Ensuring Access to the Information Society for People with Disabilities Through Effective Use of Design for All Methodologies

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Abstract. Since the European Commision's Information Society Technologies Program Advisory Group (ISTAG) coined the phrase "ambient intelligence" [1], [2] a much anticipated future has been considered. That future would involve people with disabilities living in a world populated by interconnected networks of intelligent devices, providing the means for communication, information retrieval, entertainment. A responsibility now exists to include people with disabilities in the debate and discussion of what such a future will mean to them, how it will improve their quality of life and how the potential of future technologies can be appropriately exploited. This paper outlines a collaborative process undertaken by the Central Remedial Clinic, providing a total of 34 people with different disabilities with an opportunity to reflect on and discuss the ISTAG scenarios and envision their own future as citizens with disabilities in a world surrounded by and supported by, as yet unrealised, ambient intelligences.

1 Introduction

The European Commission's Information Society Technologies Program Advisory Group (ISTAG) in 2001 published a set of four separate scenarios articulating a vision of how technology interconnected by ambient intelligences would practically influence and affect the lives of people [2].

Such a vision of the future promises much to people with disabilities who are currently limited in their ability to participate in society by the barriers and limitations they experience. Although to date, technology has provided people with disabilities with new opportunities for education, employment and leisure, much of this technology has been specialised, expensive and at times socially isolating [3].

Facilitating the participation of people with disabilities in defining a vision for a new society will involve ensuring that they are at the forefront of discussion and have opportunities for inclusive articulation of their own vision of how such technologies can be exploited. Historically however, regulatory, social and ethical standards have tended to follow rapid technological proliferation [4].

A Design for All approach encourages the full inclusion and participation of people with disabilities in the design and development of new technologies [5].

The purpose of this paper is to report on and present the results of a project which involved providing people with disabilities with a forum to discuss the ISTAG scenarios and to discuss how they saw future technologies affecting their own lives.

C. Stephanidis (Ed.): Universal Access in HCI, Part I, HCII 2007, LNCS 4554, pp. 10–18, 2007.

It was also intended that this group, by engaging in this, educational process, would coalesce into a group of people with disabilities with the skills and knowledge to participate in future inclusive design processes, thus influencing the future of technology development.

A series of information sessions, involving the participation of a total of 34 people with physical, sensory and cognitive disabilities. These information sessions provided participants with a brief overview of the areas of ambient intelligence, ubiquitous technology and natural interfaces. These also provided the opportunity for participants to gather and individualise information. All sessions were followed by a series of focus groups where participants were given the opportunity to identify and articulate their own vision of what ambient intelligent technology in the future will constitute, and more importantly how it impacts upon their own participation in society.

2 Method

A total of 34 people with disabilities who work in or use the services of the Central Remedial Clinic participated in a series of formal and informal information sessions aimed at presenting current research in the area of Ambient Intelligence and Design for All over a period of nine months, from March 2006 to November 2006.

The aim of these sessions was to increase the first hand knowledge people with disabilities have of current research and thinking in the area of Ambient Intelligence and to facilitate the articulation and discussion of their vision of a future where they could exploit the potential of such technology.

All participants were taking a short course in Assistive Technology, which was developed and delivered by staff of the Central Remedial Clinic, where one module from six was dedicated to "Future Trends in Technology".

All the participating students with disabilities were taking the course in order to increase their own awareness and knowledge of new technology. The particular profiles of participants with disabilities are outlined fully in the Results section that follows this.

This module comprised a total of twelve hours of direct tuition, followed by a series of facilitated web discussions based on the materials presented during the face-to-face sessions. The central vehicle facilitating these discussions was the ISTAG case study scenarios [1], [6], these case studies were developed as a means of presenting a vision of the future based on new developments in technology and society. This vision is based on a future in which Ambient Intelligence in integrated seamlessly into the fabric of society and as part of the day-to-day lives of citizens.

As mentioned previously, these were selected as a means of providing a focus for the discussion and reflections of students participating in the course module outlined above.

Students were asked to discuss the four scenarios under the following headings, the results of these discussions are summarised in the Results section of this paper. Based on these discussions, a questionnaire was developed specifically to examine the opinions of participants with disabilities regarding a future based on a society of services and technology integrated by Ambient Intelligence.

After completing the online discussion of the ISTAG scenarios, students were provided with a further four hours of lectures in the area of Design for All and the effective inclusion of people with disabilities in the process of product and technology design.

This process was modelled on a previous study with people with disabilities conducted by the authors of this report in a similar educational process [6].

