Design for All: Strategies and experiences of user involvement in IST research projects

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Ever since 1998, ISdAC International Association has been actively promoting a Design for All approach with regard to IST applications, as well as supporting several initiatives in this regard.

Since it is ISdAC's belief that Design for All starts with active user involvement in the earliest stage of the product development process, part of our activities have been focusing on gathering information on disabled people's experiences with existing products as well as inventarisation of the difficulties encountered when becoming active online. This way we have been able to put together a group of disabled experts online, who can act as a user test bed for several research projects in this regard.

Recently we have been involved in two IST research projects. This paper will present in detail the user requirements capture strategies and experiences in the scope of the IPCA project. Furthermore I will formulate some conclusions & recommendations in the field of an IST DfA approach based on our experiences.

Keywords : Design for All, DfA, user requirements, ISdAC, IPCA.

1. INTRODUCTION

Over the years, the importance of a Design for All approach has been growing. Nowadays almost everyone acknowledges the need for and benefits of user centred design, incorporating the needs of specific target groups in the design process in order to obtain a better end product with a wider market audience. Several methodologies and guidelines have been developed in order to facilitate this (e.g. USERFIT[1], INUSE[2]), and European project funding has been made

[1] D Poulson (Ed), (1996) USERfit. A practical handbook on user-centred design for Assistive Technology. European Commission, DGXIII TIDE Project 1062

[2] http://www.ejeisa.com/nectar/inuse/6.2/contents.htm

available to further explore what needs to be done in order to incorporate the DfA concept in the product development process as well as education (DfA curricula[3]).

This field is also of interest to ISdAC[4]. Founded in 1998 as a European organisation of and for People with Disabilities (PwD), we have a two-fold mission :

- Challenging Europe and its nations to make the Information Society fully accessible to people with disabilities
- Challenging people with disabilities to express their possibilities and to demonstrate their abilities in the context of ICT

The members of the ISdAC team form a strong virtual unity with a common vision. They extensively use Information and Communication Technologies to interact with each other, and are therefore very aware of the necessity of direct user involvement in the design process as early as possible.

Over the years, ISdAC has evolved more and more in the direction of a European user organisation, rather than a political lobbying group, although both are equally important and we will remain active on both fronts. Our involvement as a user group within several EC funded projects, has given us the opportunity to build up expertise in the field of user modeling. I would like to present 1 of these projects in detail, and discuss our user requirements capture and user feedback strategies, as well as highlight some of the results and formulate some recommendations that can be of use to anyone thinking about a DfA approach.

2. THE IPCA PROJECT

2.1. Description

The project I'd like to present is IPCA[5], which aims to develop a new intelligent interaction mechanism that will enable people with severe motor and speech disabilities to control standard, and especially web-based, applications. The system will be based on a flexible combination of existing non-invasive sensors and encoders able to control different physiological parameters, and a set of software tools that will allow the user to interact with existing computer applications, in order to facilitate user interaction with different Internet applications and services.

The product has 2 components, which will closely interact with each other, as shown in Figure 1 :

- The Multi-channel Monitoring System (MMS), which is based on non-invasive sensors able to control several physiological parameters from the user such as: EMG, EDR, accelerometers, etc.
- The Ambient Navigation Toolkit (ANT) that will interface between the MMS and some standard software applications, by providing keyboard and/or mouse emulation functions. Its components are:
    - A smart Web Browser that will facilitate user interaction with Internet services.
    - Training system
    - Personal profile manager
    - On-screen keyboard with scanning and word prediction capabilities
    - Emotional Response Monitoring System

[3] IDCNET Project (IST-2001-38786), http://www.idcnet.info
[4] www.isdac.org
[5] Intelligent Physiological Navigation and Control of web-based Applications - IST-2001-37370 - www.ipca.info

