Inclusive design by taking special measures — making libraries accessible for all

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Abstract

In this paper, we present an inclusive design project where the overall aim has been to make public libraries accessible for all visitors. In a first phase, we studied and provided the participating libraries with a number of recommendations as to how to enhance accessibility to their library environments. While doing this, we however also came to recognize a number of issues that were yet to be resolved concerning access to library services for visually impaired users. For this user group, as a second phase, we have designed and implemented the AudioIndex prototype system that allows visually impaired users to browse and search for audio books without the need for library staff guidance, i.e. also including this user group in the services provided by the library. This process has come to change our view on the issue of inclusive design from a product-centric perspective to one that is more service-centric.

Throughout the project, we have been working in close collaboration with end users as well as with representatives from the Swedish Disability Federation, that have all taken active part in all phases of the project.

Introduction

Inclusive Design is often described as “a process whereby designers ensure that their products and services address the needs of the widest possible audience” (DTI, 2001).

With ties to the political concept of an inclusive society, the value of inclusive design is becoming widely recognized by governments as well as industry throughout the world.

In this paper, we present an inclusive design project supported directly by the public libraries in the Umeå region, Sweden, and the structural funds of the European Union. The overall aim of the project has been to make libraries services accessible for all visitors. Throughout the project, we have been working in close collaboration with end users, as well as with representatives from the Swedish Disability Federation, that have all taken active part in all phases of the project.

We will introduce and discuss the various steps and phases of the accessibility project; our user-centered methodology; and the resulting changes to the public library environment. Specifically, we will look at when and how we came to recognize that a general improvement to the accessibility, following good practice in inclusive design, just was not enough for a particular user group, the visually impaired, and that special measures needed to be taken. For us, this recognition has come to shift our perspective on inclusive design from being product-centric to service-centric.

Context

Following the old adage that “knowledge is power”; public libraries stand out as important resources in serving the information need of the citizens of a community. On an even higher level, public access to library services can also be regarded as essential for strengthening democracy, as literacy and free access to information are fundamental conditions for anyone seeking to participate in the democratic process. Nevertheless, a number of people do not have access to libraries in the same way as most people do. While concerns such as socio-cultural belonging, age, and gender issues also apply in accessing library services, a particularly vulnerable group is those that due to limitations in their cognitive or physical abilities have no or limited access to library services (Bradley & Dunlop, 2005). This project was initiated to find ways of allowing these different groups of people access to public library services in the same way as ordinary library visitors, i.e. to make the library accessible for all members of the society. In this, the project draws on and finds inspiration in the social model of disability, where the notion of disability is radically redefined (Barnes, 1991). The social model of disability holds that while a person’s impairment might be their visual inability, what in fact disables them in society is not that but inaccessible transport systems, inadequate public services, and poorly designed buildings and spaces. Redefining disability in this way provides opportunities for analyses which enable new and dynamic products, services, and environments to emerge whose designs aim to remove disabling barriers and, in doing so, will also come to benefit the whole community.

User Involvement

We have been working in close collaboration with end users all the way through the project and representatives of the Swedish Disability Federation have also taken active

part in all phases. Involving users in the design process is particularly important in inclusive design due to the cultural and experiential gap that exists between designers and users (Eisma et al, 2003). Hence, in this respect we argue that it is important that users participating in the inclusive design process are “real” end users, and not just anyone outside of the design team that is made to represent a user. While the latter may sometimes be adequate for basic usability testing – where for instance a visually capable person is turned “visually disabled” by being asked to perform a task in a totally dark room – we argue that the huge experiential gap that exists between the visually capable and the visually impaired, in terms of how they experience and find meaning in the world, cannot be adequately simulated. Real end user involvement in all phases of the project and in that keeping up a continuous dialogue between designers and impaired participants hence becomes useful means in trying to bridge this experiential gap (Clarkson, 2003).

The Project

The project can be loosely segmented into four partly overlapping phases, described in some detail in the following sections: first, we compiled existing guidelines for accessibility through an extensive literature survey, field studies, accessibility inspections, and carried out on-site interviews, based on which we provided recommendations for enhanced accessibility of the existing library environment as well as compiled a list of issues yet to be resolved for certain user groups to reach a high degree of inclusion. Second, based on this compilation, we generated a range of novel concepts for increased accessibility to libraries especially for visually impaired visitors through ideation and scenario-making; evaluated these concepts together with the intended users and members of Umeå City Library; and mutually decided as to which scenario to further explore. Third, through experience prototyping using a Wizard-of-Oz implementation, we were able quickly assess and through design iterations improve the singled out concept with real end users in situ in a real library environment. Fourth, we designed and implemented a finalized prototype system in eight copies that have been installed in Umeå City Library in March 2006 and which have been in full operation ever since.

