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SHAPING MOBILE WIRELESS SERVICES FOR DISABLED: THE ROLE OF SCENARIOS AND FORESIGHT STUDIES

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Abstract: *Many people with disabilities are on the wrong side of the digital divide and are over-represented amongst the groups most likely to be excluded from the internet and wireless technologies. Services based on such technologies could be an extremely useful resource for disabled people but the shape of them is a complex process. In this paper we present foresight studies and particularly scenarios as tools for shaping mobile wireless services for disabled people and give some examples.*
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1. Introduction

Information and Communication Technologies (ICT) have undergone many changes in the last 25 years, each time producing new opportunities for work, life, education. Personal Computers (1980), Internet and the World Wide Web (1990) and now mobile and wearable computing supporting the paradigm of "anytime, anywhere access" (Perry et al., 2001). It means that users have continuous access to computing and Web resources at all times and where ever they may be.

All these new technologies present both opportunities and challenges for the economic and social inclusion of disabled people, as companies seek to harness new technology for the benefit of business.

Results of recent studies, however, have identified the growing evidence of the continued exclusion of groups and individuals as a result of age, ethnicity, disability and income, so a "digital divide" arises between those who are able to exploit the potential of the new technologies and those who remain socially and economically unconnected to the "network society" (NTIA, 2001).

Many people with disabilities are on the wrong side of the digital divide – the gap between those people who have access to and are able to use the internet and those that don't - than their non-disabled counterparts. Disabled people are over-represented amongst the groups most likely to be excluded from the internet, such as the unemployed, those with lower income or less education. They also face unique technological barriers and prejudices and yet they are often left off the digital divide agenda.

The new ICTs could be an extremely useful resource for disabled people. They help them to become more independent and have access to new services from any place at all, provide access to a telecommunications network and the necessary equipment, make them better informed about the world, help them feel more connected to the world, help them to reach people with similar interests and experiences. Traditional obstacles bound up with the reduced mobility of disabled or elderly people and with the difficulty in using public transport can be overcome with the help of them (Hamburg, Hersh et al., 2004; Hersh and Hamburg, 2004). In the next part of this paper some aspects about the using of mobile wireless services and examples of European projects with this topic are presented.

In the last parts scenarios and foresight studies are shortly described as tools for shaping mobile wireless services for disabled people. Some examples are given for the application of scenario technique used within the European funded projects TYAEST, ECUADEVALA and BASKI which are targeting at the qualification of disabled people.

2. The use of mobile wireless services by people with disabilities

Mobile wireless technologies change the ways for communicating, conduct business, and how interact with family, friends, and community. The technology is freeing us from the constraints of fixed-site communications, physical transactions (e.g., handling money, opening doors), and manual controls (e.g., adjusting thermostats, pressing elevator buttons). Wireless technologies, combined with advances in computing, are enabling many exciting new applications that can simplify daily activities, increase independence, and improve quality of life. People with all types of disabilities will be prime beneficiaries of this wireless revolution, which goes far beyond mere mobile phones (cell phones) and pagers (Peifer, 2005).

In the last decade there have been major changes on the usage of mobile phones. The most significant change was from analogue to GSM (global system for mobile communications) digital phones. The GSM standard was developed by the European Telecommunications Standards Institute (ETSI) and is now used by more than 1 billion people in over 200 countries (Jill, 2005). There are now more GSM phones than televisions and personal computers together in the world. The short message service, often referred to as 'text messaging', has proved very popular and recently handsets have become available with speech output of text messages and other functions to help blind users.

Since the number of mobile phone subscribers now exceeds the number of fixed line subscribers, most of the financial investment is going into the mobile area. Mobile phones, in Europe, frequently incorporate GPRS (general packet radio service) which is 'always on' and provides data rates of up to 115 kbit/s. However third generation networks and terminals are now being introduced in a number of European countries. Third generation can deliver data rates of up to 2 megabit/s, but in practice significantly lower rates are the normal case (Jill, 2005).

Wireless data networks now compete with cell phone networks. Low-speed wireless data networks have been around for many years for pagers, and in recent years, the Blackberry two-way pager has become a top choice among the deaf community for independent mobile communications. For high-speed wireless Internet access, wireless fidelity (Wi-Fi) technology based on Institute of Electrical and Electronics Engineers (IEEE) standard 802.11 has spread rapidly into homes, businesses, campuses, and community facilities because it provides high-speed network access (up to 11 Mb/s) for very low cost. This technology is also attractive because it operates in a radio-frequency band that does not require a license fee.