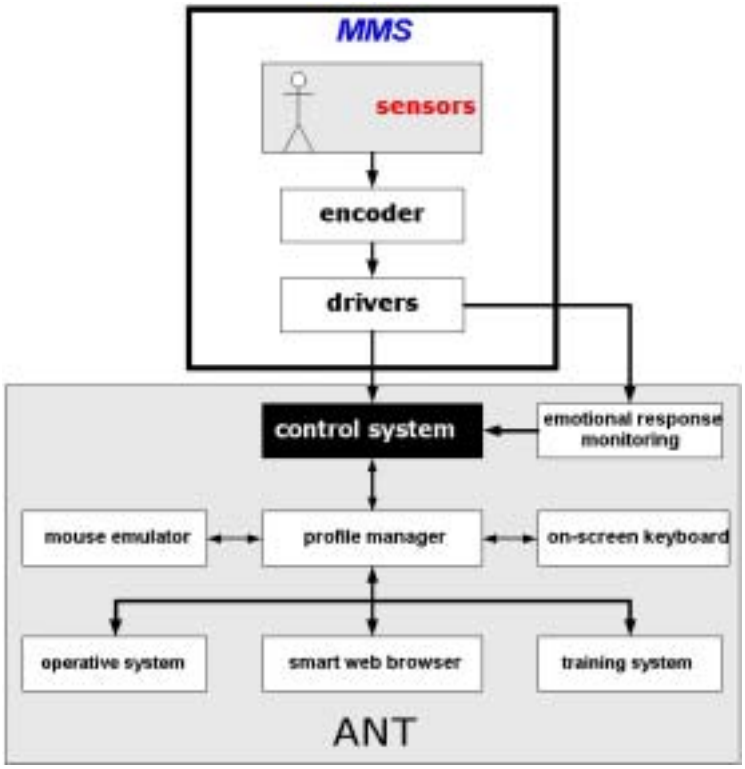

FIGURE 1: IPCA architecture including the MMS and ANT systems.

Given the aims of the project and the developed product, the main target user group is people with severe physical and/or speech impairments.

2.2 User requirement capture

Let us now take a look at the strategies used in order to recruit the test users and guide them throughout the tests. For gathering the user needs regarding the MMS system, the actual test as well as the user recruitment has been coordinated by our project partner IBV[6], whereas for the ANT this has been coordinated by ISdAC. In order to avoid becoming too technical and discussing things beyond ISdAC's expertise, in this document the main focus is on the ANT user test whereas the MMS user test will be briefly mentioned.

2.2.1 Recruiting the users

With regards to finding the test users, a slightly different approach has been taken by both IBV and ISdAC. For the recruitment of the test users of the MMS, IBV has cooperated with user associations in Valencia, as well as the Neurological Service of the "Hospital General Universitario", where some of the patients took part in the tests. The contacts with the users always took place through these 'intermediary organisations'.

ISdAC has taken on a slightly different approach, using an 'online recruitment procedure'. This was done by building up an active internet presence through active involvement is several online news- and interest groups on relevant topics (e.g. disability newsgroups). Simultaneously, relevant organisations that were present online were also contacted. Through these existing channels a standard message was spread, introducing IPCA-project and the forming of a user test bed, inviting interested individuals to join and apply as a test user online by means of a form that already gathered some basic information about the user and his specific disability. That way a first selection could already be made based on this information.

This approach had the advantage that the targeted users were individuals (home users), and already had some internet expertise, which was relevant for the test scenario. In most cases Assistive Technology was used to allow them to access the World Wide Web. The next step

[6] Asociación Instituto de Biomecánica de Valencia, http://www.ibv.org/

was then a close follow-up, initially by e-mail and telephone, followed by a personal visit at the user's home or a neutral location if desired. That way we could already get a general idea about the user's specific situation, the current tools used for accessing the PC, and specific difficulties being encountered in doing so. Based on this information, the best possible candidates for the ANT test were selected.

Evidently, the latter approach involves some ethical issues regarding anonymity and privacy of the individual test users. This was overcome by signing an anonymity agreement stating that ISdAC would not pass this information on to third parties. Furthermore, privacy was ensured by only stating the user's age, sex and location in any external communication and reporting. All users taking part in the ISdAC test receive a lump sum payment by means of a cost statement to compensate for their time, effort and sharing of expertise.

2.2.2 The actual tests

Let us now have a look at the tests themselves, aimed at obtaining user feedback on the needs and requirements in the early stage of the project, so that they can be taken into account during the next development phase of the product.

The test coordinated by IBV was on the possibilities and requirements regarding the sensors that will be used to allow the user to control the mouse. Two possible sensors were tested: an EMG sensor, measuring muscle activity by detecting and amplifying the tiny electrical impulses that are generated by muscle fibers when they contract, and a tilt sensor that registers horizontal as well as vertical inclination. In both cases, additional software was used in order to 'translate' the sensor signals into mouse movement on the screen. An interview procedure was used to obtain the user's comments and feedback about the systems being tested.

