AN INCLUSIVE APPROACH TO COOPERATIVE EVALUATION OF WEB USER INTERFACES

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Abstract: Accessibility has been one of the major challenges for interface design of Web applications nowadays, especially those involving e-government and e-learning. In this paper we present an inclusive and participatory approach to the Cooperative Evaluation of user interfaces. It was carried out with an interdisciplinary research group that aims to include students with disabilities in the university campus and academic life. HCI specialists and non-specialists, with and without visual disabilities, participated as users and observers during the evaluation of a Web site designed to be one of the communication channels between the group and the University community. This paper shows the benefits and the challenges of considering the differences among stakeholders in an inclusive and participatory approach, when designing for accessibility within the Universal Design paradigm.

1 INTRODUCTION

Accessibility has been one of the major challenges in user interface design for Web applications nowadays. Besides enabling general access to information needed for all citizens, it is a requirement for the various domains such as e-government and e-learning, in which knowledge and education have been considered part of the mission of nations and organisations.

Interface design for accessibility has long been advocated as a fundamental requirement for usability in general. Some efforts have also been done towards the definition of recommendations for providing the designers with tools to guide them in designing and evaluating the applications accessibility, especially Web sites.

Theories and methods in user interface design have encouraged the participation of the user, in different ways and through different phases of the user interface production. The participation of users in the interface design process has been considered one of the best practices of the Human-Computer Interaction (HCI) field. At the same time the paradigm of Participatory Design (PD) has been challenged when people with different types of disabilities have been involved among the participants of the design and evaluation process.

This paper brings this issue to discussion by presenting a methodological proposal that extends the Cooperative Evaluation Technique from PD with artefacts of Organisational Semiotics (OS) to enable an inclusive and participatory setting in a real context of Web information system design. IPE is an acronym for Inclusive Participatory Evaluation, a new participatory technique we planned with the aim of having people with different physical capabilities, experiences and interaction styles participating together in a cooperative evaluation of user interface.

The IPE technique was applied successfully in the context of "Todos Nós" project – an interdisciplinary project being conducted in our University, which aims at promoting educational inclusion (Mantoan *et al*, 2005). Participants from "Todos Nós" come from different professional backgrounds, including people with disabilities. The Web has been serving as an important communication channel with people from inside and outside our University, and Web-accessibility has been one of the main concerns in the design of "Todos Nós" portal.

Some results of using IPE are discussed in this paper, especially considering the needs and benefits of the technique in an inclusive environment to evaluate accessibility and usability of Web user interfaces. The paper is organised as follows: Section 2 presents the theoretical background for this work, which sets its basis on the concepts of accessibility and the paradigm of Universal Design.

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It is briefly presented here the two pillars of our framework: Participatory Design and Organisational Semiotics. Section 3 presents a summary of IPE technique. Section 4 shows the first results of applying it in a real context of user interface evaluation. In Section 5 we conclude.

2 THEORETICAL BACKGROUND

This work draws upon concepts and practices of Participatory Design and Organisational Semiotics to build a theoretical framework and understand usability, accessibility and design for all as well.

In a broad sense, accessibility has been directly related to the commitment of improving the quality of life of elderly and people with disabilities (W3C, 2005; Bergman and Johnson, 1995). However, taking into account the Universal Design philosophy (Connell *et al*, 1997), it is possible to understand accessibility as the easiness to approach and use environments and products to the greatest extent possible without discrimination. Although Universal Design general principles point to ideal situations, they constitute a valuable tool to guide the design and the evaluation of more inclusive environments and devices, which respect and consider the differences among people.

Accessibility has been perceived as a necessary attribute to the quality in use of software systems, or to their usability (Bergman and Johnson, 1995; Bevan, 1999; Graupp *et al*, 2003). If a user can't reach his/her objectives established in the interaction with a computational system, the usability of this system, relative to this user fails (Bergman and Johnson, 1995; ISO, 1998). A design that indiscriminately respects and considers the differences among users must ensure that objectives established in the interaction with a computational system are reached (accessibility) with effectiveness, efficiency and satisfaction (usability), to the greatest extent possible (Graupp *et al*, 2003).

Besides Web-accessibility recommendations (e.g. Section 508, Web Content Accessibility Guidelines 1.0, and 2.0), in the Web context, there are some techniques, which can be combined to assess the accessibility of Web-based systems: the use of different graphical and text-based Web browsers, the use of assistive technologies, automatic *mark up* languages validation, accessibility verification with semi-automatic tools, assessment based on checkpoints, evaluation with users with different abilities and/or disabilities (W3C, 2005; Graupp *et al*, 2003; Theofanos and Redish, 2003). Nevertheless, there are still few proposals in the literature considering the user's participation in an inclusive design setting.

