work. Thus, the frustrating experiences accounted for a total of 27% of the time, This main finding is exacerbated by several supplementary findings. For example, the users were unable to fix 26% of the experienced problems, and they rated that the problems recurred with a median frequency of about once a week. Experiencing the same problems repeatedly is likely to add to the frustration. The users in this study were highly experienced, precluding that frustration is only a concern for novices.

Categories and Subject Descriptors
H.0 [**Information Systems General**]; H.5.2 [**Information Interfaces and Presentation**]: User Interfaces – *theory and methods, user-centred design.*

Keywords
User experience, frustration, dissatisfaction, non-usability.

1. INTRODUCTION
The widespread interest in the user experience generally concerns fun, beauty, engagement, motivation, flow, excitement, joy, reflection, and other pleasurable emotions [1, 4-9]. A notable exception is Scheirer et al. [12], who attempt to frustrate the user on purpose to create affective responses. Users' experiences with information technology are, however, not restricted to pleasurable emotions and experiments with the effects of deliberately induced frustration. Rather, frustration appears to be an all too common user experience.

Ceaparu et al. [2] recently reported the disturbing finding that people lost 47-53% of the time they spent using ordinary computer systems due to frustrating experiences. That is, for about half of the time the 111 users who participated in the study were unproductive because they were, instead, preoccupied with trying to diagnose and recover from frustrating experiences. The excessive amount of time lost in these frustrating experiences was lost during the use of web browsers, email, text processing, and other ordinary systems. While Ceaparu et al. studied frustrating experiences during computer use in non-work contexts, Lazar et al. [11] performed a similar study of computer use at work. A total of 50 users took part in the study, and they lost an average of 43% of their time due to frustrating experiences. The lost time was about evenly split between time spent trying to solve the encountered problem and time spent recovering lost work. In both studies the frustrating experiences were spread across many applications and many problem areas, making it difficult to target efforts aimed at addressing the reasons for the frustrating experiences.

Frustration appears to be a basic notion that requires little explanation. Causes of frustration with computer technology include application crashes, long response times, unclear error messages, inability to satisfactorily complete tasks, confusing interfaces and so forth. In their definition of frustration, Lazar et al. [10, p. 189] emphasize unattained goals: "User frustration can be defined as when the computer acts in an unexpected way that annoys the user and keeps the user from reaching their task goals." Frustration is a frequent companion of computer use and a major reason why many people hesitate to use computers, or avoid computers altogether. Thus, frustration raises important research questions, three of which are addressed in this study:

- How much time is lost due to frustrating experiences?
- How severe are the frustrating experiences?
- Is a solution found or are the frustrations likely to recur later?

The main motivation for this study is that the amount of time lost due to frustrating experiences in the studies by Ceaparu et al. [2] and Lazar et al. [11] is almost too large to be believable. Therefore, this study replicates these previous studies.

2. METHOD
To investigate user frustration empirically we conducted a small diary-based study methodologically similar to Ceaparu et al. [2].

2.1 Participants
A total of 21 computer-science students (5 female, 16 male) participated in the study. Participants' age ranged from 21 to 33 years with an average of 26.3 years of age (*SD* = 3.2). Participants

Published in M. Hertzum and M. Hansen (eds.), *DHRS 2010: Proceedings of the Tenth Danish Human-Computer Interaction Research Symposium*. Computer Science Research Report #132, Roskilde University, Roskilde, Denmark, 2010.
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DHRS 2010, November 18, 2010, Roskilde, Denmark.

had an average of 13.1 (*SD* = 4.1) years of experience with computers, and they were at the third year of their bachelor-degree studies or the first year of their subsequent master-degree studies. All but one of the participants had a European cultural background; one participant had a Chinese cultural background.

2.2 Procedure

The study was presented as an assignment at the first lecture in a course on human-computer interaction. Students were encouraged to participate in the study as a way of adopting a user-centred frame of mind and gaining awareness of negative experiences with computers, but participation was voluntary. Sixteen students did not participate, either because they did not make the assignment or because they chose not to hand in the forms documenting their frustrating experiences.

Participants were asked to select a period of at least an hour of their computer use in the course of the next week. No specific kinds of computer use were assigned or expected. Rather, participants were to perform their ordinary computer-related activities and report any frustrating experiences. Frustrating experiences could be both major problems and minor issues. The possible span of frustrating experiences was exemplified with application crashes, dropped network connections, long download times, error messages, awkward workflows, hard-to-find features, and inconsistencies across applications. Finally, it was emphasized that "any experience that causes you frustration qualifies as a frustrating experience". That is, frustration was in this study defined as a subjective experience present when, and only when, a participant felt frustrated.

For each frustrating experience participants were to fill in a form similar to the frustrating-experience report in Ceaparu et al. [2, Appendix A]. This form included questions about what participants were trying to do when the frustrating experience occurred, the importance of the task, the level of frustration experienced, how often the problem happens, how long participants spent fixing the problem, how much time they lost in addition to the time spent fixing the problem, and whether they could work on something else during the frustrating experience. Participants were instructed to familiarize themselves with the frustrating-experience form before they started and to fill in a frustrating-experience form right after each frustrating experience. Participants were also asked to fill in a form with background information such as age, gender, and the length of the session during which they tracked their frustrating experiences.

3. RESULTS

Participants kept track of their use of computers for an average of 1.72 hours, and the main result of the study is that 27% of this time was lost due to frustrating experiences, see Table 1. The lost time consisted of an average of 0.27 hours spent fixing, or trying to fix, the problem that caused the frustration and an additional 0.20 hours of lost work, for example because something had to be redone.

Participants had an average of 2.38 (*SD* = 1.47) frustrating experiences. The frustrating experiences mainly concerned widely used applications such as web browsers, email clients, text processors, social media, music-management applications, and basic operating-system tasks such as the copying of files. A small number of frustrating experiences concerned more specialist applications such as software for compressing files and installing updates. Examples of frustrating experiences include:

(a) "Trying to make internal mic work in Skype." The participant spent two hours trying to solve this problem but eventually gave up without having found a solution. The experience received the maximum rating for level of frustration.

(b) "I was trying to output a PDF file in Photoshop. I was finishing up work on an A3 poster, a large 300 dpi/CMYK file with multiple layers. After a prolonged waiting time, the exporting of the PDF froze the application and I had to force close Photoshop – losing the latest changes to my poster." The participant spent 20 minutes fixing this problem and an additional 30 minutes redoing lost work.

(c) "Was trying to update a program I had just installed. The program shows the text 'Updating' and you wait… and wait. You don't know whether you are supposed to wait (because there are many files to update) or whether the program has frozen. No information/progress bar or other signs of activity. I try to cancel, but no reaction. I have to close the program in Windows' job list. This works but produces a series of error messages, which I simply close." This frustrating experience lasted 6 minutes, during which the participant felt unable to work on something else.

(d) "Using Microsoft Word 2007 to search for a text in a document. Standard shortcut for this (ctrl-F) not only does not prompt a search option, it made some of the text bold. Because of the changed appearance of Office 2007 there is no File/Edit menu with this option in it. After a while I found the new placement of this function. I realized that this was because it was a Danish localized version where shortcut keys were also changed." This experience lasted only one minute but received the maximum rating for level of frustration.

Participants' ratings of their frustrating experiences are summarized in Table 2. Across all the 50 frustrating experiences, participants' median rating of the level of frustration was 7 on a scale from 1 (not very frustrating) to 9 (very frustrating). Surprisingly, *level of frustration* only approached a significant correlation with the duration of the frustrating experience (p =

Table 1. Time lost due to frustrating experiences, *N* = 21 participants

Measure	*Mean (hours)*	*Std. deviation*	*Percent*
Length of reporting session	1.72	1.42	100
Time spent trying to fix the problem	0.27	0.62	16
Time lost to the problem (apart from the time spent trying to fix it)	0.20	0.17	11

Table 2. Ratings of frustrating experiences, *N* = 50 frustrating experiences

Question	*Median rating*	*Correlation with duration of frustrating experience* [a]
Level of frustration (1:not very frustrating - 9:very frustrating)	7	0.26
Importance of task (1:not very important - 9:very important)	6	0.34 *
Frequency of problem (8-point scale)	4: once a week	0.28 *

[a] Spearman ρ correlation with the sum of the time spent fixing the problem and the additional time lost to the problem, * $p < 0.05$.

0.06). There was, instead, a significant, though weak, correlation between the *importance of the task* and the duration of the frustrating experience, indicating that the longer frustrating experiences tended to occur during the more important tasks. Participants' median rating of the *frequency of the problems* indicated that the frustrating experiences recurred about once a week. The frequency with which problems recurred correlated significantly with the duration of the frustrating experiences, indicating that the shorter frustrating experiences tended to occur more frequently. Experiencing the same problem repeatedly is likely to add to the frustration.