The ANT toolkit test was focusing on gaining insight in obstacles the layout and design of a Web site or standard application may cause when using a mouse emulation system. Usability issues due to information overload, misleading links and etc. were neglected during the test. This approach was chosen because in later stages of the project, mouse emulation will be controlled by biofeedback sensors which may be the only means of accessing a computer system for people with severe physical handicaps and speech impairments. Furthermore, since controlling a mouse emulation system by biofeedback sensors is a new advanced technology, very little is known with regard to user-friendly screen design and navigation modes. The use of such technology is physically strenuous and mentally demanding, and therefore the layout and design of an application or service regardless of whether it is Web-based or not, must be adapted in order to allow for most direct access to the requested information. This is the main goal of the Ambient Navigation Toolkit (ANT) to be developed in the course of the project.

In cooperation with our project partner FIT[7], questionnaires, an interview guideline, a standard Web-browsing task and a standard usage scenario of an email application were established as data collection tools. A User's Design Workspace was especially developed for this test scenario to allow the test participants to experiment with their proposed adaptations of the layout of the Web pages in collaboration with a test conductor. This turned out to be a valuable tool not only to verify layout decisions for the test participant but also to show the diversity of needs among the test participants due to impairment and/or personal habits.

A general questionnaire was presented asking about the personal, educational and professional background as well as prior computer and Internet usage of the test participants. In total, six test participants took part, five of them being male. Five have a secondary school degree, one a degree from a vocational school. Two have followed an additional vocational distant training in computer skills and are officially employed, two others are actively involved in disability organisations on a voluntarily basis. The age range was between 19 and 48. All test

[7] Fraunhofer Institute for Applied Information Technology, http://www.fit.fraunhofer.de/index_en.html

participants were severely physically handicapped and wheelchair-bound, one of them partly bed-ridden and one on constant artificial respiration. None of the test participants can access the computer by standard equipment.

All of the test participants were using the Internet since more than two years, five of them for more than three years. They are accessing the Internet for more than 15 hours per week and at least five days a week. All test participants were familiar with a Web-based email applications and search engines (mostly "Google"). All used at least 3 different Internet services (see Table 1).

	1	2	3	4	5	6	x/6
homebanking	X	X	X			X	4/6
e-shopping	X	X					2/6
Online auctions		X					1/6
email	X	X	X	X	X	X	6/6
Chat	X	X		X		X	4/6
News	X		X	X	X	X	5/6
Ftp	X	X					2/6
Search engines	X	X	X	X	X	X	6/6

TABLE 1: Internet services and applications used by the test participants

For the actual test, each user worked with a mouse emulation system that is currently available on the market, in order to highlight the difficulties encountered when using such systems to access web pages and standard applications. The following mouse emulation systems were used: CrossScanner[8] by RJ Cooper & Associates, Gus!Scanning[9] Cursor by Gus Communications, Cyberlink System[10] by Brain Actuated Technologies and Windows MouseKeys by Microsoft Inc .

In regard to the assistive technologies utilized by the test participants for computer access the following table shows software and hardware elements normally used by the test participants and the kind of mouse emulation system used during the user test. The kind of mouse emulation each test participant should use was determined by their physical capacities (e.g., for a person with spasticity, it would have been impossible to use the Cyberlink system).

Tp	**Impairment**	**Ass. Technologies Normally Used**	**Ass. Technologies Used in the Test Scenario**
1	Quadriplegia	joystick for mouse control	Cyberlink system
2	Spinal Muscular Atrophy	mini trackball for mouse control	Cyberlink system
5	Spinal Muscular Atrophy	trackball for mouse control with left hand, standard mouse with max. sensitivity with right hand; virtual 'onscreen' keyboard for typing	Gus!Scanning Cursor
3	Amyotroph Lateral Sclerosis	joystick for mouse control; *Lucy laser* keyboard for typing	CrossScanner software

[8] http://www.rjcooper.com/cross-scanner/
[9] http://www.gusinc.com/scancur.html
[10] http://www.brainfingers.com/

Tp	Impairment	Ass. Technologies Normally Used	Ass. Technologies Used in the Test Scenario
4	Cerebral palsy	headmouse; *Lucy laser* keyboard for typing;	Windows MouseKeys
6	Cerebral palsy	Windows MouseKeys; mouthstick for typing on a standard keyboard	Windows MouseKeys

TABLE 2: Allocation of mouse emulation systems to the test participants

A pilot test was organised in order to investigate whether all the elements of the test were feasible within the time limit established and given the mouse emulation systems being used. Both standard tasks needed to be performed within a time frame of 30 minutes, followed by a face to face interview. In order to avoid jeopardizing validity and reliability of test results by fatigue of the test participants, the total time of the standard tasks and interview was limited to two hours. The questionnaire was to be filled in afterwards at the user's own pace.