Mobile wireless technologies will become a more important part of our future, and they can provide greater freedom and independence for people with disabilities.

For disabled users, third generation systems offer the potential of providing remote sign language interpretation services or remote location and guidance services for blind or intellectually impaired travellers (Hamburg et al 2004,2005).

However, there are challenges in making wireless products universally accessible. Today's cell phones often have displays that are difficult to read, buttons that are too small to press, audio that is difficult to hear, and features that are too complicated to understand. Accessibility problems are aggravated by the compact nature of many mobile wireless devices, in which integrated functions limit or prevent alternative input/output capabilities. The National Institute on Disability and Rehabilitation Research established the Rehabilitation and Engineering Research Center (RERC) on Mobile Wireless Technologies for Persons with Disabilities to promote universal wireless access and to explore innovative wireless applications for people with disabilities. A variety of research, development, training, and dissemination activities are part of the center's mission.

Although, in some areas the European Union acts as a single entity, the provision of telecommunication services for disabled customers is largely determined at national level. Historically Europe was dominated by state-owned national telecommunication operators who charged high prices, provided terminals for rent, provided some special services (e.g. text relay services)

and undertook research in new terminals and services for disabled customers. Most of these national operators have now been privatised, but they are often the dominant providers for fixed line services. At the same time regulation has been significantly reduced. One result has been a dramatic reduction in research and development for disabled customers by the fixed line operators.
What is not known is what price the operators will charge in order to get an appropriate return on their financial investment. There is no legal requirement for the operators to provide affordable services to disabled users.
There are a large number of projects in Europe to enable disabled people to benefit from these developments in mobile communications. Some examples are the followings.
ETSI are working on the concept of a universal communications identifier which identifies the user and not the terminal or service. This means that a user would have a single number or name irrespective of whether it is a phone, fax or email terminal. To achieve this, the network would incorporate a personal user agent which knows all the user's communication services as well as personal preferences for access, filtering and redirection. In addition it would be able to automatically invoke network services (e.g. text or video relay services) and automatically switch to the appropriate media for the individual user. A significant aspect of this major development is that the needs of disabled users are being considered from the outset.
Another project is "Ask-It" which is developing an extended ambient intelligence space for the integration of functions and services for elderly and disabled people across various environments. The system will interact with the user using natural interfaces like speech, touch and gestures as well as intuitive semantics. It will also model the user behaviour and build a profile of user's preferences based on his or her interactions; for instance it could take into account the type of wheelchair being used. In addition it will handle security aspects to ensure the privacy and security of personal data. The European Commission has contributed $10 million towards this ambitious project which involves 45 partners.
Finally the COST 219ter action on accessibility for all to services and terminals to next generation networks involves 17 countries. This action aims to coordinate and stimulate rather than undertake research. Their current activities involve adapting scenarios relating ambient intelligence to involve disabled users. They are also developing a database of existing schemes and resources for testing for accessibility, and identifying the most appropriate test procedures for different situations.

3. Scenarios and foresight studies to shape mobile wireless learning services for disabled

In this part we present the scenarios and the national forecast studies as tools to help designer of mobile wireless learning services for disabled by analysing the way disabled people might react to such technologies.
Scenarios are different from forecasts in that they provide a tool that helps designers to explore complex environments in which people work and learn and the factors that drive changes and developments in those environments.
Scenarios are "Narrative descriptions of assumptions, risks and environmental factors and how they may affect operations. Scenarios attempt to explore the effect of changing several variables at once with objective analysis and subjective interpretations" (Wikipedia 2005).
"Scenarios are narratives of alternative environments in which today's decisions may be played out. They are not predictions. Nor are they strategies." (Ogilvy and Schwartz, 2004)
A growing number of corporate executives are using scenario planning to make big, hard decisions more effectively. Shell for example has been started developing Global Scenarios more than 30 years ago under the guidance of Pierre Wack and still develops scenarios for decision making (Leicester, 2004).
Scenario planning derives from the observation that, given the impossibility of knowing precisely how the future will play out, a good decision or strategy to adopt is one that plays out well across several possible futures. To find that "robust" strategy, scenarios are created in plural,

such that each scenario diverges from the others. These sets of scenarios are, essentially, specially constructed stories about the future, each one modeling a distinct, plausible world in which we might someday have to live and work.
Within the European program FISTERA (Foresight on Information Society Technologies in the European Research Area) national foresight exercises regarding ICT (including also wearable devices (FISTERA, 2004)) have been analyzed considering three aspects: technology in the narrow sense, application areas and technology related to social issues.
Some observations have been done within FISTERA about the nature and limitations of national foresight studies referring to their main objective of exploring possible future developments of ICT:

