GUIDE OF ACCESSIBILITY AND USABILITY RECOMMENDATIONS AIMING FOR THE DEVELOPMENT OF HYPERMEDIA FOR DEAF

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ABSTRACT

This paper presents a guide of recommendations to help future hypermedia projects directed to deaf children. The essence of this design guide was given through studies in the areas of Deafness, HCI, Accessibility and Hypermedia identifying elements of accessibility and usability for these users, but also through the application of research with the audience. In the methodology, data collection was accomplished with teachers and students from two institutions, one of inclusive education (school A), and other of special education (school B). For teacher it was administered questionnaires with open questions and for students we used the technique of participant observation. It was verified that is essential the use of LIBRAS (Brazilian Sign Language) in hypermedia aimed to deaf children, because only if your first language being respected and recognized that the child can learn all the initial concepts and use them as a mediator in the learning of written Portuguese. Furthermore, a resource in the written form of sign language was presented, the Signwriting, that although nowadays underutilized, it is really a effective resource that should not be discarded. Finally, it was noted that the recommendations presented include simple alternatives, easy to implement, but not least important or urgent, to issues that require extensive and detailed research in the area, as the work of multidisciplinary teams.

KEYWORDS

Accessibility, Deafness, IHC, Hypermedia

1. INTRODUCTION

Currently, it is undeniable that the influence that the hypermedia together with their digital interfaces has at the lives of people in all spheres, be it academic, professional or social. However at the same time that many barriers to information access are overcome, such as space and time, especially with the Internet evolution, it is encountered a new problem: many people with special needs end up not being considered during the development of digital interfaces that surround them.

On this context, the Brazilian Computer Society (SBC) in its document entitled "Grandes desafios da pesquisa em computação no Brasil (Mayor Challenges in Computing Research in Brazil) 2006-2016," recommends "universal access to knowledge of the Brazilian citizen" as one of the goals to be achieved with the help of computation by the year 2016 (SBC 2006).

Thus, it is understood that there are still many people who are disadvantaged in relation to universal access to knowledge not only in Brazil but worldwide. Among these people, there is a group which makes the subject of this work. These are the people who are deaf. Throughout history, the deaf were and still are unfortunately targets of prejudice and misunderstanding by most hearing people, being regarded as inferior or incompetent. Thus, it is noted that the main challenge of the deaf is to belong to a world dominated by the auditory-oral communication rather than their spatial-visual communication. This situation worsens in deaf access to hypermedia.

Corradi (2007) draws an analogy with the situation experienced by the deaf in digital environments. He compares the difficulty of many listener users to use the internet because there are a lot of pages in languages not close to the user with the difficulty encountered by deaf people when faced with the dominance of the

Portuguese in the digital interfaces. Similarly, the auditory-oral language is a barrier to information access by deaf that do not dominate especially in reading and writing.

In this context it is the purposed this work, aiming through the study of Interface Design and its related areas such as Human-Computer Interaction (HCI), Ergonomics, among others, seeking information to aid in the development of hypermedia accessible to deaf, specifically for children. Hence it is of fundamental importance to study skills (physical, psychological, intellectual) of these users to identify the requirements necessary to interface to enable access for them. Once diagnosed these requirements, solutions that support the extension of computer systems can find allowing these systems, in fact, propitiate the participatory access to the knowledge of these users.

In the scope of this work is required the following problem: what are the guidelines for accessibility, cognitive and perceptual aspects that should be considered in the development of hypermedia for deaf children? Therefore, it is aimed the objective of this work that it is to list a series of recommendations in order to assist the development of hypermedia that are accessible to deaf children. For this purpose, studies on topics such as deafness, HCI, Ergonomics, Accessibility and Hypermedia, and a field study in two educational institutions (A and B schools).

2. SPECIAL EDUCATION AND THE INCLUSION IN BRAZIL

According to Guerra (2005), scholar inclusion is the affirmation of the principle of international quality education as a right for all. The term was officially formalized in 1990 on the World Declaration on Education for All Conference in Jomtiem, Thailand. Later, in 1994, with the Salamanca Statement, the education sector seeks to make the world aware about the paradigm of inclusion (SASSAKI, 1999 apud WAR, 2005). Thus, the educational field has witnessed a period of change in its structure, giving rise to the integration of students with special eduative in regular education, human resources and support services for special needs (CORDE, 1996 apud WAR, 2005).

In this context, according to Merserlian (2009), Brazil has the purpose to include students with special educational needs in the classes of regular schools, through the Law of Guidelines and Bases of National Education (LDB- Lei das Diretrizes e Bases da Educação Espercial) - number 9394/96 published in 1996. According to article 58 of LDB the Special Education, for the purposes of this law, is the mode of scholar education, provided preferably in the regular education for students with special needs, which says in its 1st paragraph: there will be required specialist support services in regular schools to attend the students with special needs and it must also designed curricula, methods, techniques and educational resources differentiated.

Thus, according to the LDB, the deaf students who were referred to the special school, could now enroll in regular schools and have specialized support services.