Recommendations for Accessibility

In the first phase of the project, the objective was to compile as much background information as possible about accessibility in general. This was done in three ways: First, we did an extensive literature survey, inclusive of relevant textbooks, scientific articles, legislation documents, design case studies, web searches, and reviewed existing guidelines and principles in relation to accessibility to public environments for people with different kinds of impairment. As an example, the book “Förskjutna horisonter: Livsförändring och lärande i samband med synnedsättning eller blindhet [Displaced Horizons: Life-changes and Learning in Relation to Visual Decay or Impairment]” (Berndtsson, 2001) painted a useful picture for us as designers in understanding what it means to experience gradually losing one’s vision and becoming visually impaired. It

provided a useful foundation for us in understanding the background to the many issues and challenges that visually impaired people are faced with and thus made us better prepared for meeting and interviewing them about their experiences in relation to library visits.

Second, we undertook field-studies at five different libraries of varying sizes. These field studies were useful both for getting insight into real library environments as well as how different these environments actually are from one another owing to large differences in size and capacity. In addition to soaking up the atmosphere and finding inspiration, we also carried out more strict accessibility inspections and evaluated the different library premises according to an accessibility protocol developed by the Swedish Disability Federation.

Third, as a result of a concern for the situation for the visually impaired expressed by Umeå City Library as well as by the Swedish Disability Federation, we also conducted walkthrough accessibility inspections together with five visually impaired library visitors. These where observed and interviewed in order to identify challenges and issues in the library environment in elation to accessibility. For this, we utilized observational methods and straightforward semi-structured interviews.

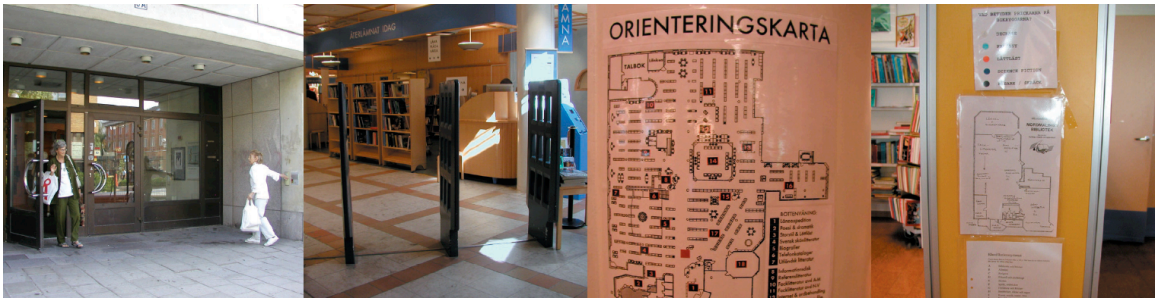

Figure 1 – A few examples of accessibility problems for impaired visitors

A few examples of some of these concerns are provided in Figure 1. From left to right, 1) Manually opened doors swing outwards, which makes wheelchair access difficult; door opener misplaced and hardly visible; 2) Narrow entrance to library through alarm gates and confusing floor patterns provide difficult access for visually impaired visitors; 3) and 4) Maps for orientation and overview not located near the entrance, lacks both tactile feedback and Braille writing.

Based on these efforts and the perceived accessibility issues, we provided the participating libraries detailed and extensive written recommendations for how to directly enhance accessibility to the five library environments that were part of our field-study, concerning issues such as interior and exterior entrance design; tactile pathways; use of contrasting colors; door openers; maps for overview and orientation; location of desks and shelves in the buildings; sign systems; floor pattern design; door design; staircase and elevator design and placement, and so on. While compiling these recommendations, we came to recognize that a number of issues appeared yet to be resolved for particular groups of users to reach a high degree of inclusion, even if our lists of perceived accessibility issues were adequately seen to.

Ideation and Scenario-building

The bulk of these issues yet-to-be-resolved concerned the visually impaired. Visual impairment is a vision loss that constitutes a significant limitation of visual capability that cannot be corrected by means such as refractive correction, medication, or surgery (Arditi & Rosenthal, 1998). There are many different causes of visual impairment and it is often age-related. It is thus a fairly common condition; where about 75 percent of those visually impaired are older than 65 years of age, most of whom get their visual impairment gradually with age. With the aging population, more and more people are also expected to be subject to visual impairment in the future.