For the Internet-based test scenario the Belgian news portal "De Standaard[11]" was selected, because it represents the complexity of information presentation and structure that is common for many websites nowadays. Furthermore, it is presented in the native language of the users, and offered an in-site search function, which was considered very important particularly when accessing a Web site with assistive technology. It is a fact that operating the assistive technology takes up already a lot of attention and due to accidental selection of buttons or links errors occurs more often influencing the process of building of a mental site map, so users get more easily lost. The standard task was to find out "what is playing in the theatre in Ghent tonight', without leaving the news portal. Since browsing the Internet for information gathering is an activity all Internet users engage in quite often, this was considered an appropriate task.

As an example for a standard application the email application "Mozilla Messenger[12]" was used, because its layout and functionality corresponds with other standard email applications. Email applications are an important tool for people with limited mobility to communicate with the outside world and it is necessary to fill out forms to operate it. This process was considered to cause particular obstacles when accessed with a mouse emulation system and inspired us to further investigate how the layout and design could be modified to ensure a maximum usability The standard task was stated as follows: "Please send a 'hello' to the following email account: hg@fit.de.".

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[11] http://www.standaard.be/
[12] http://www.mozilla.org/

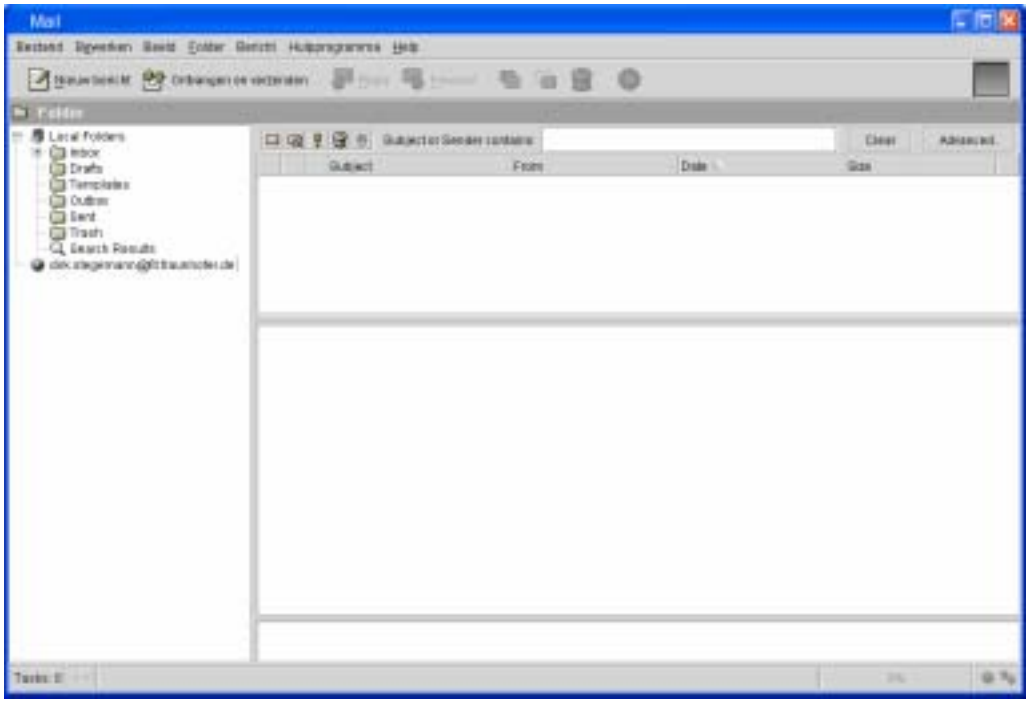

FIGURE 2: Email application “Mozilla Messenger”

The interview following both tests covered all areas of screen design like adaptability of sections, buttons, links and forms. Test participants were also interviewed about expected functionalities of the Smart Web Browser, design of the dialogue interface of the Smart Web Browser and operational modes of the mouse emulation system. When formulating the questions, it was taken care that the wording was bias-free and understandable without specialized knowledge in Information Technology, so e.g., jargon was avoided. All interviews were conducted by one of the test conductors. Notes were taken by two of the other test conductors and matched in order to increase validity of results (Maguire et al., 1998).. Protocols were taken throughout every test session, because as it is known in usability research, watching test participants doing provides often more important data than listening to them (Coyne et al., 2001; Rubin, 1994). Transcriptions were prepared from the protocols in order to analyse the data.