Participants were also asked how they fixed the problem. For 26% of the frustrating experiences the answer to this question was that participants were unable to fix the problem. Given that participants were computer-science students this percentage is unlikely to be lower for other groups of computer user. Finally, participants indicated that for 60% of the frustrating experiences they were unable to work on something else until the problem was solved. Participants could not simply shift their attention to something else before they had found a solution to a problem or while they were waiting for an application to restart or for information to download. This emphasizes that participants were often unable to compensate for the frustrating experiences by multitasking.

4. DISCUSSION

The participants in this study were frustrated for an average of 27% of the time they spent using computers. The time lost due to these frustrating experiences can be divided into the time spent fixing, or trying to fix, the problems that caused the frustrations and the additional time spent redoing lost work. The participants spent an average of 16% of their time on the former activity and 11% on the latter. The percentage of time lost due to frustrations in this study is about half of the percentage of time lost in previous studies [2, 11]. A reason for this difference has not been identified. The difference appears, however, to be a minor issue compared to the substantial percentage of lost time in this study as well as in the previous studies. Thus, the present study essentially confirms the main finding of the previous studies.

The severity of the main finding is exacerbated by the supplementary findings that the median level of frustration was high, that the longer frustrating experiences occurred during the more important tasks, that the same problems recurred about once a week leading to repeated frustrations, that the participants were unable to work on something else during more than half of the frustrating experiences, and that the participants were unable to fix about one quarter of the problems. The last of these supplementary findings indicates that the participants were often left with lingering frustrations, rather than with the positive sense of achievement that may accompany the resolution of a problem. Moreover, the participants had an average of more than a decade of experience with the use of computers and they were pursuing a university degree in computer science. This shows that frustrating experiences are not merely a concern for novices, and it suggests that another sample of users is likely to experience more frustrations, rather than fewer.

The duration, recurrence, and severity of the reported frustrating experiences suggest that frustration is a major threat to usability in general and universal usability [13] in particular. This puts emphasis on the implications of our findings for designers, managers, and policy makers in terms of providing the basic, yet pertinent, means of countering user frustration: more consistent terminology, clearer menus, simpler task flows, shorter response times, more informative dialog boxes, strengthened error handling, better training, improved documentation, and, in general, easier-to-use interfaces. In terms of implications for researchers, there is a need for additional studies of the magnitude of the problem. The studies so far show that between a quarter and half of the time spent using computers is lost due to frustrating experiences. If these numbers scale up, it is a major societal problem. In this relation it would be interesting to know whether people experience more frustrations with computers than with other artefacts, including pen-and-paper technologies. There is also a need for research that goes beyond the exploratory level and starts to address how frustrating experiences, which cannot all be eliminated, can best be dealt with in real time. Feild et al. [3] find that the presence or absence of user frustration during information searching can be predicted with good accuracy on the basis of query log data. This may provide opportunities for mitigating increases in user frustration through dynamic changes in the interface and interaction. For other systems sensor data may provide similar opportunities.

A possible limitation of this study is that the participants self-reported their frustrating experiences during a relatively brief session; they may have selected their session so as to have something to report. Ceaparu et al. [2] addressed this possible limitation by having each participant perform one session in which they self-reported their frustrating experiences and a second session in which they observed another user and reported his or her frustrating experiences. The self-reported and observational sessions were similar with respect to the duration of the frustrating experiences, their severity, and the other investigated aspects of user frustration.

5. CONCLUSION

This study has replicated previous studies of the amount of time users lose due to frustrating experiences with computers. Twenty one users recorded their frustrating experiences in a variant of time diaries during an average of 1.72 hours of computer use. As in previous studies the amount of time lost due to frustrating experiences was disturbing. The participants in this study were frustrated for an average of 27% of the time they spent using computers. The frustrations were generally experienced as severe, and during more than half of the frustrating experiences the participants were unable to work on something else for the duration of the frustrating experience. These findings, and other supplementary findings, underline that frustration is a common user experience.

The frustrating experiences were spread across a number of mostly ordinary applications, such as web browsers, email clients, text processors, social media, and music-management applications. The frustrating experiences were also spread across many problem areas. Consequently, it is difficult to target efforts aimed at addressing the reasons for the frustrating experiences. It is, nevertheless, an important challenge for researchers as well as practitioners to eliminate the sources of unnecessary frustration and seek ways of mitigating the frustrating experiences resulting from sources that cannot be eliminated.

6. ACKNOWLEDGEMENTS

I am grateful to the students who participated in the study by recording their frustrating experiences.

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Using card sorting to explore collectivism in students' approaches on a university website

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ABSTRACT
This paper discusses issues regarding the influence of national culture on the use of a website. The paper adds to previous research by analysing the concept of a collectivistic approach towards language use and information management on a university website. A novel combination of card sorting techniques with task explorations was used to disclose the 14 Pakistani bachelor students' mental models of the organisation of information on their university website, and their choice of vocabulary for the university website. The paper provides preliminary results on the culturally specific preferences for interacting with the university website among the speakers of the same language, Urdu. The students show a preference for English website text, but require a sub-section in Urdu that non-English family relatives are able to read. Furthermore, the variability between the students' mental models is high, as measured using a distance metric. The study tentatively suggests that Pakistani students in Lahore consider their association with their family of importance for how they manage information on the website.

Author Keywords
Card sorting, Language, Information Management, National cultural dimension, Collectivistic websites.

ACM Classification Keywords
H5.m. Information interfaces and presentation

INTRODUCTION
In this study, we analyse a university website of a Pakistani university by conducting user-tests with card sorting techniques and information search tasks. The study adds to previous research by analysing the concept of a collectivistic approach towards language use and information management on a university website. We theorise that national culture profoundly influences the contents through shared knowledge structures and ultimately impacts on design and development of the website. The culture consists of several elements of which some are implicit and others are explicit, most often these elements are explained by terms such as behaviour, values, norms, and basic assumptions.

Previously a variety of Information Systems and HCI research has been done from the concept of national culture. The national culture, in this study, is defined as behaviours and values that are followed in one geographical area (e.g. Estonian national culture) [1]. We use national culture to refer to the understanding of a student's mental model of university websites when he or she is residing and studying in Pakistan; eventually we will compare these results with results from studying Pakistani students in Denmark. This would give a chance to problematise the notion of culture so that it is not only formed through the county of birth, but it is about the context in which one enacts culture.

This study aims to document how the understanding of a university website among university students in Pakistan has profound characteristics of the local environment, and how a theme of family orientation and association is asserted and portrayed in their mental models of the website. Regarding family orientation, from a cultural psychological perspective, collectivism is a construct that summarises how groups are considered as the basic unit of analyses [2]. Callahan explains that computer users are integrated in strong groups in collectivistic cultures [3]. Robbins studied commercial websites in several geographical regions and found that website registration requirements, security provisions, and privacy policy statements are denoted with individualism /collectivism [4]. Regarding the characteristics of the local environment, Natel and Glaser found that translation, even though of excellent quality, creates a cultural distance which impacts on the web users' evaluation of the site. Conversely, where language is less important, such as in the evaluation of the quality of an offer, a consumer's native language has no impact on the buying decision [5]. The main research theme in this paper is to explore how Pakistani students approach the language use and information management on a university website.

METHOD

In order to achieve the study goal and answer the research questions, a two step research design is developed to obtain the results. In the first part of the research, we investigated how the students living in Pakistan organise the contents according to their mental model. As it is research in progress, in the second part of the study, we plan to investigate how the Pakistani students living in Denmark organise information and contents. In this paper, we report only on the first part of our study.

A total number of 14 students participated in the study. The data collection was done by the first author, who speaks Urdu and English. The study was conducted in the usability laboratory at the University of Management and Technology (UMT), located in Lahore, Pakistan. The activities were focused on the students and their way of organising the contents of the university website. An equal number of male and female students took part in the sessions. All of the sessions were conducted individually and the interviews were audio recorded for later analysis. The students were primarily involved in card sort activities and task exploration activities.

Activity 1: Open card and semi-closed card sorting

Card sorting is a technique that helps to understand how subjects group information into groups [6]. Card sorting can provide an insight into users' mental models, illuminating the way that they often tacitly group, sort and label tasks and content within their own heads [6–7]. The students of the experiments were provided blank 1" x 2" cards in two colours and asked to write and group them according to their understanding of the university website where they were studying. The students were provided 15 minutes to write as many cards as they could and group them in different categories and later they were asked to explain their grouping scheme once they finished their categorisation.

In the semi-closed card sort, the students were provided with 50 small cards containing the contents of the same university website. The students were also provided with five predefined categories and were asked to make an extra category if any of the cards did not fit in predefined categories.

Activity 2: Task exploration and interview

The students were provided with five tasks that all tested the findability of information on the university website of students. The amount of time that students took to find these tasks was noted down during the task exploration activity. These students were handed over a Likert scale evaluation survey of the university website at the end of tasks.

A time of three minutes was provided to the students to do each task. This approximation of time was calculated through a pilot exploration of all information on the website. An example of such a task:

Please find the contact information of the person/secretary who can provide you further information about Hostels. Please notify the instructor when you finish.