The primary need among this user group, based on our literature survey, field-studies, and the interviews we conducted, had to do with way finding as well as browsing and retrieval of magazines, books, audio books etc. within the library environment. If possible, improvements should allow the visually impaired visitor access to these services without the need to resort to personal attendance from library staff. After further discussions with the participating libraries, we began a process of generating a novel ideas and concepts in this area. Through brainstorming sessions within the design team, a range of different ideas came forward. Many of these ideas centered on the possibilities of using sound as a means of way finding and browsing, particularly as a complement to tactile pathways and tactile maps.

Working Ideas and Concepts

Below are just a few examples of the many ideas and concepts that were generated:

- ‘Whispering Bookshelves’: When walking around in the library, the bookshelves whisper to the visitors to communicate what kind of books they contain. Similarly, other objects and services available in the vicinity of the visitor make themselves known to the user by means of whispering their role, content, or function.
- ‘Automatic reading of cover texts’: Each shelf in the library contains a bar code reader and a pair of headphones. The visitor can walk up to the shelf, put the headphones on, scan the book’s bar code, and a synthesized voice reads the cover text of the book.
- ’Hand-held pointing device giving sound feedback’: The visitor uses a hand-held device that can be used to point in the physical world and to get sound feedback about the nature of the specific object or general direction at which the device is pointed.
- ’Follow Me’: On a tactile map by the entrance, a visitor can choose what part of the library he or she wants to visit. When walking over there, sounds are provided to guide the visitor in the right direction.
- ‘Murmuring Stream’: An indoor stream is arranged that goes all the way through the main library passage. The sound of the murmuring stream of water guides the visitor in an ambient, low-key way, and also contributes to a relaxing and calm library atmosphere for all visitors.

About twenty or so ideas and loose concepts like these were introduced to and discussed with a focus group of end users, that provided valuable feedback. They were positive towards the use of sound for way finding and information retrieval. Some of their concerns however, were that many visually impaired people already rely heavily on sound for way finding. Adding too much sound to the environment, they argued, could mean that their existing way of making sense of the world could be interfered with.

Notwithstanding, the group agreed upon, if the user could always decide when and where to hear the sounds and when not to (i.e. being able to 'pull' sounds from the environment rather than having sounds 'pushed' to them) and that their ears would not be completely covered by for instance headphones (and thus shielding them off from the environment) sound would be an appropriate means.

Through discussions and assessment with the focus group, with the Swedish Disability Federation, and with members of Umeå City Library, a mutual decision was taken as to continue with the 'Hand-held pointing device giving sound feedback' scenario.

Experience Prototyping

To be able to test and evaluate the concept of a 'hand-held pointing device giving sound feedback' with real users in a real library environment early on in the project, we developed an experience prototype based on this concept that took the shape of a Wizard of Oz prototype. An experience prototype is a representation that is designed to understand, explore or communicate what it might be like to engage with the product, space or system we are designing (Buchenau & Suri, 2000). A Wizard-of-Oz prototype is an experience prototype that only works by having a member of the design team behind the scenes who is pulling the levers for the user to experience actual functionality at the interface level, which allows testing of quite complex interface concepts before the system is actually implemented. Historically, the Wizard of Oz approach has also proven especially useful for prototyping speech systems (Gould & Lewis, 1983).

The purpose was to allow intended users to experience using the system, without us actually having to fully develop the underlying technology at this stage. Tests, assessments, and interviews and discussion about their experiences of using the Wizard of Oz prototype were conducted with seven visually impaired users at this stage. The results of these trials provided positive feedback from the intended users, as well as a number of ideas for improvement. Among other things, the feedback concerned specific aspects of the audio feedback; the hardware design; use-related issues; other possible areas of use; and a lot of suggestions for added functionality and features.

Design and Implementation of the AudioIndex Prototype

Based on these trials, we were commissioned to design and implement a finalized prototype, called the AudioIndex system, consisting of eight fully functional prototype

systems that have been installed in Umeå City Library in March 2006 and which have been in full public use ever since.

The AudioIndex system allows visually impaired users to browse for audio books by pointing directly with their index fingers on the spine of the audio book as it stands in the shelf. The system then recognizes which audio book it is and quickly provides the user with information about the author, the title, and a summary of the contents of that particular book in the form of synthesized speech. Users are also able to point at other objects in the library, such as bookshelf, to find out what kinds of books are to be found in that particular shelf. It was developed over the course of about a year.