Literature in Participatory Design has shown different ways of including end-users in the process of designing technology (Müller *et al*, 1997). PD provides a set of techniques, which may support different phases of the design lifecycle such as problem identification and clarification, requirements and analysis, high level design, detailed design, evaluation, end-user customisation and re-design.

In a PD perspective, a product is not only designed *for* the users, but also *with* them, collaboratively. In PD users' engagement is considered valuable to reach product quality, as it allows a better understanding of their activities and work context by the combination of different experiences (Müller *et al*, 1997). At the same time, PD can be useful to the users, inspiring them to think about and analyse their own process of work. PD could provide a valuable approach to inclusive environments, where the individual differences must be taken into consideration and users' direct involvement plays an essential role.

Particularly, the Cooperative Evaluation Technique (Monk *et al*, 1993; Müller *et al*, 1997) is a participatory practice to support the evaluation phase, providing early feedback about re-designs in a rapid iterative cycle. It can be used with an existing product which will be improved or extended, with an early partial prototype or simulation, or with a full working prototype. Designers without specialised knowledge of human factors should be able to use it. Usually, an evaluation team is formed of one end-user and one developer to explore a software system or a prototype, and develop criticism, so that changes could be made to improve the product. In this work we have adapted the Cooperative Evaluation Technique with artefacts of Organisational Semiotics to support participation of users with different physical capabilities, experiences and interaction styles in a cooperative and inclusive evaluation of user interface.

Organisational Semiotics understands the internal activities of an organisation, including its information systems and its interactions with the environment, as a semiotic system (Liu, 2000). Organisation is understood in a broad sense, meaning a group that shares some pattern of behaviour and sign systems.

We have been using some methods and tools from OS to better understand the information system behind the user interface in different levels (e.g. physical, empirical, syntactic, semantic, pragmatic and social). Particularly we have been using methods from the set known as MEASUR in our practice (Methods for Eliciting, Analysing and Specifying User's Requirements) (Liu, 2000) to approach the design and the evaluation of technical information systems, considering its social context (e.g. responsible agents, behavioural patterns and social norms).

Problem Articulation Method (PAM), for example, is a method from MEASUR to be applied in the initial phase of a project when problem definitions are still vague and complex. Usually, it is used to understand the aspects involved (e.g. needs, intentions, existing conflicts, etc) in the design of an information system, allowing a big picture of the problem context, the main requirements and a shared understanding among stakeholders (Liu, 2000). In this work we adapted the Evaluation Frame – one of PAM artefacts – to support the direct involvement of users with disabilities in an inclusive participatory evaluation of user interfaces.

3 IPE: INCLUSIVE PARTICIPATORY EVALUATION OF USER INTERFACES

When designing *with* stakeholders from different profiles (e.g. experiences, backgrounds, capabilities), designers should be sensitive to differences which come up and provide a flexible setting to allow each stakeholder to participate without discrimination.

Our first experience with IPE technique was conducted with the participation of eleven members of "Todos Nós" project. The participants have different professional backgrounds and include people with disabilities – one of them with low vision and two with congenital blindness (both Braille readers).

The technique was carried out to assess a functional prototype of "Todos Nós" portal (Mantoan *et al*, 2005). Its activities were planned to take place during two to three hours. The aims of the evaluation were to elicit accessibility and usability problems, and to collect suggestions about the portal interface design from prospective users.

During the exploration of "Todos Nós" portal, a blind member, a low vision member and a sighted member acted as users, while another blind member acted as one of the observers. To guarantee the participation of each member, some materials were adapted to Braille (e.g. the participation term, the task sheet, the observer's guide and the Evaluation Frame) and/or printed with a larger font. Each computer used during IPE activities had the necessary technologies to support the interactions between users and the portal (e.g. screen magnifiers and screen readers). Although Perkins typewriters were available for the blind participants, they decided not to use them so their contributions could be easily read by the other participants as well by HCI specialists who would analyse them. Following we summarise IPE technique.

3.1 Summary of the Technique

ABSTRACT – Three to four teams are composed by one end-user and two observers (one of them could be the system designer or an HCI specialist). Each team criticises the software system user interface or prototype. After that they share their impressions about the users' experience, supported by an evaluation frame adapted from the Organisational Semiotics artefacts.