After the task, the first author did a semi-structured interview with each student about their remarks on the experiments, culturally specific preferences, use of Internet, their view on the design of the university website, navigation on the university website, background studies and their view on the use of the website in Urdu and English.

The novel approach of card sorting techniques and task exploration was intended to discover how the students organise contents of the university website. The open card sorts would present a thought process of what is the mental model, choice of taxonomies, and culturally specific preferences of students for the university websites. The semi-closed card sort was used to gain additional feedback from the students about how the students can closely group the contents of the university website. The task exploration was used to observe how they did interact with the website. The activities were performed within subject, therefore the order was changed to control and minimise the learning effect. A large proportion of the usability literature explains how people approach websites and use information findability through scenarios of task exploration on new websites. This approach provided us with a set of different observations of the students' perspectives on the university website.

ANALYSIS AND RESULTS

Each student took between 90 to 110 minutes to go through activities. The qualitative data was gathered through think aloud description of open and semi-closed card sorting. The explorative semi-structured interview emphasised on students' use of the university website, accessing websites in local language and evaluation of the university website. A total of 23 hours of data was collected from the 14 students. All the students could speak English and Urdu. We used an excel card sorting analysis template and University of Wisconsin Card Sorting tool, UW card sort analyser, to analyse semi-closed card sorting [7] [8]. We used a mixed approach to explain the open card sorting that allowed us to measure the minimum, maximum and average distance of students' sorts that shared attributes.

In this sample group of students, a small number (3) of students organised information into multilevel categories whereas the rest (11) organised it into a single level category during open card sorting. All the students used standard taxonomies or a descriptive approach to explain the contents of the university website.

The students who use computers regularly and interact with websites frequently tend to group information into standard taxonomies. In contrast, students who spent less time on the Internet in their daily routine exercised an interpretive and descriptive approach for the contents of the university

website. For example, Student 4 used a descriptive taxonomical approach '*which program introduced*',' *about changing programs*', '*dues of changing program*', '*about the status of university*'. Students 1 and 5 used the taxonomies '*registration for the courses*' which refers to the information related to courses which students take. In contrast, students 3, 19 and 15 used the taxonomical tag of '*registration*' for the same concept.

It also emerged during the analysis of the experiment that some of the categories are culturally influenced and not affected by the amount of time a student spends on the Internet. The labelling convention of conventions '*extra-curricular activities*' and '*ranking of the university*' were equally distributed between all types of students. We do not expect this labelling for the next experiments in Denmark.

There were two main factors that were prominent in the students' way of organising information. The first factor, in the students' organisation of information about their university website, was the use of language. Despite the fact that all students speak Urdu, Punjabi or another native language, all the students used the English language to construct the contents of the university website.

The second factor in the students' organisation of information was the use of context specific content in their sorts. These context specific contents include '*fee*' and '*pick and drop*'. Pick and drop refers to the university initiatives for transportation of students as students expect the university to take care of transportation. A majority of the students used '*rank*' or '*status of the university*' in their card sorts so that students could compare it with other universities in the higher education commission. The higher education commission is a primary regulator of higher education in Pakistan which facilitates the development of higher education systems in Pakistan.

When we [student] go to some university, we first check what university [a] holds in ranking, it is an approach of students that we want to check on PEC [Pakistan Engineering Council] and HEC [Higher Education Commission] ranking that where university [a] stays in relation to other universities in the country.

For the semi-closed card sorts, students of the experiment placed 8 out of 50 cards into a new category with a name '*other*' or '*miscellaneous*' in semi-closed card sorts. The taxonomies of the cards and categories were directly taken from the university website of the students. A number of students were unable to understand '*alumni*' and placed the cards which were not fitting in other categories.

We measured edit distance by using UW card sort analyser for semi-closed card sorting [7]. Edit distance is a measure that explains the similarity or difference between sorts of two users. The basic idea of an edit distance metric is that minimum numbers of steps are required to convert one sort into another sort where one step comprises of moving one card from one group to another group [9]. The result of edit distance showed that students' categorisation varied significantly as the smallest distance is 20 between students 11 and 2. The agreement of cards in a single category for all students was very low and classification of cards changed enormously within students.

There was no clear pattern that students studying in second and third year of study managed to complete tasks quicker and find information quicker than the students studying in their first year of study.

Figure 1. Semi-closed card sort experiment.

The students' evaluation survey was designed to get an insight and feedback about the website. The survey initially included 23 variables. The similar concepts were merged together and 10 variables were finalised. The result of the survey showed that student's satisfaction was below average from their university website.

The use of website was primarily focused on registration for the courses and downloading forms for course registration. Only three students of the study used the library section of the website to search for articles and books in the library. The students present an argument for not using the facility of library on the university website because most of the course information and guidance is provided by the lecturer and they can easily access it from the university book and photocopy shop. Half of the students could not find task related information for course code and course on the university website.

One student expressed the problems with searching for information on the university website:

There are less categories and lot of subcategories, there should be a try of making lot of categories and less subcategories. For example if I want to see my schedule, I have to click mouse five or six times on different categories, it should be arranged in such a way that I have to click minimum clicks. [Student 6]

Students explained that they would like to see the university website in English, but they wanted to see a section of the university website in their native language 'Urdu'.

DISCUSSION

The study tentatively suggests that Pakistani students in Lahore organise information into a single level category considering their association with their family of importance for how they observe information on their university website. This study explains that there are culturally specific preferences for the university website among the speakers of the same language. The study also explains that although all the students had a native language as mother tongue, their preference for the university website was English. This result correlates with a study done in Botswana [10]. The study done in Botswana showed that most of the people in Botswana feel comfortable using Microsoft Word in English, rather than a localised version with the native language [10]. A majority of students disclosed a close association with their family and wanted to see a section of the university website in their native language Urdu. The analysis of semi-closed card sort showed a large variability between all students of the study.

The variability between the students was measured using edit distance. The theory suggests that an edit distance of 3 and 4 in a stack of 20 cards is explained as a closely related card sort [7]. We can contextualise this for a stack of 50 cards and easily say those students of our study vary in their grouping. Not all the taxonomical concepts, e.g., '*alumni*', were understandable by the students. So even if they wanted to see the website only in English, they could not understand particular taxonomies.

CONCLUSION

The study tentatively suggests that Pakistani students in Lahore organise information into a single level category. The study also suggests that Pakistani students consider their association with their family of importance for how they perceive information on the university website. This study helped to understand how the understanding of university students in Pakistan has profound characteristics of local environment and how a theme of family orientation and association is asserted and portrayed in their card sorting. The study also suggests that information management of university websites in bilingual countries not only depends on usability but also depends on what is the preference of language for other family members.

The current study focuses only on a single case study in a country with two official languages. The initial results would have been obvious if more students participated in the study and interview sessions would also be conducted with the family members of the students. Another limitation of the study is that only one genre of website was researched. Also, since the students who participated in the activities were young, the study only builds on a small group of students studying in a university.

This study provides a guideline for designers that what should be considered important during the localisation of a university website and to what level these localisation factors play an important rule during the contents construction of a university website.

ACKNOWLEDGMENTS

We thank Imran Hussain in UMT for his support to conduct the experiments in Pakistan, and all the students in the UMT for their time.

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User reflection on actions in ambulance telemedicine systems

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ABSTRACT

Much information is shared, interpreted and recreated between caller, emergency dispatch personnel and ambulance crew during an emergency call. This paper studies the use of reflection in the ambulance control center based on the information an ambulance crew produces during patient treatment in the ambulance. The study is based on an ethnographical single case study of a Danish ambulance control center that uses a system called "amPHI" to monitor outgoing and homebound ambulance runs from scene of injury to arrival at the emergency department. The paper finds that the control center uses the documented and shared information to support organizational learning, increase effectiveness of interaction with callers and support social practice in the control center. The reflections are a result of the health professional backgrounds of the emergency medical dispatch staff that enable them to understand and use the feedback delivered through the system. The paper argues for broadening the scope of telemedicine use outside the boundaries of communication between ambulance and emergency department.

Categories and Subject Descriptors

H.0 [**Information systems general**]; H.4.3 [**Communications applications**]: Information browsers. Bulletin boards.

Keywords

Telemedicine, shared information space, organizational learning, emergent change.

1. INTRODUCTION

In Denmark in 2009 160.000 ambulances were dispatched, where 60.000 of them were level A dispatches (dispatches that are life threatening or critical for the patient's safety)[1]. For level A emergency calls time is of the essence. The faster information about location, condition of patient and other context is transferred to ambulance crew, the better the chances are of giving the proper treatment on time[7].