Online discussions took place using the Learning Management System, MOODLE (www.moodle.org) Moodle, a free online resource was used by the author to provide project participants with a range of collaboration tools, including, asynchronous discussion board, synchronous chat, and a file publishing and sharing facility.

Although dedicated Virtual Learning Environments, such as Blackboard™ and WebCT™ are commercially available, the costs associated with buying and maintaining such a system are prohibitive for many schools. This and the advantage of being able to tailor an online environment for the participants involved have resulted in a rise in popularity of "do it yourself" [8] systems such as MOODLE which is used here.

3 Results

3.1 Description of Project Participants

As mentioned previously, a total of 34 participants with disabilities were involved in this project, the distribution of male and female participants is presented below in Figure 1.

Fig. 1. Distribution of male and female project participants

Participants had a broad range of physical and sensory disabilities with several presenting with a learning difficulty. The chart below describes the representation of disabilities within the group participating in this project.

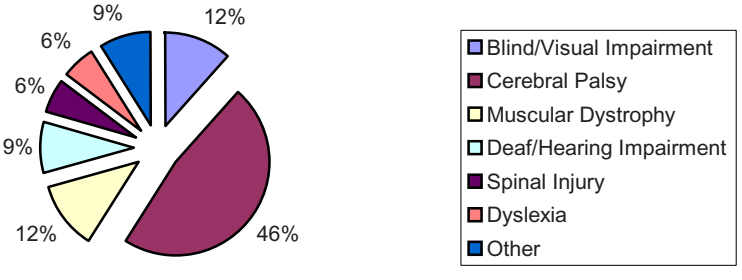

Fig. 2. Distribution of disabilities amongst participants

As can be seen from Figure 2 above, Cerebral Palsy is the condition most significantly represented among participants in this project, this is reflective of the service users of the Central Remedial Clinic, which as a service primarily deals with people who predominantly have physical disabilities.

As stated previously, participants were surveyed in terms of the technology that they most commonly use, so as to present a profile of the technology use of this particular sample of people with disabilities.

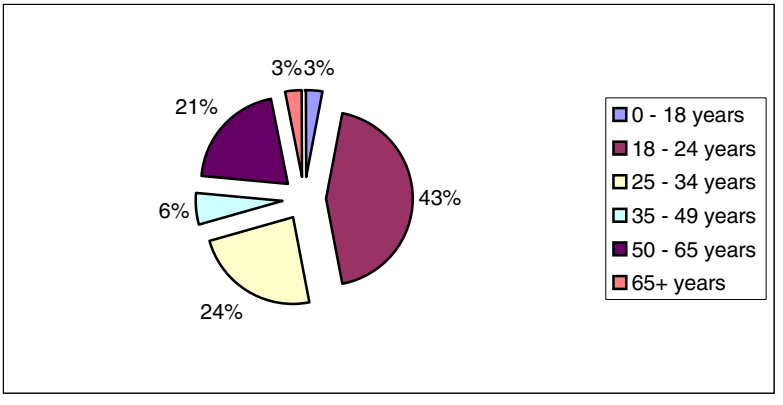

Fig. 3. Age profile of participants

3.2 Presentation of Student's Online Discussion

Participants in this project were asked to discuss the four ISTAG scenarios presented using an online learning platform, which captured all student discussions.

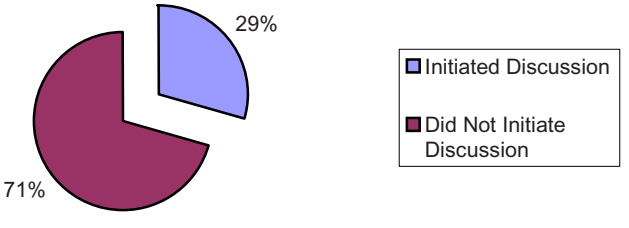

Fig. 4. Representation of Student discussions, highlighting the number of participants who actively initiated discussions during the online process

As is obvious from the above many participants were slow to initiate online discussion and express opinion without the prompting or support of others. However, as can be seen below, the majority of those participants in the discussion took an active role in the ongoing discussions of the four ISTAG scenarios.