To Bueno (1999 apud Selleri, 2007), the integration considers the problem lies in the characteristics of exceptional children, so it focuses on the detection of these features and establishing criteria for the inclusion or not in regular education. Already the inclusion when considering the existence of multiple differences, arising from personal factors, social, cultural and political, understands that the current school can not cope with this diversity and emphasizes the need for structural modifications of the current schools to be able to educate with quality to all children, whereas the differences are normal and therefore learning should adapt to the student.

For Martins (2001) an inclusive school is one that educates all in regular classes, where everyone has adequate educational opportunities, have challenges to overcome in a consistent manner with their conditions are supported along with their teachers, are supported and assisted by other members the school.

Note, so over this topic, the inclusion in the field of Special Education is a very controversial issue, in which both sides, those who advocate or who question the inclusion of deaf students in regular education that carry with them significant arguments. However it is noteworthy that the purpose of this paper is not to defend one or another point of view, but only to understand the current context that we have in relation to deaf education in Brazil. With this scenario, it is possible to verify the need for further studies, such as the this study, regardless of the context in which it is applied to the final product.

2.1 Signriting

According to Corradi (2007), the SignWriting is a writing system of Sign Language, created in the United States of America in 1974 by Valerie Sutton, but its use was started in Denmark. The author reveals that this system originated in the description of the dances of choreographer and aroused the curiosity of researchers from the Danish Sign Language that sought a way to write the signs.

For Campos (2006), it is a system of graphic representation of sign languages which allows through visual symbols to represent the settings of the hands, their movements, facial expressions and body movements (figure 1). The author adds that the Signwriting compares with the alphabet used to write in Portuguese, English, Spanish, French, etc., and can be used to write different sign languages.

Figure 1. Examples of signals written in SignWriting. Sourced: Campos (2006).

In Brazil, the publication of the "Trilingual Illustrated Encyclopedic Dictionary of Brazilian Signs Language" allowed for the first time in the country, the extensive documentation of LiBRAS and explanation of general guidelines of the writing system of sign language - SignWriting in the same material. The application of this system gains more space due to the strengthening of the deaf community, especially after the recognition of sign language as a preferred intermedium of communication for deaf persons (CAPOVILLA & RAPHAEL, 2001).

3. ARCHITECTURE OF DIGITAL INFORMATION INCLUSIVE (IMCI)

Corradi (2007) proposes a framework of what she calls the Inclusive Digital Information Architecture (figure 2), aiming to present the links between the principles that can promote digital environments that enable the digital and social inclusion of different types of users, among them the deaf. The Information Architecture Inclusive Digital is based in the planning of digital environments in order to accomplish missions and informational purposes and specific technology, in view of potential service users demanding and interactive, regardless of their sensorial, linguistics and motor conditions. This architecture must map and organize information environments and technology based on the principles of universal design, accessibility, usability, assistive and digital technology (CORRADI, 2007).

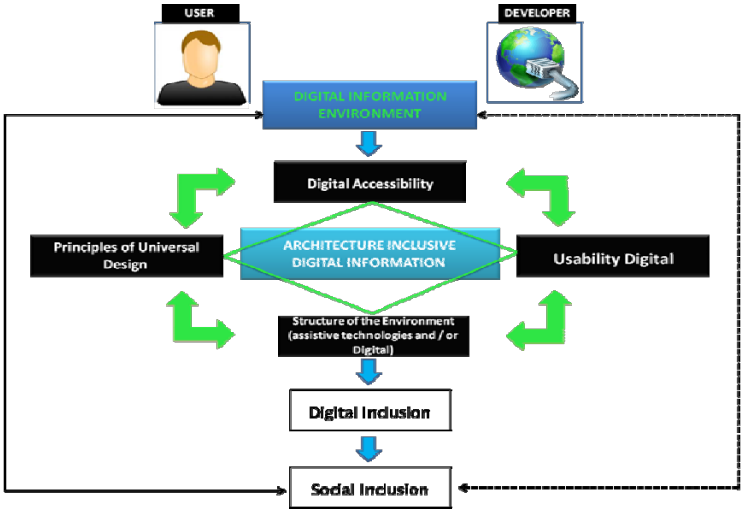

Figure 2. Scheme of Architecture of Digital Information Inclusive. Adapted from Corradi (2007).

Thus, in this inclusive process, both users and developers should be involved during the development of digital information environments, for developers, by allowing the participation of users in the process of building digital environments, ensure the creation of more accessible interfaces through the application of accessibility elements compatible with reality and informational needs of the audience that it is intended.

4. METHODOLOGY

According to Gil (1999), this research can be classified according to their ends, their means, as well as its approach to the problem. As for the purpose, the research is exploratory, it aims to provide greater proximity to the problem of making it explicit or hypotheses set, as well as ideas to improve or discover insights. In relation to the media, it is a case study, which is "an empirical inquiry that investigates a contemporary phenomenon within a real life context when the boundaries between phenomenon and context is not clearly evident and where multiple sources of evidence are used" (Yin, 2001 cited in Duarte, Barros, 2006, p.216). According to Dencker (2000), the case study can include analysis of examining records, observing events, structured interviews and unstructured or any other search technique. Its object may be an individual, group, organization, a group, a set of organizations or even a situation.