Since only one of the test participants was used to work with a mouse emulation system and the layout and design of a Web page or a standard application could not be adapted in the tests to the extent desired, they have had no opportunity yet to verify whether their assumptions about e.g., more usable screen design are true. In order to allow the test participants to experiment with the layout of a Web page that was rebuild according to their preferences in interaction with one of the test conductors, the User’s Design Workspace was developed especially for this test scenario. It is a toolkit that records user navigation behaviour and provides mechanisms to modify Web documents according to the user’s requirements. It is written in the Java programming language (JDK1.4.1[13]). By using this tool, the test participants were able to rearrange the different parts of the Web page (tables, links,…) according to their personal preferences, and immediately see the results. Apart from that, the UDW kept a log of each activity in order to be able to track the specific path each user has followed in order to solve the tasks and to further investigate whether this choice was based on personal preference, rather than the assistive technology being used.

2.2.3 Some results

This section highlights some of the findings obtained throughout the different tests. Overall, the results of this study are drawn mainly from interviews conducted with the test participants after

[13] http://java.sun.com/j2se/1.4.1/download.html

they had completed the two standard tasks with a mouse emulation system and observations made by the test conductors. Experiments conducted in the UDW initiated valuable discussions whose results are reported on as part of the interview. In order to avoid repetition, results that are stated in the following are derived from the interviews with the test participants. In all other cases (e.g., results derived from observation), the source of information will be stated extra.

The first results concerns sections and links. Since news portals like the one used in our test typically present information about a lot of different topics, they arrange information under according headers and present it in sections with links leading to Web pages with further information. These sections vary in size depending on the intention of the portal provider and the information available.

For people accessing a Web site with a mouse emulation system, it is very important to get an overview of a Web page without having to scroll, because moving the scroll bar takes a lot of effort. However, on quite a lot Web sites and even more so in Internet portals, scrolling is necessary, because the provider wants to give the most comprehensive overview about what topics, services etc. can be offered, which makes it impossible to show everything on one screen regardless of browser type, font size etc. in use. Furthermore, in order to avoid physical fatigue, it is very important to keep the mouse movements required to reach a certain link or button as little as possible. Therefore, the sections of a site need to be shortened and rearranged according to the users´ preferences.

Two of the users indicated that when arranging the sections, the whole size of the computer screen should be used, both horizontally as vertically. All test participants agreed that for sections they are not so interested in, it is sufficient to display only the header as a reminder. Once they are interested in finding out more about the section's topics, they would like to click on the header and then be presented the entire section. One user suggested the possibility to be able to rename the sections for easier recognition.

When asked what sections the test participants would like to be offered in any case, only the sections "Weather" and "Quick News" were mentioned by all of them. For all other sections, the choice was based on personal preference and interests, so the user should be able to sort the sections accordingly, and determine where they should be placed best depending on physical capabilities and how movement of the mouse can be controlled most readily and easily. Experimenting within the UDW has revealed that all users prefer a 'top-down' approach when arranging the sections. All of them have put the login and search fields at the top, followed by the sections arranged according to their personal interests. As far as the presentation of sections, on the left or right side of the screen was concerned, and for presenting buttons and links in horizontal or vertical line, this was dependent on the test participant's physical strength and personal habits. Since this also applies to the order of buttons in toolbars, also there some customisation is desirable. Since there are often buttons in a toolbar that the user doesn't necessarily need, the ability to remove them might enhance ease of use. Leaving sufficient spacing between buttons, links and sections eliminates the risk of errors when choosing an option.

Advertisement that is spread over a Web page was considered by five of the test participants as very disturbing, because it takes more effort to view the information on a Web page. Whereas all of them realised the necessity for economic reasons, they would like them to be grouped together at the webpage, preferrably at the bottom or only visble on the user's request by selecting the appropriate button.