The emergency ambulance dispatch process involves many actors where the information needs to be transferred, all the way from *caller* to *emergency medical dispatch (EMD)* to *ambulance crew* to arrival at the *emergency department (ED)*. Communication during level A dispatches is very sensitive to misunderstandings because information shared between EMD operators and ambulance crew needs to be short and precise with sufficient health professional content to ensure proper preparation for the scene of injury. This calls for IT systems that support information sharing between these actors and support a variety of tasks such as documenting the treatment process or wirelessly transfer patient readings and contextual information, also called "telemedicine systems" [5]. Telemedicine systems have several potential benefits for patient care in transit and studies have shown a reduction in patient transfer time from paramedics to ED staff by 50% as well as significantly decreased wait times for paramedics at the ED [2]. However, such systems are not without their challenges since user interface and input methods need to be tightly integrated into current work system practices [12]. Work systems in the pre-hospital phase denotes the treatment and care of the patients by ambulance crew and also the actors that make the arrival possible in the first place; the health information produced by the EMD personnel enables the mental preparation for the ambulance crew. Even though scholars like McCarthy [7], Horan and Schooley [6] have studied how systems can support time-critical information services technically, very little literature exists on the role of telemedicine information systems when used by other user groups, e.g. the EMD staff.

With that in mind I set out to investigate the research question: *"How are telemedicine information systems used in the pre-hospital phase by emergency medical dispatch personnel?"*

2. METHOD

To empirically investigate the research question I have conducted a preliminary ethnographical case study observing a control center in Region Northern Jutland in Denmark over the course of three days.

The study consisted of three full days (approx. 30 hours) of observations of three actors: the EMD staff, the ambulance crew and the ED. Observations consisted of approximately 30 calls, 3 ambulance level A dispatches and 4 patient handovers to the ED. Unstructured in-situ interviews were conducted and counted around 15 informal interviews with EMD staff, 5 informal interviews with ambulance crew, and 1 formal interview with the planning nurse at the ED. Interviews and observational notes were both audio-taped and documented in writing from memory shortly after.

I took a 'quick and dirty' ethnographical approach where reflective learning processes were used during and immediately after the daily observations [11]. The four principles of ethnography from Blomberg [3] were used: I observed the work in action on site in natural settings; holism was used by observing the system used in relation to other actors, groups and work

Published in M. Hertzum and M. Hansen (eds.), *DHRS 2010: Proceedings of the Tenth Danish Human-Computer Interaction Research Symposium*. Computer Science Research Report #132, Roskilde University, Roskilde, Denmark, 2010.

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DHRS 2010, November 18, 2010, Roskilde, Denmark.

practices; descriptive understanding of the work instead of prescriptive by having an open mind; in addition an open, positive and curious mind supported viewing the work from the members' point of view [3]. The focus of observations and inquiry was how information was received, interpreted, condensed and reenacted by the EMD staff while answering incoming calls.

The data were interpreted qualitatively on the fly with feedback from the members from informal interviews. The data were then arranged and coded from specific actions to abstract theoretical categories in order to find similarities between calls and uses of the system.

The reason for defining the study as "preliminary" is because the data were not saturated during my stay and further research is needed on the topic of telemedicine systems use in the ambulance control center.

3. THE CASE

Region Northern Jutland is one of five Regions in Denmark, each responsible for their own ambulance dispatch services. Region Northern Jutland (NJ) is the only region in Denmark to integrate a dispatch system with a telemedicine system; the system "amPHI" that has been in operation since 2005.

The system was designed with two user groups in mind: (a) all of Falck's staff (the organization responsible for logistics of ambulances) would go from paper to touch based documentation of patient records in the ambulance, (b) all EDs in Region NJ would have the information pushed from the ambulances to an overview display so the clinical staff could estimate patients' health before arrival. The system was never developed with the EMD personnel in mind. In April 2010 however, every region in Denmark was by law required to have EMD staff with medical backgrounds (often nurses) to answer health related emergency calls. In Region NJ it was then decided to make amPHI available to the EMD staff as well and adding them as a new user group, although the interface was not designed for them.

3.1 The control center

The control center consists of 4 staff; two EMD staff who interact and assess all incoming calls and two Technical Dispatch (TD) staff who handle logistics of the vehicles, basically all communications with ambulance crews regarding non-health related information.

3.2 A typical call

The typical call contains 5 steps, as shown in Figure 1. The EMD operator uses 3 different IT systems in parallel: the emergency system "*112*" used by the police, the order system "*EVA*" used by Falck to dispatch vehicles, and the system "*amPHI*" which displays dispatched orders and details (description of the information displayed below). (1) The police initially answer all emergency calls and if it is health related they enter initial information into the 112-system. (2) The EMD hears an alarm going off and initially assess the situation by scanning information provided by the 112-system. Information is typically the location of the caller and the sort of emergency (e.g. illness, injury, or accident) and type of symptoms of patient (e.g. unconscious, cardiac arrest, or uncontactable). (3) From here the EMD orders an ambulance immediately if needed (the prior examples of emergency type all result in a level A dispatch) through the EVA order system that is sent to an ambulance. This results in an order appearing on the ampHI overview screen with the details initially given by the police to the 112-system. (4) The caller is then redirected from the police to the EMD where the EMD operator assesses the situation and guides the caller to give appropriate care until the ambulance arrives. (5) During the call the EMD operator then edits the order through EVA with more contextual information that the ambulance crew can see in order to properly prepare for the scene of injury. The edited order is appended to the existing order in the amPHI system.

On the amPHI screen orders are placed in rows of a 7-column table: from the left is date, order number, ambulance number with a direct telephone number, dispatch level outgoing and homebound (if properly assessed, the dispatch levels are identical), address location, report with detailed information to ambulance crew, and a time code indicating departure and arrival.

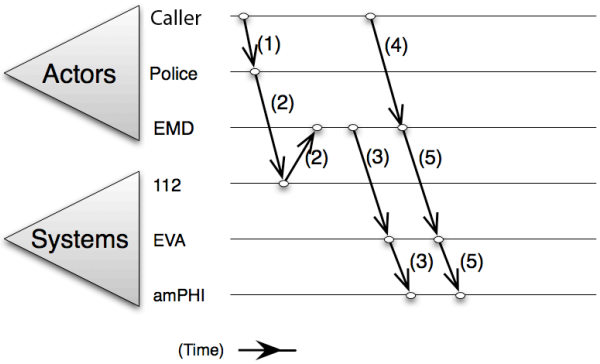

Figure 1: Overview of the call process

4. ANALYSIS

In the analysis I will present an example of an extreme work situation where tradeoffs between communication and action take place. The example shows both work in progress and use of the documented information by the ambulance crew. The uses are: (a) use to reflect on interaction and assessment, (b) use due to concern, and (c) use for supporting social practice.

4.1 From normal to extreme performance

The story begins with a car accident where two cars collide head-on on the highway. This triggers the fire alarm of the TD staff and several other unrelated emergency calls happen simultaneously. One of the operators is immediately redirected to the caller calling about the accident. This event marks the beginning of going from normal to extreme performance in the control center [6].

While the first EMD operator talks to the caller over the phone (two ambulances are already sent to the scene) she finds the order of the ambulances in the system and appends the report with the following information (translated and transcribed with deliberate typos): "*wedged in – legs misplaced – many sm – blue around eyes – urged to keep head completely calmairbags released – awakept 2 – airbag released – awake situated outside – has nosebleed*".

This information is crucial to the ambulance crew since it tells them that two patients are at the scene of injury, one stuck in the car, the other ("awakept 2" is a typo where "awake" refers to patient 1 and "pt 2" refers to patient 2) is outside of the car. Why the second patient is outside the car is not important enough to

write down but will instead be realized by the ambulance crew. Due to the stressful situation I did not ask about what "many sm" meant, but it could indicate "many symptoms". The "blue around eyes" indicates a severe head trauma from the back because the blood is pressured from the back of the brain to the front of the face. Combined with "wedged in" the ambulance crew now knows that the car may need to be cut open first and they can prepare to treat the patient on the scene of the injury while waiting. Because of the fire alarm going off the fire department is already called to scene. They always bring bolt cutters in the case of car accidents. If the ambulance did not know that the patient was wedged in or not aware of the head injury, precious time would be lost finding the patient stuck and going back to the ambulance for the required equipment for treating the patient on site. If the trauma is too severe, however, they would need to force the patient out of the car but this is a choice they are now enabled to make because of the information shared.

4.1.1 Use to reflect on interaction and assessment

The overview screen also shows the same order three times but with different vehicle numbers assigned. This indicates that there were actually three casualties and not two previously mentioned (only 1 patient can be treated at the time in an ambulance). It is a critical piece of information that the EMD staff only gets by looking at the amPHI system because they were not aware of the communication between the first ambulance crew and the TD who dispatched a third ambulance. The ambulance was dispatched on site but due to commotion in the control center none of the EMD staff notices until they look at the screen.

In Schön's terms this encounter enables a reflection-on-action process [9] of the EMD staff, because something was obviously done wrong. It can be explained with the situation being really tense because many emergency calls are happening at once, and the TD staff also coordinates with each other making the background noise louder. When the car accident alarm is triggered the police is still on the line with the caller and the EMD staff is waiting for the call to be redirected to them. The police have already indicated two casualties in the 112-system and this information is taken for granted. Thus the EMD operators do not inquire the caller further even though this would have been a good idea. The caller is already in a state of panic due to the severe state of the scene of injury and he needs to be calmed down while the EMD operator inquires about the scene of the injury. When the caller mentions that one of the patients has blue eyes, this focuses the EMD operator to tell the caller to inform the patient to hold her head completely still in order to avoid further neck injury and head trauma.