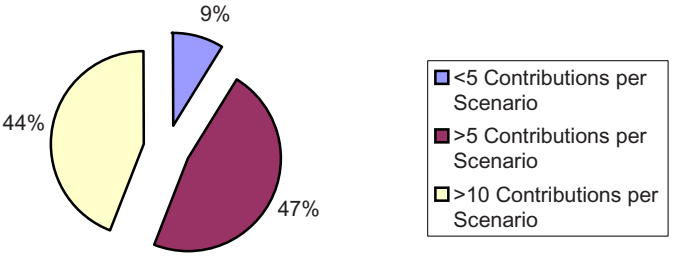

Fig. 5. Percentage of Discussion Contributions per Scenario by each student participant

From the above it is clear that the majority of participants actively involved in discussion of the ISTAG scenarios, thus reflecting a greater level of reflection and analysis on the part of each individual person with a disability participating in this process.

During the discussions all participants were asked read each story and comment on how the technology in the background of each scenario might impact on their lives as people with disabilities. Participants were also asked to comment on what they saw as their "difficulties" or issues with these scenarios. Several of the responses were interesting and in a qualitative way informed the discussion in this paper.

Some of the user comments drawn from these discussions are outlined below in conjunction with a short summary of the authors' summary of these discussions.

Within the scope and context of this paper it is impossible to present all of the discussions in a complete and quantitative manner, rather, a snapshot of each of the sets of discussions will be captured with the author paraphrasing and summarising the full discussions for the purposes of illustrating the overall themes that emerged from student's reflection and their discussions.

3.3 Summary of Student Discussions

Scenario 1: Maria - Road Warrior

The overall impression presented by all participants was of a life supported by a range of yet to be realised *navigation technologies*. This scenario facilitated a large amount of discussion amongst participants, where the majority expressed the view that such technology could be of great benefit to people with disabilities. Of particular interest to note was the enthusiasm with which people with visual impairments embraced the potential of such technology, with several accounts of extending current technology being envisioned during the discussions;

> "*…a lot of GPS and navigation aids are too simplistic right now, and need to be hooked up to a bigger number of satellites and other systems for Blind people, it would be good to imagine a system that made travelling much more 3D…*".

Of further interest in these discussions was the fact that many participants felt a level of cynicism toward a technology that could provide navigational support to people with disabilities. Many participants pointed to the difficulties that Maria

would continue to experience in the physical/built environment regardless of her ability to use Ambient Intelligence to navigate around any environment.

> "*…a navigation tool is not much good unless it can spring out a ramp when you get to a flight of stairs*!"

Positively, the discussion highlighted the benefits of a "personal communicator" providing people with a disability with a single point of access to many different sources of information, support and guidance, although some did comment on the potential obtrusive nature of such a technology.

> *"… we are not far from having personal communicators now, my mobile phone has almost all the functions that I imagine that I need, it is important though to know when I can switch it off…"*

Scenario 2: Demitrios – Digital Me

This case study/scenario generate less discussion than that of Maria, although some of the discussion did highlight two particular areas of interest to people with disabilities. Firstly, having a "communication agent", able to communicate differently to different people and secondly, the idea of being able to adopt a great many "digital personae".

How people with disabilities understood the concept of a communication agent during this process may have been somewhat misunderstood, with many of those participating in these discussions articulating a communication agent as being an immediate technology that facilitates communication for those with difficulties interacting with others, much as current Alternative and Augmentative Communication is intended to do.

> *"….Dimitrios, if he had a stroke, could get one of his Mini-Me's to go back and do the talking for him after his stroke…."*

Some discussion was dedicated to the usefulness or otherwise of a "universal translator" – this was seen of particular relevance to people with difficulties with text, such as those whose first language is sign, or indeed for those who communicate using symbols/symbolic representations.

> *"…I cant see a communicator like this being able to interpret or translate different types of sign language, you would have to have video on a screen or his videoconferencing system and the translation to happen straight away….I just cant see it being fast enough…"*

It is interesting to note that most participants did focus on the communication agent as a stand alone piece of technology, with little reference to any Ambient Intelligence that it may be part of. Exploring this further may indicate how people with disabilities currently consider the technologies that they use.

Some participants speculated about the relevance of creating multiple "digital personae" for people with disabilities, thus ensued some discussion of the merits of online communities, such as BEBO (http://www.bebo.com). One participant speculated on the merits of people with disabilities being able to experience alternative experiences of interaction with people in such circumstances, where he considered that an online, avatar agent could represent him in a way that may not be

possible when he interacts with people on a face-to-face basis. Although this was from a social perspective an interesting turn in the discussions, no other participant took up on this particular thread.

Much of the discussion regarding the impact of the Ambient Intelligence surrounding Dimitrios would certainly merit more in-depth sociological analysis, well beyond the scope of this project.

Scenario 3: Carmen – Traffic, Sustainability & Commerce

Interestingly, the students using wheelchairs participating in these discussions, related to this story by interpreting their own wheelchairs as part of an overall "city system", where they envisioned themselves moving throughout the city receiving regular updates regarding the accessibility of buildings etc.