The efficient management of links offers the opportunity to allow fast access to information spread over a Web site as it is also mentioned in guideline 9 of the User Agent Accessibility Guidelines 1.0[14] (UAAG 1.0), a W3C recommendation. Since direct access to links is a powerful

[14] http://www.w3.org/TR/UAAG10/

tool to facilitate navigation, it could be helpful to extract the links of a Web site in a list and present it on user's demand. However, given the high amount of links available on a web page, this needs to be done in a structural manner. Therefore the test participants were asked about their preferences on what priority the listing of links should follow and what links of a Web site should be part of it. Five of the test participants preferred to have all links of a Web page summarized in an extra list, accessible by a button in the top level of the Web page. The link list should start with the links followed most often, for instance a top-ten list, continued with the rest of the links in alphabetical order they can access e.g. sequentially. Displaying a link list in this manner might also be beneficial to disabled people using screen readers or learning disabled people, since this provides the most direct access to specific information.

In regard to the email application, the test participants had no objections to the layout. They described it as clear and easy to use.

With regards to button and font sizes, It is already a well-known problem (Nielsen, 2001; Gappa et al., 2001), that especially for older and visually impaired people most Web pages are presented with too small fonts. This was not different for the website used for this test. Experimenting with the size of fonts and buttons in the UDW showed that when the user is obliged to move the mouse by muscle strength only, the size of fonts and buttons needs to be at least 1.5 cm high and 3 cm wide. However, this has the disadvantage that the amount of information able to present at one screen in this way becomes very little. Therefore it is advisable to make the button and font size configurable individually, depending on the user's visual capbilities and the assistive technology being used.

During the test session it was observed, and confirmed by three of the test participants, that sometimes buttons (e.g. for closing the application) were triggered accidentally due to difficulties in controlling the assistive device. Since not all users experience this problem, the ANT system should be configurable, giving the user the option to confirm before triggering a button or closing/opening applications.

When filling in forms, e.g. on a search page, it turned out to be extremely difficult for the users to navigate the mouse to the required text field, and then selecting it by a mouseclick in order to be able to input text. One of the users forgot to fill in a required field, which resulted in a pop-up error message stating that input is required. It took him a lot of effort to close the pop-up screen and navigate the mouse pointer to the input field again. Furthermore, very often in this case ALL the input fields are emptied, forcing him to start all over again. Therefore it was suggested by the test participants, once the search form opens, the cursor should be placed by default in the first field to be filled and from thereon move automatically from field to field regardless of whether it is optional or mandatory to fill it. The ANT system should enable the user to configure whether forms should only be submitted upon the user's request. Also, it should be ensured that in case mandatory fields are not filled, the user is provided with feedback explaining why the form could not be accepted. In order to facilitate navigation, the cursor should then be moved by default to the first field requiring input.

In case the search query was not successful, the last text input to the form should be kept until it is changed by the user. In order to avoid a lot of extra clicks in case the proposed text needs to be changed, each time the cursors enters a field with text, the text should be marked automatically, so it can be deleted by selection of a character from the keyboard or a mouse click. Pop-up menus displaying the input of this field from the current session are helpful for remembering what has been sought for already, but as it could be observed during the test session, for people accessing a form with a mouse emulation system selecting items from a pop-up menu is rather difficult, so they are not of much use. The email application did not cause difficulties in the form filling process for any test participants.

Both test scenarios revealed that pop-up or drop down menus are a big obstacle for navigating a Web site or an application with a mouse emulation system. One reason is that they close immediately once the mouse leaves the predefined field of the pop-up. A suggestion of the test participants was to open a pop-up menu once the user selects the according menu point and close it only upon user's request. This could be achieved e.g., by presenting a pop-up menu on a newly opened Web page that offers a "back"-button in order to return to the main page. In that case, selection of an item from a pop-up menu can be achieved by sequential navigation.

The availability of a powerful search function is crucial for successful navigation for all people who depend on a most direct navigation mechanism. This might be due to a variety of reasons as people are blind and need to memorize location of information, which is impossible in a complex Web site, or people are cognitive impaired and have problems with reading, or as in this case use a mouse emulation system. Therefore test participants were asked what information facilitating navigation (e.g., search for section and link titles) they consider important and what should happen in case the search is not successful.