Although the injury situation was not properly assessed at first, the tradeoff was to provide the informant with sufficient information to prevent the injury from becoming worse. It is an example of how it is necessary for the EMD to make tough decisions and sometimes give treatment over the phone if needed urgently.

The information on the amPHI screen that shows an additional outgoing ambulance becomes important learning material for the EMD staff. They learn the need to explore the context of the scene of injury further and not always trust information from the police.

4.1.2 Use due to concern

When the place has settled down both EMD operators look up the patients in the amPHI system to check how they are doing. They see that one of the patients of the traffic accident has a trauma score of 16 (anything above 10 is critical). It also reassures the EMD staff that they were right in appending further information to the order and telling the patient to hold still because she was heavily traumatized.

The time code is red which means a trauma level 1 will be arriving shortly at the ED. Looking at the time of departure it seems that the most critical patient will arrive the latest due to being stuck in the vehicle. When inquired about why they used amPHI, one of the EMD operators answers: "*We cannot help it. It's too exciting*." The possibilities of following the patient with whom they are involved engage the operators with interest in their job. It prevents the job from becoming mechanical and adds concern for the process the same way as working as a nurse.

4.1.3 Use for supporting social practice

Even later, one of the EMD operators opens up the trauma patient's record because she is concerned about her. She explains to the whole control center team how the blood pressure readings and the pulse going up and down is very disheartening but also a textbook example of head traumas, Both EMD operators, both TD operators, the control center boss and the deputy manager of the TD personnel listen intently to the conversation of the health professionals educating the whole team in how to understand the readings.

The amount of orders shown on the screen also point out a sense of busyness. Although the EMD is not responsible for allocating vehicles to patients they still have a say in the matter of what kind of competencies are needed on the scene of injury. Engaging each other and discussing what vehicles are available for dispatch supports the team working as a collective whole but it also ensures that the TD and the EMD is bonded together socially as a team by sharing stories and complementing each other's competencies.

4.1.4 Use due to health professional backgrounds

As told by the previous example, the use of the system by the EMD staff serves several functions in the group work at the control center. The system is used as an artefact that enables reflection on actions to gain more precise knowledge of the post treatment than the limited knowledge they are able to produce by interacting with callers, and this knowledge is used to improve handling of future situations.

The abovementioned use of the amPHI system is only possible due to the EMD staff having a health professional background, and ironically enough this was the reason why the amPHI system was set up for them to use in the first place. The available patient medical records increase the possibilities for learning from day to day and not only during supervised formal meetings.

5. DISCUSSION

Even though the amPHI system is used for organizational learning and development it is unclear whether or not the reflections can stand on their own because the staff alone largely determines when to engage in reflecting on their own performance. A feedback form that incorporates face-to-face dialogue with other actors than the control center would be preferable. An example is from one of the EMD operators who at a party met one of the paramedics who told her that the EMD should not call them with additional information unless it was life-threatening because the paramedics are alone in their paramedic vehicles whereas

ambulance crews are two so they can more easily review new information regarding the scene of the injury.

The types of unintended use draw parallels to Orlikowski's definition of "emergent change" that refers to unanticipated changes of use of an IT system as well as changes in the organizational structure when implementing the system [8][10]. Although I focused only on the here-and-now use after implementation, the findings emphasize not to underestimate that new work practices will emerge when introducing new systems [4]. One of the implications of the findings is to broaden the horizon of IT systems that support shared information, especially in regard to the user groups. In this sense an important realization is to keep an eye out for these unintended uses of systems because they hold potential for knowledge of a further redesign of the system. In August 2011 all Danish regions are required to have a nation-wide bidding round of telemedicine ambulance systems. In this regard it is worth it to take a look at existing work practices in Region NJ since valuable experiences with a telemedicine system already exist here. If a new system is implemented in Region NJ that does not support reflection processes for the EMD staff, it could result in less effectiveness and in worse case a higher mortality rate during emergencies.

6. CONCLUSION

Due to the health professional backgrounds of the EMD staff a new understanding and use of the treatment information of the telemedicine system emerged. Concern for the patients after arrival of the ambulance crew prompted the EMD operators to look at patient readings while they were treated in the ambulance. The patient readings and feedback of ambulance crew were then used for reflection on their actions taken to assess whether or not the interaction between caller and EMD operator could have been improved. The concern of the patients as well as the use of information from the ambulance enables a social practice among both the TD and EMD operators where shared experiences and mutual understanding emerge and bonds the whole team together for increased performance in extreme situations.

7. ACKNOWLEDGEMENTS

My sincere gratitude to the humorous and friendly staff of Region Northern Jutland's control center, the open and honest staff of Falck who threw me into numerous unknown situations and the nurses of Aalborg Emergency Department who showed me around the ED.

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Analysing User Lifetime in Voluntary Online Collaboration

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ABSTRACT
This paper analyses persuasion in online collaboration projects. It introduces a set of heuristics that can be applied to such projects and combines these with a quantitative analysis of user activity over time. Two example sites are studies, Open Street Map and The Pirate Bay. Results show that there is a correspondance between some features of site design and user participation patterns in the projects.

Keywords
persuasive design, online collaboration, heuristics.

1. INTRODUCTION
This paper analyses how user activity changes over time in two collaborative online projects, The Pirate Bay and Open Street Map. The paper combines two analyses: first, a heuristic analysis of site design assesses persuasive features of the projects, second, a quantitative analysis of user histories looks at how user participation patterns varies between the two projects.

1.1 Online Collaboration
In this paper, online collaboration refers to the phenomenon of voluntary participation in cooperative projects co-ordinated over the Internet. The phenomenon is represented in projects such as Wikipedia[1], a collaboratively written encyclopedia and Peer-to-Peer University[2], an online education resource. In general, such projects have several common characteristics, namely, that contributions are made on a voluntary basis, coordination of work tends to be organic and without formal hierarchy, and that projects are typically based around specific values.

Online collaboration projects are a fascinating field of study and present a unique opportunity for researchers. The digital nature of participation means that an unprecedented level of data is available for analysis, as user actions are recorded by the system in question and are often freely accessible. This data thus allows us to apply quantitative analysis to the study of human creativity and innovation.

1.2 Persuasive Design
In order to analyse participation in the projects in question, we employ the concept of Persuasive Design. Persuasive Design is concerned with the ways in which computers and related devices can alter user behaviour through psychological processes. B.J. Fogg, the founder of the discipline, defines persuasion as "an attempt to change attitudes or behaviours or both"[1]. Utilising the perspective of Persuasive Design in this research means looking at the ways in which projects encourage users to participate.

Fogg proposes the Fogg Behaviour (FBM) Model for analysing persuasion[2] . According to Fogg, successful persuasion is dependent on three factors: a user's motivation to perform a target action, their ability to do so and triggers to perform the action made by the system. Designing persuasive technologies involves boosting motivation or ability or both, while also ensuring that the desired behaviours are triggered at the appropriate time.

The clarity of this model is very useful for helping one think about persuasion in a dynamic way; one can see how site designers can remove barriers to ability or attempt to increase motivation as part of their persuasive strategy. On the other hand, the model seems most applicable to conceptualising one-off persuasive goals, such as persuading users to click on a sign-up link, or to purchase a product. The model is less intuitively useful when applied to large-scale collaborative projects, which involve repeated actions by users over an extended period of time. Since our cases do not deal with one-off actions such as buying a book or something similar, it seems appropriate to frame the model differently to account for these differences. Below, in section 2.1, we propose a set of heuristics to fit online collaboration sites.

1.3 Summary of Cases
The quantitative analysis is based on complete user histories downloaded from two online collaborative projects; Open Street Map[3] (OSM) and The Pirate Bay[4] (TPB). Open Street Map is a collaboratively produced map of the world. Participants contribute by adding points to the map which they may have derived from exploring an area with a GPS transmitter or simply from local knowledge. The Pirate Bay is a site which indexes torrent files which are used to download files collaboratively, from multiple computers at a time. Participants contribute by uploading torrent files and allowing other users to download files from their computer.

2. METHODOLOGY
This paper uses two distinct methodologies: on the one hand, a set of heuristics are employed to conduct an analytic walkthrough of participation in the sites. On the other hand, complete participation histories for a sample of users of both projects are downloaded and analysed.

2.1 Heuristic Analysis
The heuristics used in this research are based on the Fogg Behaviour Model, adapted to take account of the peculiar nature of online collaboration projects. As stated above, online collaboration projects share several characteristics, 1) contributions tend to be made on a voluntary basis, 2) work tends to be coordinated organically by participants without the use of rigid hierarchy, and 3) projects are strongly driven by specific values which are embodied in their work. These facets have

[1] http://wikipedia.org
[2] http://p2pu.org/
[3] http://www.openstreetmap.org
[4] http://thepiratebay.org

several implications for project design and thus for the heuristics needed to analyse these.