> *"…even if we could get information going into town about a new set of stairs or a broken lift, that would be great, and if the chair brought us automatically to a new accessible place that would be better…."*

Many participants spoke of the benefits of online shopping services for people with disabilities with several speaking of their own experiences of using e-commerce sites and how this eliminates some of the environmental barriers they experience in the community.

Other participants discussed the limitations of their home environmental control technologies and expressed the need for further connectedness between the technologies that they are using.

> *"…its not that crazy that you could shop from your own home, even now all you need is the computer and the Internet, the only problems at the moment are switching the computer on and paying the bills…"*

It is interesting to note that this scenario, on initial review by the authors of this paper, would appear to promote most meaningful discussion regarding the concept of Ambient Intelligence, this may be because the participants in this project had first hand experience of technology supporting them in the home, supporting them for activities such as shopping and with mobilising independently around a urban landscape.

Scenario 4: Annette & Solomon – A Context for Social Learning

Scenario four generated most discussion, possibly because all of the participants were engaging in a social learning activity mediated by Internet technologies, so a certain relevance could be drawn between the scenario and the immediate experiences of the participants in this project.

The major theme that emerged during these discussions was related to how Ambient Intelligence in an educational context could compensate for the gaps people felt they had in their education to date, how poor literacy or memory difficulties could be supported by Ambient Intelligence, or at least a collective knowledge repository that people could be connected to at all times.

> *"…imagine, not having poor spelling stand in the way of doing an essay or assignment…"*

Some of the participants speculated that access to Ambient Intelligence within education would eliminate the need for education completely, leading to lives dedicated to leisure;

"… if technology did all the learning for me, I'd have the time just to enjoy myself with my friends…"

One further issue of note here was that of how Ambient Intelligence could change the process of learning away from one that is dependent on interaction with text, either in terms of reading/listening/writing etc., and whether or not technology could replicate practical learning opportunities. Some speculation was made as to whether virtual reality type technology could harness Ambient Intelligence to provide people with real life experiences of different learning opportunities with one participant speculating that;

"you could try out what it was like to be a nurse or fireman without becoming that person, and you'd always be able to go back to normal again…."

These findings will be discussed in more detail in the next section of this paper.

4 Discussion

Imagining a future of ambient intelligences supporting us as we go about our day to day lives can often be difficult, in particular establishing a consensus on what that future will be like requires a great deal of thought, discussion and planning.

As mentioned previously, such a future can provide opportunities for greater participation at all levels of society for people with disabilities.

For researchers and designers, a continuing challenge is that of providing a platform from where people with a disability can be involved in the process of planning and envisioning a world where they can exploit the potential of future ambient intelligences and other technologies.

Using the ISTAG scenarios as a starting point from which to facilitate people with disabilities articulating their views of ambient intelligence and how these could potentially

One major limitation of this process, was the time that was dedicated to the discussion process, each participant had only four weeks to complete his or her discussions of the four ISTAG scenarios. This meant that for some of the scenarios, students limited their discussions to statements of how they felt each of these related to their own lives. Pressure of time meant that there was little time to clarify issues and misunderstandings that arose from different participants understanding of the scenarios.

Further moderation by course tutors would also have been invaluable in facilitating a greater level of reflection by students and would have encouraged a greater degree of collaborative and peer learning during the process.

Furthermore, for future work using this process, it would be important to create inclusive online communities, such as those proposed by Brufee [9].

Notwithstanding these limitations, the process was a rich and valuable one on the part of the students and tutors. A great deal of insight was gained into how people

with disabilities envision a technology supported future for themselves, and it provided students with a much greater appreciation of how they can engineer the future more directly.

Student's comments and discussion elicited during this merit further and more in-depth analysis, which is beyond the scope of this paper, which is focused only on reporting on the process. Future work however, would be greatly enhanced by a more rigorous pedagogy emphasising increased collaboration between students and opportunities to discuss the scenarios both in face to face sessions and mediated by online technologies.

The purpose of this project was twofold; firstly to establish a starting point from where people with disabilities could be facilitated in the process of imagining a world with ambient intelligences. Secondly, to provide them with a practical knowledge base from which they can, in the future, practically participate in realising this future.

The intended outcome for participants in this process was that they would acquire the skills necessary to participate in inclusive design process for new technologies and new systems. For an organisation such as the Central Remedial Clinic, establishing such an expert user group will prove an invaluable tool in future Design for All projects.

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