- The studies are little homogenous in terms of scope, motivation, methodology, time horizon, participation,
- National visions are underdeveloped in many studies because their primary motivation is to "catch up" or "keep pace" with global competition,
- The time horizon was often set in the very near future,
- Some of them are very limited in ability to envisage new applications.

In our projects we use far-sighted scenarios considering the possibility of a paradigm shift and the emerge of "ambient intelligence" e.g.:
"a view on the future where one can reach anybody and anything from any place at the moment one needs it, with a variety of devices and services which adapt to the context and preferences of the user as well as to the constraints of the overall environment. In this view, persons are surrounded by intelligent interfaces supported by computing and technology which is everywhere, embedded in clothes, furniture, walls, vehicles, etc. The environment becomes aware of whether and who is present and reacts accordingly. As interaction one uses speech, pointing, gestures and even direction of sight. One could say the environment becomes the interface (ITEA 2001, p. 64).

The vision for 'ambient intelligence' (AmI) is described in greater detail in the "Scenarios for Ambient Intelligence in 2010" (ISTAG, 2001).
One of the main ICT trends resulted from foresight studies is that wireless will become more and more important supporting mobility of services, people and devices.
In the context of learning mobile technologies allow the extension of the classroom beyond its normal physical location, access to electronic resources in situation when a desktop/laptop is not available (mobile eLearning), communication with a community of learners and teachers beyond the spatio/temporal boundaries of the institution, access to administrative information such us timetables and room locations.
In the area of application of wireless mobile devices for aiding people with disabilities is still very much experimental, there are not mature commercial products with a wide user base that may be considered at this time in the context of education, etc.
In nowadays in ICT development the enterprises use "personas" for improving usability and accessibility of their products. The personas (personas: actors´ masks in ancient Greek) concept can be seen as a special kind of scenario building. Therefore hypothetical archetypes or "stand-ins" for actual users are built. These archetypes are not real people, but they represent real people throughout the design process and are defined by their goals. Interfaces and applications are built to satisfy personas´ needs and goals (Cooper 1999). Personas can be introduced and tested in different scenarios; they can be understood as a kind of sub-scenario integrated in different environments.

4. Examples of Scenarios

We give some examples of scenarios of people with disabilities using wireless mobile devices and Web-based learning applications that we developed within the European projects TYAEST, ECUADEVALA. and BASKI.*
IECUVADVLA means "Improvement of Employment Chances of the Unemployed and the Visual and Auditive Disabled by Innovative Applications". IECUVADVLA was initiated in

the context of a participatory learning partnership of five countries: Romania, Germany, Hungary, England and the Netherlands. Investigations of the existing situation in the participating countries were already carried out. Furthermore, some specific wireless-based Learning courses will be designed in order to improve computer skills, the employment application techniques of the target groups, and the awareness and knowledge about the target group's rights.

Scenarios are also used in the European project TYAEST. Within this project alternative education models for young adult education, particularly for young disabled adults, were developed to increase "consumption" of education. The developed scenarios were disseminated and analysed within a workshop held together with disabled young people at a special school in Germany.

The third European project is BASKI, aiming at the development of basic skills for people with learning disabilities in accordance with Article 26 of the Charter of Fundamental Rights of the European Commission (European Commission 2000), in which the rights of disabled people for measures to be taken to ensure the full integration into society is recognised and respected. In this project scenarios are developed and used to demonstrate how learners with mentally or learning difficulties can make use of self paced and self-directed ICT-based learning. The application of wireless eLearning is seen as one access path to achieve the learning targets. Wireless learning offers new opportunities for the target group of the project because it can be combined with daily medical care and allows also the use of learnig applications in shifting locations e.g. at home and at nursing home or hospital.

Thes built scenarios do not represent actual individuals but rather individuals engaging in activities that are possible using today's and future wireless technologies and the Web. The used method contains the development of a small story-telling system, for that reason something similar to the persona concept mentioned above is applied. The first example is a so called "best case" scenario. It must be pointed out that "best" in scenario technique is always understood from the scenario designer's point of view. It does not have to be very probably to realize but at least it must show a possible future.