To start with, we can see that the voluntary nature of contribution requires high levels of motivation among participants. Projects thus need to develop strong motivational support for participation. Secondly, if work is to be coordinated in a decentralised way, then projects need to facilitate a high level of communication and coordination between participants. The value driven nature of projects can serve as a motivational tool for increasing participant motivation, but these values need to be reflected by the site design and also in the products of the projects in question. Based on these aspects and on the FBM, we suggest the following heuristics for analysing design of collaborative online projects.

1. The values that underpin the site should be clearly visible to all users and should be reinforced regularly.

2. Triggers to participate in the project should be visible to users of the product. Triggers should recur throughout user lifetime and not just be visible to entry-level users.

3. Participation in the project should be as simple as possible and documentation of technical aspects should be easily available.

4. The project should encourage users to identify themselves with the project and feel as if their contributions are valued through rewards, feedback or other mechanisms.

5. The interface should facilitate interaction between users and coordination of collaborative efforts.

These heuristics are applied to our cases in section 3.1 below.

2.2 Quantitative Analysis

2.2.1 Data Retrieval

The data for this study was retrieved by downloading histories of user activities stored publicly on the websites in question. URLs for user profiles were obtained by entering the unique sub-directories for user profiles into Yahoo! SiteExplorer[footnote: http://siteexplorer.search.yahoo.com/] and downloading the first 1,000 results, which are the maximum that can be downloaded. [footnote: Since TPB stores user profiles at two different subdomains, it was possible to download a larger sample.] Duplicates were removed and a script based on Python's 'Beautiful Soup' module was used to download the full histories associated with each user, converting pages from a html format into a tabbed text file.[5]

2.2.2 Bin division of participants

In order to facilitate analysis, it was decided to divide each sample of users into three bins based on total activity levels. After analysis of the Lorenz distribution of participation rates for both projects, it was decided to divide the samples based on the formula of 60, 30, 10. The first 60% of participants are the lowest level contributors, the next 30% are medium level contributors and the final 10% are the highest level contributors. This method was chosen because of the high rate of participation inequality observed within the samples, whereby a small number of participants are responsible for a large percentage of contributions while a majority of participants only ever contribute a relatively small amount [3, 4].

2.2.3 Data Analysis

In order to analyse user participation rates over time, a series of spreadsheet formulae were used to number all user participation events according to when in the user's lifetime they occurred. Thus, all user activity could be charted on a timeline starting with their first ever contribution to the project. Using these timelines, a series of frequency distributions were derived which plotted the percentage of total contributions for each user group that occurred within a specific time-frame (e.g. two weeks, three months, etc). This methodology allowed us to make broad observations about the average lifetime participation rates of particular groups of contributors and compare these with other users of the same project or with the respective user division of the other project.

3. RESULTS

3.1 Heuristic Walkthrough

Using the heuristics outlined above, we conducted a walkthrough of participation in both projects in order to assess the persuasive strength of the sites.

1. The values that underpin the site should be clearly visible to all users and should be reinforced regularly.

– OSM - values are not very visible to surface level users but they are present in a regularly updated blog, and are often embodied in the various Projects of the Week, which set regular challenges for OSM mappers.

– TPB - prominent logo neatly captures many of values. However, there seems to be little readily accessible content discussing the broader context of file-sharing and copyright laws.

2. Triggers to participate in the project should be visible to users of the product. Triggers should recur throughout user lifetime and not just be visible to entry-level users.

– OSM - “Sign Up” and “Edit” triggers are visible from front page. The Project of the Week acts as a recurring trigger for participants.

– TPB - “Register” button visible from front page but not immediately obvious. No obvious encouragement to upload torrents present.

3. Participation in the project should be as simple as possible and documentation of technical aspects should be easily available.

– OSM - plentiful documentation for new beginners linked to in registry email, including a beginner's guide and screencast videos.

– TPB - a large selection of tutorials are provided in the forum, where it is also possible to ask further questions.

4. The project should encourage users to identify themselves with the project and feel as if their contributions are valued through rewards, feedback or other mechanisms.

[5] Beautiful soup is a Python module specifically designed for screen-scraping HTML pages http://www.crummy.com/software/BeautifulSoup/

– OSM - Symbolic rewards are given to users based on the number of points they have uploaded, however these are on user pages and are not particularly obvious.

– TPB - Users can achieve Trusted and VIP status based on their contributions to the site. In the forums users are given ratings based on how helpful their posts are.

5. The interface should facilitate interaction with other users and coordination of collaborative efforts.

– OSM - Project encourages co-ordination via OSM Wiki. However, users must search for the appropriate forum or mailing list. There is a strong focus on making connections with other OSM users in one's geographic area.

– TPB - There is a single forum which is easy to find and has a large amount of material. The forum also makes it possible for users to request torrents. The comment feature on torrents enables users to request seeders, provide links to subtitles, and rate torrent quality, among other things.

3.2 Quantitative Analysis

3.2.1 Summary of data

The TPB dataset consisted of 268,141 torrents produced by 1,495 users. The set had an average contribution of 179.36 torrents per user with a median of 10. The OSM dataset consisted of 1,884,104 edits contributed by 762 users. This gives an average of 2472.58 edits per user, with a median of 299. The average lifetime of TPB users is 308.35 days and the median is 169 days compared to 514.88 days and 516 days for OSM users.

Due to problems with the data retrieved we have only analysed low and mid-level contributors. This is due to obvious flaws in the data retrieved for the highest level contributors to OSM, whereby these contributors had improbably low lifetimes, for example, some users with many thousands of uploads had lifetimes of only eleven days. This suggests that the data retrieved was only a partial representation of their total lifetime and as such lifetime based analysis of their contributions was thought not to be representative.

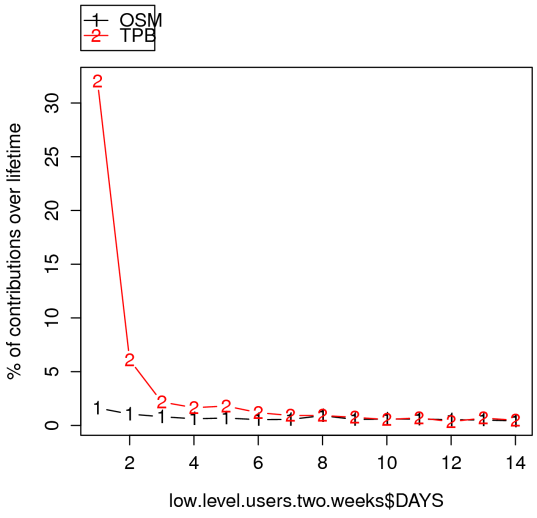

Fig 1. Low level user activity over first two weeks of lifetime

3.2.2 Comparison of low level users

Time-based analysis of contribution rates of low-level users across systems show a considerable amount of difference between the two projects. As can be seen in Fig. 1, Low-level TPB users contribute proportionally far more in the first days of their lifespans than corresponding OSM users. This difference is particularly apparent in the first two weeks of lifetime and the first day especially, where TPB users contribute 32.04% of their total uploads, while OSM users contribute only 1.62% of their total edits.

It is only after about 14 weeks that OSM contribution rates start to be significantly higher than TPB rates, with OSM editors contributing 1.28% of total lifetime edits while TPB users contribute 0.68%. This difference becomes more pronounced as time goes on, as can be seen in Fig. 2. In the period between 330 days and 360 days after first activity, OSM editors contributed 3.69% of total lifetime edits while TPB users contributed 0.88%.

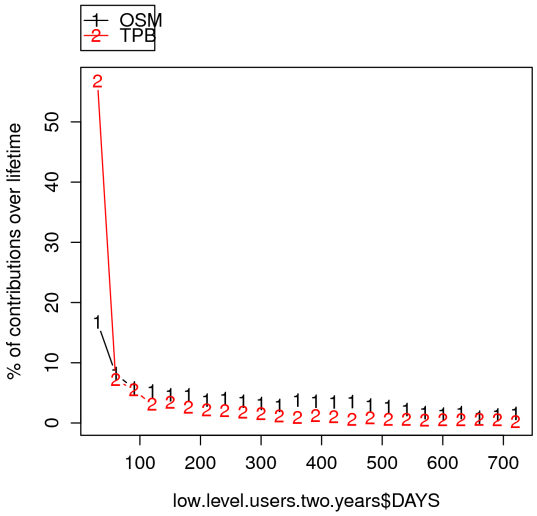

Fig 2. Low-level users activity over first two years of lifetime

This comparison points to a different dynamic of participation which can also be seen in the different lifespans of users; the median lifetime of low-level TPB users is 19 days, while the median lifetime of low-level OSM users is 432 days. 36% of low-level TPB users contribute for only one day, while only 13% of low-level OSM users do the same. These figures suggest that OSM is far better at persuading users to maintain their involvement in the project. The fact that the median lifespan of low-level OSM editors is well over a year suggests a far more sustainable level of involvement among OSM editors.