OBJECT MODEL AND MATERIAL – The software system or prototype, a set of user's tasks to help focusing in the part of the user interface to be evaluated, a set of questions – observer's guide – to help the observers to interact with the user, recording materials (e.g. papers, pens and/or pencils, audio and/or video records), a poster hanging on the wall with the Evaluation Frame, and *post-its* to fill the frame. Depending on the stakeholders' physical characteristics, it may be necessary to adapt some of the materials and provide alternatives for note taking activities.

PROCESS MODEL – *Starting Talk*: The co-ordinator explains the activities to be carried out, the roles to be played by each participant, and the need for agreement concerning ethical values. *Phase 1* (Concurrent Cooperative Evaluation): three to four teams are formed so they assess the software system or prototype concurrently; (a) each team, composed of a user and two observers, criticises the software system user interface or prototype supported by the user's tasks and the observer's guide. While one of the observers keeps a dialog with the user during the tasks performance, the other takes notes about this dialog and the user's interaction with the interface (e.g. the user's hypothesis, his/her choices, bad and

good impressions, commentaries about the software system or prototype); (b) each team talks about the activity carried out, summarising good and bad characteristics of the software system user interface or prototype, as well as the user's impressions about the interaction activity itself. *Phase 2* (Write-Paste): all the teams share their impressions about the software system user interface or prototype, discussing issues/problems and solutions/ideas regarding the user's experience, writing them down on *post-its*, and pasting these *post-its* on the Evaluation Frame.

RESULTS – Criticism of the prototype or software system user interface, considering user's experience, especially as regards the accessibility; the register of the problems found and some possible solutions, taking into account the differences among participants.

4 PRELIMINARY RESULTS

From the **CONCURRENT COOPERATIVE EVALUATION PHASE** we could perceive the users had different strategies to browse, search and read content in the portal.

In the execution of the first task regarding the search for the Convention of Guatemala and its interpretation, for example, the blind user, who already knew the site structure by previous experience on it, reached the "Law" section link using TAB key and hearing screen reader feedback. After entering in the "Law" section, she used the screen reader search tool to look for the word "decree" in the Web page. She perceived the second occurrence of this word was part of the link to the asked document, accessing it and completing the task. This user spent about seven minutes to complete the task, copying the answer from the Web page and pasting it in a word processing document.

The low vision user, on the other hand, scanned the navigation tree of the portal supported by the mouse pointer and the screen magnifier – located at the top of the screen, occupying a quarter of it. As soon as this user found the "Law" section link, she accessed it, selected the bold face presentation text of the page with the mouse pointer and used the Delta Talk software to help her reading the text. At the same time she heard the selected text, she scanned other parts of the Web page, but she didn't perceive there was a link to the asked document. So, she decided to use de portal search engine to help her in this task. The first attempt was unsuccessful, as she entered an expression that referred to another document. Entering a new keyword, she perceived visual cues provided by the search engine, which showed up the searched keyword in the page with results, helping her to find the right link to the asked document. After 35 minutes the execution of this task was interrupted without conclusion.

The sighted user adopted an exploration strategy to this same task. She accessed different sections of the portal before entering the "Law" section. When entering this section, she perceived the link to the asked document, but understood it should be in the "International Treats" subsection. This user spent about seven minutes to complete the task, summarising the answer in her task sheet.

The three users successfully completed the second task, which asked for the definition of "inclusion" in a published interview. The blind initially tried to reach the interview through the "Articles" subsection, without success. Thus, she decided to take advantage of the portal search engine, completing the task in five minutes. The low vision user decided to make use of the portal search engine at first, completing this task in seven minutes. After exploring different sections, the sighted user also decided to use of the portal search engine, completing the task in nine minutes.

The blind and the sighted user also completed the two extra-tasks, while the low vision user couldn't start them due to time constraints – IPE activities should last no more than three hours. The first extra-task asked for accessing a document in PDF format, and the blind user reported some difficulties when opening this kind of file through Web browsers as some PDF files still have their content inaccessible. The second extra-task, regarding the last published news, was easily completed.

From the de-briefing – the talk established after tasks execution – we emphasize the following aspects:

- *The best features of the portal*: for the sighted user it was the possibility of having a broad view of what could be found in the portal; for the low vision user it was the yellow cues provided by the search engine showing up the searched word or expression; while for the blind user it was the absence of Flash presentations, the long descriptions provided for the links and the possibility of accessing all the provided links.
- *The worst features of the portal*: for the sighted user it was the redundancy provided to the main sections links (e.g. horizontal top menu and vertical left navigation menu both providing access to the main sections of the portal), and the use of the same image to represent sections and subsections in

the navigation structure; for the low vision user there were nothing wrong with the portal; while for the blind user it was also the redundancy considering the main sections links: first the screen reader reads aloud each section title and after it reads the long description provided for each section link. For this user each long description should be read together with its link text. In fact, each link in the vertical left navigation menu had a long description together with its link text, but the screen reader didn't give her the chance to change between the link text and the long link description. Figure 1 illustrates the horizontal top menu and vertical left navigation menu.