Michael Erickson is 26 years old. He is blind since he was injured by a car accident at the age of nine and now he is working as a freelancer author for different newspapers. Michael is able to read braille and has a suitable device for the laptop he works with. In addition he uses programmes that convert text into speech. For going online at home he links up to a broadband connection by a WLAN (wireless local area network). At travel he applies either local "hot spots" or his high speed UMTS connection. He wants to build up his own Web-homepage; therefore he attends an eLearning course for HTML and homepage-design especially developed for blind users. He found this course just by visiting an online portal for blind users. This course is adjusted to the needs of blind users in different ways. It is HTML based and needs no further software but a standard browser e.g. Mozilla Firefox or Microsoft Internet Explorer. The course works without video clips or Flash animations so neither the screen reader nor the braille output devices have problems to present the contents of the eLearning platform in a suitable way. To raise accessibility the platform is set up in a simple way and all learning modules have the same structure. The course is supplied by specially trained and certified eLearning-trainers which communicate with the learners via email, phone, chat, forums or online conferences. For Michael it is possible to spent time on learning while he is travelling by train and very soon he has got his own homepage with a frequently visited Web blog.

Such a positive scenario should influence developers or providers for ICT and eLearning as well as decision makers in economy or politics. On the one hand it draws a vivid picture of a wanted (see above) future on the other hand it formulates the demands for the future developments.

It is also possible, and sometimes more useful, to build up negative scenarios either in addition to other scenarios to cover all possible developments or as a single scenario to point out erroneous trends.

Beside the construction of extreme scenarios it is a common way to extrapolate current developments to obtain a scenario which is of higher possibility. This scenario has a more predictive character under the condition that the future development does not strike a new path. For scenario developers it is often a more interesting thing to construct an extreme scenario. Therefore another scenario, a "worst case" scenario, is introduced now.

Freddy Sober is 21 years old and unemployed. He has attention deficit disorder with dyslexia, and the combination leads to substantial difficulty reading. Even Freddy has no cognitive disability; he visited a school for mentally handicapped children. Due to his problems he is still hardly able to read after finishing school. It is extremely hard for an illiterate to get a job in Germany where Freddy is living. Therefore his counsellor at the employment office gives him the advice to improve his skills with the help of eLearning. The counsellor himself has no idea about eLearning but he has heard that is a wonderful thing. Freddy is quite clueless about the councillor's advice and asks his older brother for help. His brother promises to share his computer with Freddy (Freddy has no computer) and to search for information about eLearning. For this reason he uses an internet search engine and types the keywords "reading", "learning" and "eLearning" and receives nearly two million hits. After about half an hour of searching he found an offer for an online eLearning course about basic reading skills that offers a free 30 days trial period. So he set a bookmark to his browser and shows Freddy how to call this bookmark. After this he leaves Freddy for a business travel. Later on Freddy tries to use the eLearning application but as he calls the side the computer demands cryptic things like "Java", "Quicktime" and "cookies". Because he is not familiar with these messages he calls his brother on his mobile phone and asks for help. After a long conversation Freddy is able to fix these problems and start the application. After logging in with his name and a self chosen password a Website appears in a very colourful way and a video starts playing. In spite of using a broadband internet connection the video clip is transmitted very slowly. After the clip ended Freddy is confronted with a colourful Website which is full of icons and symbols which are not understandable in an intuitive way. A few minutes of trial-and-error later, just before giving up, he is able to start the first lesson of the course. Unfortunately it is impossible to freeze or repeat the animated graphics that guides though the course and he misses a speech output helping him to read and understand the written words. He also misses the contact to a trainer or other learners. After finishing the first lesson he is not motivated using the program any longer and switches of the computer and being disappointed about eLearning.

5. Conclusions

The process of designing accessible and useful mobile wireless services for disabled is complex. It requires attention to many variables and considerations of needs what are often unpredictable.

Scenarios which resemble a set of stories, written or spoken, can express multiple perspectives on complex events giving meaning to these events.

We consider that they are more suitable for shaping services for disabled than traditional forecasting or market research because they present alternatives images instead of extrapolating current trends from the present.

We are in the process of building new scenarios in the three projects and of evaluation of them within discussion with experts and within events with disabled people and with responsible with them.

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