3.2.3 Comparison of mid-level users across systems

The lifespan analyses of mid-level users reveals some surprising results. As with the analysis of low-level contributors, mid-level TPB users start their activity periods by contributing more than their OSM counterparts, although the difference is not so great, 3.86% of total contributions in their first day vs 1.39% of OSM mid-level contributions (Fig. 3).

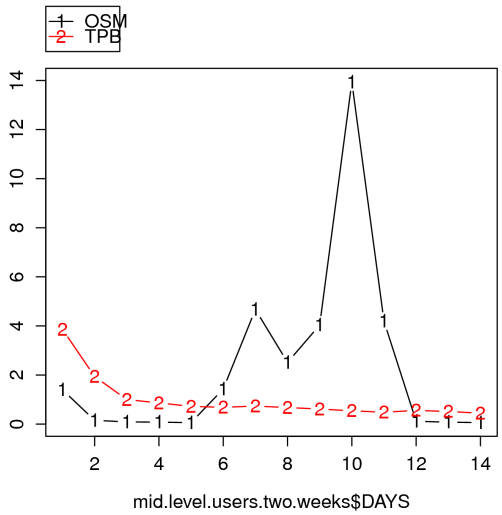

Fig 3. Mid level user activity over first two weeks of lifetime

What is surprising is the extremely large rise in OSM contributions relative to those of TPB users after the sixth day. This increase in contributions is reflected in the two year timeline (Fig. 4) where the OSM contributions are more concentrated in the early days of lifespan than those of TPB users. This huge concentration of productivity in the second week of OSM user activity leads to consistently lower productivity over the following months of activity, until 390 days where the OSM users again begin to outperform their TPB counterparts. The average lifespan of mid-level TPB users is 476.22 days, while the median is 406.5, OSM mid-level users on the other hand have an average lifespan of 784.25 days and a median of 785 days.

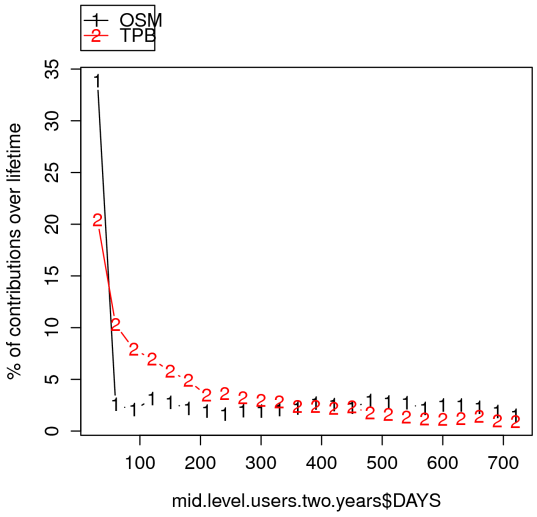

Fig. 4: Mid-level user activity over the first two years of lifetime

This indicates that despite the flurry of activity in the first week, mid-level OSM users are both longer-lasting and more consistent than their TPB counterparts.

4. CONCLUSIONS AND FUTURE WORK

The foregoing analyses have produced some interesting results. The heuristic analysis found that OSM is better than The Pirate Bay at presenting the values behind the project and reminding users of these on a regular basis. Moreover, its 'Project of the Week' feature represents a recurring trigger which constantly encourages users to maintain their activity in the project. It is also better at facilitating social gatherings and coordination between participants which may provide other forms of triggers through 'Mapping Parties' and normative pressure to contribute.

Meanwhile the quantitative analysis has shown that OSM users in general contribute over a longer period of time and at a more consistent rate than their counterparts in TPB. This result suggests that there could be a connection between OSM's better motivational and triggering features and its users' longer lifetimes. Testing this connection in a controlled setting could be a challenge for future research.

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Exploring the Transition From Batch to Online: Datamation as Source of Evidence

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ABSTRACT
The transition from using computers in batch mode with punch cards, paper tape, piles of print, and lengthy response times to online mode by way of the video display terminal took place in most organizations in the 1970s and 1980s. The video display terminal was a significant forerunner of the truly interactive use of computers known today. The transition invoked changes in a number of areas: technological, such as hybrid forms between batch and online; organisational such as decentralization; and personal as users and developers alike had to adopt new technology, shape new organizational structures, and acquire new skills. This work-in-progress paper extends an earlier study of the transition from batch to online, based on oral history interviews with (ex)-employees in two large Danish Service Bureaus. The paper takes the next step by analyzing a particular genre: the commercial computer magazine Datamation from 1971 to 1987. The paper uses the dominating IBM 3270 display terminal and IBM 3270 pc as archetypes. The paper aims at uncovering further facets of the transition from batch to online and its context that will eventually form the basis for telling a wider history of the transition.

Keywords
Batch computing, online computing, display terminal, history of computing.

INTRODUCTION
The term ”computing on the desktop” is today associated with the personal computer. Indeed, the personal computer resides on many desktops and has been doing so for many years. However, the desktop was invaded by computing facilities in the decades before the personal computer. The display terminal made its way to offices, workshops and schools in the 1970s and 1980s, facilitated by emerging timesharing capabilities, increasingly powerful computers, a growing need for fast access to information, and more user-friendly types of dialogue.

Published in M. Hertzum and M. Hansen (eds.), *DHRS 2010: Proceedings of the Tenth Danish Human-Computer Interaction Research Symposium*. Computer Science Research Report #132, Roskilde University, Roskilde, Denmark, 2010.

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DHRS 2010, November 18, 2010, Roskilde, Denmark.

This transition implied a considerable change for users and system developers. The former batch processing mode involved cumbersome and slow punch card technology, huge piles of print, and turn-around times counted in hours, while in online mode users could access information quickly.

More broadly, the transition invoked changes in a number of areas: technological, such as hybrid forms between batch and online, where remote batch is a good example; organisational as centralized systems increasingly became decentralized; and personal as users and developers alike had to adopt to new technology, shape new organizational structures, and acquire new skills.

In this period IBM was the dominating player in the market, partly based on the succesful IBM 360 and 370 computers. These were based on universality - hence the name "360": all around the compass. The IBM 3270 Display Terminal System announced in 1971 followed a similar principle of universality. It consisted of a range of display screens, a full-screen protocol, and data communication controllers. The development of the 3270 coincided with, and in part caused, the explosive growth of online transaction processing that began in the late 1960s. Consequently, the IBM 3270 was a major influence in the design of transaction processing systems such as CICS [7]. As it was extremely widespread and innovative, I will use it here as archetype.

This development from batch to online took place over several decades. Although online technology matured in the 1960s, the change from batch to online took place in most organisations only in the 1970s and 1980s. As an example, only in 1981 online access became available in the Danish Civil Registration System (CPR-register) although the system was established in 1968 [10].

As to terminology, "batch mode" has changed its meaning. Batch mode still exists as background processing, for example indexing of documents on personal computers and servers. I will use to the term *batch* mode in its original meaning from the 1960s to 1980s, denoting punch-card- based administrative computer processing.

Human-Computer Interaction
The transition from batch to online has seemingly been covered widely in the HCI literature as many studies have focussed on user trouble in learning and using interactive systems [9]. But the transition itself has not attracted much attention. A notable exception is Harold Sackman's comparative studies in the 1960s of programmers' performance in batch mode and online

mode that he called "problem solving mode" [12]. He found that online mode was faster in general - but his most remarkable result was the huge differences between individual programmers: up to a factor of ten. In the 1970s, the foundation of the field HCI was laid. Two significant steps were guidelines for dialogue design appearing in the 1970s [11] - that in turn were culled into huge guideline reports in the 1980s - and the pioneering work at Xerox PARC and elsewhere on truly novel interaction formats such as WIMP [1, 13]. The rest of the history of HCI is presumably well known, see [5].

Human-Punch Card Interaction?

Regarding the batch era, did anyone ever hear about *Human-Punch Card Interaction*? Hardly, but there was in fact interaction between the user and the system in the punch card era. But it has seemingly not attracted enough interest to warrant significant research studies apart from Sackman's studies. Hence, the addition of the truly interactive element caused a whole new academic field of study to emerge - Human-Computer Interaction - around 1980 with concepts, theories, methods, and tools.

BATCH AND ONLINE - A PRIMER

Before we embark on the particulars it may be in place to outline the major differences between the two modes [6].

Batch designates processing of a large amount of data - usually from punch cards or magnetic tape - typically with regular intervals: daily, weekly, or monthly. Working with the information involved huge piles of printed material, so-called Leporello lists. As batch jobs were run infrequently, the administrative routines supported were not neccessarily based on up-to-date data.

In online mode a terminal is used, either a screen terminal or paper terminal.[1] Processing took place one-at-a-time in real time as opposed in batches with data is stored on disks or diskettes with (almost) instant access time. Working online implied information being up-to-date and provision of answers to queries on the spot.

APPROACH

Returning to the batch to online transition, an initial study of this in the two large Danish Service Bureaus Datacentralen and Kommunedata [8] revealed a number of facets such as intermediate, hybrid technological forms. *Instant Execution* was an example where employees in a municipality using a display terminal could request a batch job to be executed "instantly" at Kommunedata and inspect the result shortly after, obviating huge piles of print arriving the next day. Another example was planning a new office building, where employees had a hard time in arguing for al-location of space for one display terminal per three system developers.