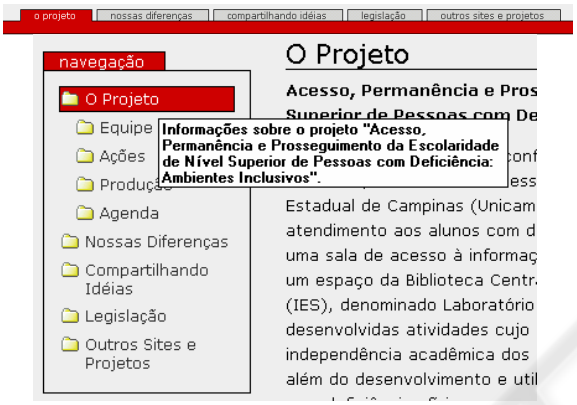

Figure 1: horizontal top menu and vertical left navigation menu showing up the long description for its first link.

- *About the tasks*: the three users reported the asked tasks resemble activities they usually do in the Web.

Analysing the Evaluation Frame data, from the **WRITE-PASTE PHASE**, we identified some problems without explicit solutions and vice-versa, suggesting the existence of more problems and necessary solutions than those explicitly pointed out by the stakeholders. This is not surprising since stressing all issues/problems and solutions/ideas weren't the only purpose of Write-Paste activity. This phase aimed at allowing the group members to share their experience with the portal, organizing and registering their suggestions of improvement. The following rates refer only to the issues/problems and the solutions/ideas pointed out explicitly by the group.

As it is illustrated in Figure 2, from 18 issues/problems related to interface design and information design, 66,67% concern the blind user's experience, 61,11% concern the user with low vision, and 66,67% the sighted user's experience. From the 21 reported solutions/ideas, 71,43% concern the blind user, 71,43% concern the user with low vision, and 66,67% concern sighted user. Inspecting the Evaluation Frame we could perceive many issues related to visual aesthetic (e.g. the need for attractive visual elements, the need for better use of blank spaces between groups of interface elements), besides accessibility issues (e.g. the need for better text description for the images, the benefits of having access keys described together with their link text, and the need for another colour schema to cater for users with low vision). This could explain the high percentage of issues/problems regarding the sighted user besides the blind user. However, the percentage of solutions/ideas related to the blind user and the user with low vision is higher as a result of the care to balance visual aesthetic proposals with user interface accessibility.

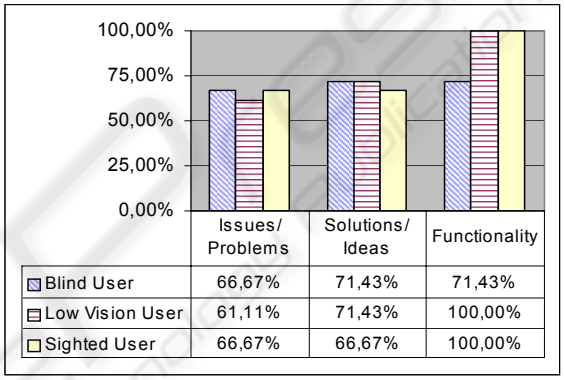

Figure 2: Quantitative aspects from Evaluation Frame.

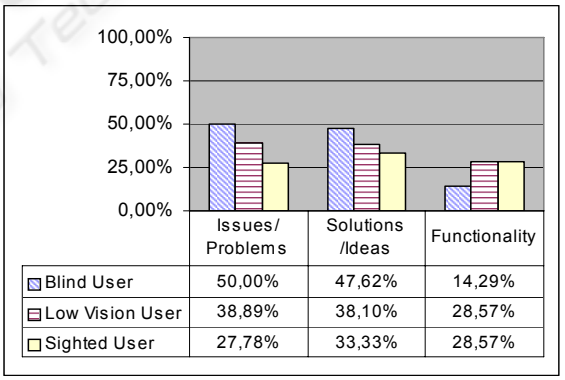

Figure 3: Quantitative aspects from Evaluation Frame regarding only accessibility problems.