Compared to typical prototype systems, we were faced with a number of considerations. First, as the system was to be used by the general public on a day-to-day basis, the system had to be robust and fail-safe both when it comes to its physical design as well as to its software implementation. Second, as the system would be managed by librarians rather than members of the design team, it had to be easy to recharge, trouble-shoot, and reset. Third, as we were to make eight copies of the system, it had also to be reasonable expensive to produce in terms of the cost of each device.

Figure 2 – the AudioIndex prototype (Photo: Linda Bogren)

Physical Design

The system consists of three interconnected physical parts. First, the main device—worn around the neck using straps—contains a Dell Axim X30 PDA. The PDA is however fully enclosed in a custom-made plastic container, thus not being exposed to the user. Second, an earpiece provides the auditory information to the user. Its cable is integrated with the straps of the main device. Volume is controlled using a small control attached to the cable. Third, a small pointing device is worn on the index finger. It consists of a custom-made plastic cover holding a battery and a dismantled MicroSensys iID PEN, connecting wirelessly using Bluetooth to the main device.

Hardware and Software Implementation

As the user points at the spine of a specific audio book, the RFID reader in the finger-mounted pointing device reads the identification number of the iCode-type RFID tag embedded in the book's spine and sends it to the PDA using Bluetooth. The PDA then sends a request over Wireless LAN to a SQL server in the library server room asking for all data for that particular book ID, including information about title, author, summary, year of publication, size, etc. After receiving this data, the PDA device employs speech synthesis software to produce an audio stream that is fed to the user through the earpiece in the order of author, title, and summary. The entire system has been written in C# using Microsoft Visual Studio .NET 2003

Discussion and Conclusion

Below, we discuss what we see as some key aspects of the project and how the AudioIndex prototype fits within the larger picture of inclusive design.

User Involvement

Throughout the design process, we have worked with end user involvement in many different ways. As noted above, we believe that involving users in the design process is particularly important in inclusive design because of the cultural and experiential gap that exists between designers and users. In trying to bridge this experiential gap, it is important to keep a continuous dialogue between designers and impaired users.

While the benefits of including users in an inclusive design process cannot be stressed enough, one must also realize that bringing in impaired users into the design process also entails dealing with the issues of participant recruitment (a process that is often difficult and time-consuming), methods (there is sometimes a need to adapt traditional user-centered design methods in response to particular challenges from older and disabled users), and ethics (impaired or old participants can be frail and vulnerable).

Prototype Aesthetics

Unlike a recent trend in consumer products, some have noted that in the area of assistive technology, the actual products – including wheelchairs, walking-canes, etc. – are often unattractive aesthetically (Allen, 2004). This may come to limit the market for these products and often stigmatizes their users. For this reason, we wanted the AudioIndex prototype to be aesthetically pleasing as well as functional. Quite unlike one's common understanding, looks are important also for the visually impaired.

A Simple Interface to a Complex World

The AudioIndex system is currently in public use and as such is subject to long term testing and evaluation at the Umeå City Library. Early results indicate some interesting ways in which the system is being used, as well as points us to why it is sometimes not used, that will help us refine the concept and develop the system further. An especially important interaction design goal for the AudioIndex prototype has been to hide both interactional and computational complexity away from the user. The only interactional means is pointing at things in the physical library environment to get synthesized speech descriptions about that object, or, whenever the user wishes, immediately silence any current audio stream by pointing at the main device itself. All other screens, knobs, and buttons that make up the system are hidden from the user.

While this knowingly limits use in terms of traditional interaction styles, we believe it is also one of the system's key strengths. Based on preliminary studies of the AudioIndex prototype in use in a group of four end users, these appeared to employ the system and the information it provides in two different ways that appear to come from its simple, efficient, and modeless interaction style. First, users frequently use the system for way finding and for browsing—by pointing at shelves to find content categories or individual books to browse by author names. Second, the system also allows the user to review, i.e. pointing at an individual audio book to get a summary of its content which is useful for the user in deciding whether or not that book is of interest.

On What Level Does Inclusion Happen?

By suggesting a number of necessary accessibility improvements to the public library in the first phase of the project, we tried to address the needs of the widest possible audience. But in carrying out this project, we came to realize that the special needs of a particular user group – the visually impaired – in a particular setting – public libraries – seemed to call for special measures to be taken in making that environment accessible also for them. As such, we must ask ourselves: on what level does inclusion happen?

Our view on the issue of inclusive design has shifted from a product-centric perspective to one that is service-centric. According to us, public libraries provide the members of a community with a number of services that should be accessible for all. To avoid include the visually impaired, we argue that specific measures – in this case the deployment of a

dedicated point-and-listen interface, called AudioIndex – must be considered also in designing for all. Hence, inclusive design is sometimes also about taking special measures.

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