This work-in-progress builds upon this earlier study by analyzing a particular genre, namely the commercial computer magazine Datamation from 1971 to 1987. This paper aims at uncovering further facets of the transition from batch to online and its context that will eventually form the basis for telling a wider history of the transition.

[1] Although the Teletype (TTY) played a significant role as terminal in the 1970s and 1980s, I have decided to focus solely on the display terminal as the visual appearance has survived into today's interactive systems.

MATERIALS, METHOD & DATAMATION

The reader may ask why Datamation? There are two answers to this question. The first is that Datamation was widely circulated in data processing circles in the Western world after it started publication in 1957. Datamation went online in 1995 and still exists at Datamation.com. Datamation carried a good number of articles and news relevant for the practitioner and a substantial number of advertisements. The second reason is completely pragmatic. In connection with orga–nisational changes in the library at Dept. of Computer Science, Copenhagen University, I happened to come across a complete set of Datamation from 1971 to 1997. The current paper focusses on the period from 1971 to 1987 where the personal computer was taking over from the terminal.

In the period at play, Datamation was published monthly or bimonthly. Each issue was between 150 and 250 pages and the circulation was from 120.000 til 160.000 copies.

Advertisements and product reviews were aboundant. For example, the September 1975 issue consisted of 182 regular pages plus a 44-page advertisements-only section. The regular pages include features (articles and interviews), news (e.g. standards), and departments (such as letters). Of the 182 regular pages, 120 were advertisements (66%). The advertisements cover largely the administrative data processing sector and the range from the largest companies like IBM, CDC, and DEC, to small niche producers, such as companies selling handheld card punches.

Letters to the editor often discussed shortcomings in earlier letters or articles, sometimes at great depth. This seems to indicate that Datamation was not only read, but also considered as a serious and credible commercial magazine. As to the credentials of Datamation from an academic perspective, the magazine regularly brought interviews with or articles written by acknowledged scholars such as Edsger Dijkstra, Joseph Weizenbaum, and Barry Boehm.

It seems that Datamation must have been an attractive outlet of advertisements. Advertisements are a particular and biased genre, but they are likely to represent a fair rendering of contemporary trends, practices, and values surrounding administrative data processing.

In good historiographic practice, several sources and several types of sources should be used in creating historical accounts of past events. This work-in-progress does not follow this practice as Datamation is the dominating source. However, this must be considered legitimate as the work is an attempt to create grounds for later historical analyses of the transition from batch to online, based on a range of sources, among these Datamation.

Since this particular Datamation material is so central to this work, let me present an overview of it. The period from 1971 to 1987 includes 252 issues each about 200 pages, roughly 50.000 pages. I have not been trawling all this material systematically. After having gained an overview by browsing, I selected a subset of issues representative of the period, including relevant special issues and articles. As to the advertisements, I have

primarily focussed on full page advertisements and advertisements stretching several pages.

I refrain from using footnotes and endnotes to refer to the articles and advertisements in Datamation. Instead I refer to them as such (15/6/75 44), meaning June 15, 1975 page 44 and (9/71 12) meaning September 1971 page 12.

RESULTS

This sections presents the findings as themes that have emerged. The themes address the central issue in one way or another. As the themes are largely generated bottom up and the paper is work-in-progreess, organizing the findings by the inital three themes: technical, organizational, and personal changes will take place later.

Market and context

As mentioned previously, IBM was dominant in the market; for a thorough exposition of the market and IBM, see chapter 6 in [2].

Although peripherals by nature are peripheral to the computers, they are by no means peripheral in the market. A survey of the 1986 financial figures shows that peripherals was the largest single sector with 27% of the total dp-market (15/6/87 30). The second-largest was mainframes at 16%. As to the focus on IBM's peripherals and the IBM 3270 as archetype, IBM not only dominated the mainframe market, but also the peripherals market with a revenue of 11.264 million dollars with DEC as second at 3.100 million dollars (15/6/87 32).

In this huge market there were myriads of terminals. A contemporary list (1/76 40-52) provided an overview. No less than 116 terminals were listed from 59 vendors.

Use, users, usability and user friendliness

Being an HCI-person it is tempting to look for materials on uses, users, usability, user friendliness. These topics were there. A good number of articles address use, primarily for the good, whereas much fewer advertisements do. There are lots of pictures showing users, but little text that address use and user issues. A few exeptions are an article in an IBM advertisement on teching users new skills (9/75 42) and reduce errors (9/75 44). Another advertisement declares that the user does not have to be an expert (15/5/71 95). Ease of use is mentioned here and there (5/77 146-7). The hallmark of usability appears to be the mentioning of an IBM Usability Lab in an IBM advertisement (2/85 94).

Dumb vs intelligent

IBM 3270 was *".. dumb terminal and the first intelligent terminal"*. This statement stems from a pilot study where I probed some collegues' view of the IBM 3270 terminal [8]. This seemingly contradictory statement reflects that the 3270 was among the first display terminals with a built-in processor that facilitated data processing locally in the screen (such as syntax checking) as well as efficient transmission between the central processor and the terminal - hence intelligent. In the 1970s and 1980s distributed data processing and minicomputers used locally were gaining foothold - as was online use. As mainframe computers had largely been designed for batch mode, off-loading the central processor was a key point before computers designed truly for time-sharing and teleprocessing became common.

Hybrid forms and technologies

The earlier study in Datacentralen and Kommunedata [8] revealed a hybrid form between batch and online called *Instant Execution*. This Datamation study has disclosed a range of hybrids, both between the batch and online mode and in the types of terminals used:

- Background editing
- Concurrent processing
- Dispersed Data Processing
- Foreground editing
- Keyprocessing
- Local Batch Processing
- Remote Batch, Remote Data Entry, and Remote Job Entry
- Transaction Processing
- Teleprocessing

A considerable number of terminal hybrids were also disclosed, such as

- Intelligent '3270' batch terminal
- A TV CRT (Cathode Ray Tube = screen), i.e. a TV used as screen
- Programmable terminal - that turned out to be based on a Selectric Typewriter.

Data entry

Data entry is another application area long gone and forgotten. It was a huge field in the batch era when enormous amounts of information from invoices, order forms, ledgers etc. were punched on cards by punch card operators. After may years with punch cards, data were gradually keyed to magnetic tape and diskettes. In an article (8/72 69) titled "The 3270: Where does it fit?" shaped as a quiz, four uses of the 3270 display terminal were listed:

1. Keypunch replacement
2. Key-to-disk system replacement
3. Teletype replacement
4. 2260 alphanumeric display replacement (IBM 2260 was a earlier screen)

This shows the way the display terminal was conceived of and used early on. A paper has even appeared on the history of data entry [3].

Selling points

A range of selling points were used in the advertisements. The two dominating arguments were economy (e.g., 1/73 16) and functionality & technical features (e.g., 2/73 118). But other facets were emphasized. One was flexility in terms of connecting to a range of computers (5/77 127) or ability to emulate other vendors' protocols (5/77 79). One vendor even claimed beauty as a selling point (5/77 49), while several vendors hinted at IBM's not uncommon delays in deliveries - which also applied to the 3270 display terminal - and boasted instant delivery or availability (9/75 81).

IBM 3270 Display Terminal and IBM 3270 PC

The 3270 display terminal appeared in numerous advertisements and product reviews. Many terminals were announced as compatible (11/72 214; 1/84 128). It appears clearly how influential the IBM 3270 display terminal system has been. An INCOTERM terminal was even shown with a red key marked "3270" standing out on the keyboard (5/74 5)

As with all other major technological changes, the new technology is firmly rooted in the existing technologies. A telling example is the IBM 3270 pc (1/84 126) that by way of added hardware to a standard IBM pc could be used both as a terminal to a mainframe using the IBM 3270 protocol and as a stand alone personal computer [7]. This is a splendid example of a batch-related technology that via IBM 3270 display terminals migrated into the world of personal computers. In fact, the IBM 3270 protocol is widely in use even today. Numerous emulators running under Windows exist that support operation of batch-based query systems that originate in the 1980s [8].

Punch Cards

Finally, as the paper addresses the transition from batch to online, it is worthwhile to note that as late as in 1977 advertisements for hand-operated card punchs appeared (5/77 262).

DISCUSSION AND CONCLUSIONS

The current paper is work-in-progress and does not warrant any strong conclusions. But a few points seem to stand out clearly. First of all, the dominance of IBM in the market shone clearly through in peripheral devices. Secondly, the IBM 3270 display terminal system has played a role which can hardly be overestimated. Thirdly, the 3270 protocol is in existence today, known as "green screen" applications. Fourthly, datamation seems to be a highly valuable source of information on the transition from batch to online, but evidence on use (and abuse), users, usability, and userfriendliness should be found elsewhere. These conclusions seem to support and encourage further use of Datamation as a valuable source of evidence on the transition from batch to online.

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