All test participants agreed that searching for sections as well as link titles would be very helpful and should be possible. Important features like the help function, glossary or guided tour of the Web site should also be accessible via search. In case a Web site offers special services like a photo-print service, four test participants found it useful to be able to search for it. It was also agreed that the search function should be tolerant against spelling mistakes, since typing mistakes happen easily due to accidental selection of keys. In case the search was not successful, all test participants considered it useful to be provided with synonyms for the word searched for without result. Test participants were also asked whether providing a history of the unsuccessful search query could be a helpful means to support the search process. Three test participants agreed with this suggestion. The question of whether the last input to the search query should be displayed by default in the input field was neglected by all test participants, because it will have to be deleted in any case.

In order to save typing, it was suggested to rather implement a sophisticated word prediction system, which could also be a useful tool for the email application. Additionally, searching for email recipients, subject, date, etc. must be available just as a text search in the text body of the emails. Since the likelihood of spelling mistakes due to involuntary key selection is also here very high, tolerance against misspellings should be provided here also.

When accessing a Web page with a mouse emulation system, it is obvious from the results described above, that there is a strong need to offer means for customization in regard to a variety of layout and design issues. The needs will also vary greatly and are determined by the individual capacities of the users. So, creating user profiles will be an important feature of ANT.

All test participants agreed that customized settings should be kept beyond a single session and are willing to accept local storage of information for this purpose. In order to ensure that users know where to customize a Web site according to their needs and have direct access to it, there should be a button called "layout" in the tool bar of the browser, as suggested by the test participants. Furthermore, the user profile should be portable to other applications. Although the layout of the email application did not cause any obstacles, all information from the user profile like preferred font style and size, preferred placement of tool bars, auto-fill functions and the like should be applied, if possible, also to application programs.

And last but not least, observation of the test participants during the test session revealed that how well a user can control the mouse movements, depends first of all on the users´ physical capabilities on this particular day. So the ANT-system should keep track of the user's actions and once it can be assumed that there are difficulties controlling the device, e.g. because the user needs to repeatedly reopen an application, the system should offer assistance in adjusting the mouse emulation system.

3. CONCLUSIONS AND RECOMMENDATIONS

Looking at the results of the above study, we can conclude that in terms of addressing the specific needs of disabled people using a mouse emulation system in order to access web pages and standard applications, there is still much to be done. Part of this will be dealt with within the scope of the IPCA project, and we will try to incorporate as many of the functionalities within the ANT system. On the other hand, the need to review and adapt the User Agent Accessibility Guidelines 1.0 based on the newly developed technique of mouse emulation by means of biofeedback sensors is also clearly proven.

However, some of these issues can already be tackled during the design process of the web page or application, which identifies the need and importance for direct user involvement whenever possible. In spite of the fact that the benefits as well as the added value of a user centred design approach have been proven, and several methodologies are available to facilitate this, we notice that often this is not put into practice for several reasons.

Through the experience of ISdAC with setting up and maintaing a user test bed within the scope of IPCA as well as the IRIS[15] project we have obtained a good view on the difficulties being faced when choosing a User Centred Design approach. Based on our experiences we can formulate some recommendations that might facilitate this process:

3.1 General recommendations

The following recommendations are applicable for test scenario's of web pages and standard applications, regardless whether the tests will be guided by an instructor, who will be observing during the test (face to face interaction) or the complete test environment (including questionnaires) is fully available online, and the user needs to perform it individually at its own pace.

- In order to find the needed users, promote the potential product/service at relevant user forums and newsgroups, also indicating that you are looking for test users.
- Provide a short (online) template for registration in order to get some basic information about the user. This will allow you to check whether the user fits the 'tester profile', and choose the best possible candidates for the test based upon this information in case the number of participants is limited. This way you will also have some possible 'backup users' if needed later on during the test. If necessary, visit the users in their home environment to get a good view on their current situation and the Assistive technology being used.
- Try to provide an 'interesting' test environment. This can be done e.g. by creating test scenario's within the specific context of the internet service that are as close as possible to the user's field of interest and his daily life sphere. Try to highlight the potential benefit of the application for the user during the test.
- Ensure the protection of the users' privacy by clearly stating that no personal information will be passed on to third parties. Make sure that in all reports, presentations etc. the users remain anonymous.
- User requirements regarding accessibility and usability issues are often very individual, based on one's preferences regarding presentation of the information and the type of Assistive Technology being used. Therefore, try observing the user while performing the test, taking notes on protocol sheets. Furthermore, try to separate the user feedback resulting from personal preferences, from the one that is related to the examined web page or application.