If we consider only aspects related to accessibility, we get a different picture from that on Figure 2. As it is illustrated in Figure 3, the blind user is the most affected by accessibility issues, followed by the user with low vision. From 18 issues/problems 50% concern the blind user's experience, 38,89% concern the user with low vision, and 27,78% the sighted user's experience. From the 21 reported solutions/ideas, 47,62% concern the blind user, 38,10% concern the user

with low vision and 33,33% concern the sighted user.

As there wasn't a well-defined frontier between issues/problems and solutions/ideas related to functionality, we grouped them together in another category. Among the seven suggestions regarding functionality, only two of them are related to accessibility: providing a form to send messages to the portal team instead of only having the e-mail contact published, and providing the users a way to choose a different colour schema. The former would benefit all users while the latter could improve the interaction of sighted users and users with low vision.

From this phase it is also registered that blind participants want to have access to information regarding visual aesthetic in images, but not only its functional role. This wish was evident by the case of the portal logo which functionally represents a link to the portal main page.

5 DISCUSSION AND CONCLUSION

This work has presented the Inclusive Participatory Evaluation technique, which extends the Cooperative Evaluation with the Evaluation Frame – an artefact from OS. This technique supported the assessment of a Web portal *with* prospective users in an inclusive design setting.

Usually users from a Web application have different backgrounds, experiences and capabilities. The IPE technique was conceived to be applied in a situation were users' differences must be recognized and considered in the design process.

The flexibility provided by the materials and the behaviour of participants in the group dynamic contributed to achieve results in which the solutions were negotiated among people with different capabilities and necessities in terms of user interface interaction. This way IPE technique could allow a designer to consider the real user's experience (e.g. technologies they use, the way the users deal with their assistive technologies), and perceive the need of balancing solutions that benefit their different conditions.

While Concurrent Cooperative Evaluation contributed to the exploration of a portal by different users and observers showing them up some aspects of interaction with the portal interface, the Write-Paste activity helped them in organising and registering their views and solutions, taking into account the differences which exist among themselves.

In summary IPE technique could support HCI specialists and/or designer to assess technologies *with* prospective users in inclusive design settings, and effectively establish solutions committed to different user's needs. As a next step to this work, we have been working on an Inclusive Web Engineering Process that considers human factors and users' participation, in which this technique is going to be integrated.

REFERENCES

Bergman, E., Johnson, E., 1995. Towards Accessible Human-Computer Interaction. In: Nielsen, J. (ed.), *Advances in Human-Computer Interaction*, Ablex Publishing.

Bevan, N., 2001. Quality in use for all. In: Stephanidis, C. (ed.), *User Interfaces for All: Concepts, Methods, and Tools*, Lawrence Erlbaum.

Connell, B. R., Jones, M., Mace, R. *et al*, 1997. The Principles of Universal Design, Version 2.0. Raleigh. Retrieved April 2005, from The Center for Universal Design, North Carolina State University: http://www.design.ncsu.edu:8120/cud/

Graupp, H., Gladstone, K., Rundle, C., 2003. Accessibility, Usability and Cognitive Considerations in Evaluating Systems with Users who are Blind. In: Stephanidis, C. (ed.), *Universal Access in HCI: Inclusive Design in Information Society*, Vol. 4, Crete, 22-27, Lawrence Erlbaum Associates, pp. 1280-1284.

ISO, 1998. ISO 9241-11 Ergonomic requirements for office work with visual display terminals – Part 11, *Guide on usability*.

Liu, K., 2000. Semiotics in Information Systems Engineering, Cambridge University Press, Cambridge, 218p.

Mantoan, M. T. E., Baranauskas, M. C. C, Melo, A. M. *et al*, (n.d). Todos Nós. Retrieved July 2005, from State University of Campinas network: http://www.todosnos.unicamp.br/

Monk, A., Wright P., Haber, J., and Davenport L., 1993. Apendix 1 – Cooperative Evaluation: A run-time guide. In: *Improving your human-computer interface: a practical technique*, Prentice-Hall.

Müller, M. J., Haslwanter, J.H., Dayton, T., 1997. Participatory Practices in the Software Lifecycle. In: Helander, Martin G.; Landauer, Thomas K.; Prabhu, Prasad V. (eds.), *Handbook of Human-Computer Interaction*, 2nd edition, Elsevier, 255-297.

Theofanos, M., Redish, J., 2003. Bridging the gap: between accessibility and usability. In: I*nteractions*, vol. 10, issue 6, New York, ACM Press pp. 38-51.

W3C, 2005. Web Accessibility Initiative. Retrieved April 2005, from World Wide Web Consortium Web site: http://www.w3.org/WAI/