15 Incorporating Requirements of People with Special Needs or Impairments to Internet-based Systems and Services (IST-2000-26211), http://www.iris-design4all.org/default.htm

- Make sure that all the activities are logged. Going through the logfiles might bring up possible problem areas within the test environment (e.g. if the user seems to be browsing through the internet application without a pattern, it might indicate that a specific functionality is not 'as easily found as you thought').
- Arrange some kind of reimbursement to compensate for the users' time and effort and sharing of his expertise, as well as his willingness to take part.
- After the tests, keep the user involved about the results and the further development of the project, so they keep an interest and are available for additional tests in the future.

3.2 Recommendations for online test environments

In case of a full online test environment, where the user has to perform the activities by himself, with only email or phone support from the instructor in case of difficulties, the following things should be kept in mind :

- With regards to personal preferences and the Assistive Technology being used, try working as individual as possible, building up close and active communication with the users (e.g. by email), but leaving room for conversation outside the strict test-related working area. Very often, in the case of a 'distant test environment' normal social interaction brings up interesting facts about the user's specific requirements, that can not be captured within a test scenario, but are nevertheless important in order to realise the user's needs and preferences, and to be able to properly respond to them in the design phase.
- Create a single contact point the user can turn to in case of difficulties performing the test. If the user 'gets stuck' at a specific point within the test scenario (e.g. problem finding a specific functionality or button within an internet service), try to give him some 'pointers' to help him in the right direction, rather than just providing him with the solution. If this has no effect, clearly state in the result processing at which point you provided the solution, so that you know at least the 'problem areas' within your internet service. Otherwise this will affect the credibility of the obtained information.
- In the case of questionnaires, avoid too many textual input, e.g. by using multiple choice questions whenever possible. However, leave enough room for the user's personal comments and feedback.
- If possible, provide the test environment and questionnaires in the mother tongue of the user.
- Closely follow up on the test user's progress so that you can identify possible problem cases (e.g. dropouts) as early as possible, and replace them if necessary.

3.3 Conclusions

As you can see, most of these recommendations require a close follow-up and prompt response, as well as some background about the disabled user's specific requirements, preferences, living situation, etc. This expertise might not always be available at hand within the organisation that designs the product. Also, communication between e.g. a designer or researcher and the end user might be complicated because of the 'different angle' when looking at the product.

In order to allow a maximum user support and minimise the efforts recruiting the disabled test users with the right 'disability profile' to test the specific internet service, one can think about involving an intermediary organisation with close contacts to the targeted test user group (e.g. user organisation, organisation with background on specific problems/user requirements) to take care of these issues. In many cases they have the right test users easily available, or at least know where to find them. This way the intermediate organisation can take care of

following up on the tests and the processing of the results, while the designer can focus on designing and implementing enhancements to the product, based on the user's feedback.

In this regard, ISdAC has already proven its added value and expertise within the framework of the IPCA and IRIS project, and is this way building up expertise in the area of user modelling. The fact that ISdAC is actively involved in several online discussion groups on different subjects and has established contact with several user organisations and individuals as part of its outreach actions, makes our organisation a valuable partner for any manufacturer wanting to test the usability and accessibility of his internet service, web page or standard application. Furthermore, we are currently working on setting up a user database online, where disabled people that are potentially interested to take part as a test participant, can register without any further obligation. This way it will be easier to select and approach suitable candidates according to specific user profiles required for future test environments.

This approach is a win-win situation for both parties : the designer is sure to get the 'right users' without too much effort, and the intermediate organisation (and thus the disabled user himself) gets involved in the design process and can build up a 'reputation' in this regard towards the disabled community. When both parties bring their specific expertise together, the result will be an IST environment with a maximum usability for all, this way making the potential market share as big as possible from the part of the designer, and ensuring that the product/service will be usable and accessible based on 'expert feedback', which already in itself might be an argument for the users to purchase it.

ISdAC commits itself to assist anyone interested in Design for All, by the necessary experts in order to achieve this goal. It is part of our mission to ensure a maximum integration of People with Disabilities in the Information Society, and we are convinced that a user centred design approach is one of the major drivers that can positively influence and speed up this process.

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