Finally, because it is the approach to a problem, we opted for qualitative research, because this method considers that there is a dynamic relationship between the real world and the subject, ie, an inseparable link between the objective world and the subjectivity of the subject not can be translated into numbers. The interpretation of the phenomena and the allocation of basic meanings are in the process of qualitative research.

It does not require the use of statistical methods and techniques. The natural environment is the direct source for data collection and the researcher is the key instrument. It is descriptive. Researchers tend to analyze their data inductively. The process and its meaning are the primary focus of approach (Gil, 1999, p. 42).

After defining the research, carried out a case study in two institutions located in the northern of Paraná State in southern of Brazil, the A school being an inclusive school and B school being a special education school. The research was conducted in two parts, first with professionals from each institution and later with their students. In the first stage, the data collection was performed through a questionnaire by e-mail. In the second part of the research that was done among students of institutions, it opted to use the participant observation and structured interview.

At A school, the observation was performed with student of 4th year from nine years of elementary school, while at B school it was carried out with students from 3rd and 4th grade, respectively. Through this technique, we analyzed the interaction of students with a digital application "Literary Classics Collection on CD-ROM in LIBRAS - The Adventures of Pinocchio", and the observed phenomena were recorded in a notebook. Just as a way to record and to illustrate the research, some pictures were made on site, not being recorded the activities in video form not to embarrass or intimidate the students.Note that some free workshops of software of image manipulation were given to the students from school B, which participated with the study, as a way to repay them for their collaboration with the research, and these workshops also generated some significant notes to the guide recommendations conception. Unfortunately, the same activity was not possible to be held at the A school, because the institution did not yet have a computer lab. Table 1 presents the application of research with teachers and students.

Table 1. Results of the questionnaire and observations

Teachers – Questionnaire	Reported that due to lack of knowledge, some people believe that because a student is deaf, we can just give him the information in written Portuguese that he will understand them without problems. As the answers given by professionals, it is an erroneous thought, since the student needs to first learn all the initial concepts through sign language and is thus his mother tongue will be respected and it will work a mediator in learning the Portuguese in its written form. The distinction between the terms of literacy and literacy is emphasized, the first focused on the area code, considering the decoding abilities (reading) and encoding (writing), also proved to be favorable to the use of SignWriting, own writing mechanics, and the second in interpretation of texts, to read and understand between lines, in the formation of critical and reflective learner. P2, in turn, understands that the difference between alphabetization and literacy is a philosophical question, depending on the education vision of teacher, that student and what kind of professional the teacher wants to form. Terminology aside, the three professionals agree that literacy proves to be the best way of learning to write in Portuguese.
Students - Observation	**A SCHOOL:** The students demonstrated disinterest by the language that was shown, the teacher / mediator made an interesting comment, saying the word "magic", the video with the translation in LIBRAS had a different signal than that it was used by her. She then explained that as the oral Portuguese, in LIBRAS there are regionalisms, there are also several ways to represent the same word in LIBRAS, depending on the context. Also the professional reported that signs made by the interpreter in the video were running a bit fast, which could hinder the understanding by students with more difficulty in LIBRAS, this way, it would be interesting for the user to control the video speed, according to her practice with sign language. It was felt that the incentive from game competitions (double) excited them, there was little interaction problems. **B SCHOOL:** with the first group, there was great importance on the use of metaphors in interfaces and it was evident that they are even more important for deaf users; it was diagnosed on several occasions that children managed to address themselves their doubts, thanks to intuitive operation interface using the metaphors, students presented lack of familiarity with "Start Menu" and "Exit", the children demonstrated the need for autonomy to stop and continue the interaction at the desired moment, it was observed that the application under test has a problem with the translations in LIBRAS, it presents the Portuguese words in the written form but not their meanings, either through pictures or explanations in LIBRAS, leaving this work to the teacher position, due to this scenario was observed dispersion during the test, when there was mediation, the children animated, this time it was noticed the students frustration, because the game suggest an item "painting" and was actually "print" to paint (problems of labels). Already with the second class, we observed the same importance in relation to metaphor, the same dispersion, the time of testing a teacher / mediator noted that the interpreters of the game should follow clothes criteria defined in the Code of Ethics of the Association of Professional Interpreters and Guides-Interpreters of Sign Language, which recommends description, suggesting the use of plain clothes and non-use of facing and accessories.

5. RESULTS

Grounded in any previous study of the themes involved and applied research, thus contributing to information obtained during data collection, it is proposed the following recommendations guides: GUIDE OF ACCESSIBILITY AND USABILITY RECOMMENDATIONS AIMING FOR THE DEVELOPMENT OF HYPERMEDIA FOR DEAF:

I. Prioritize the use of LIBRAS (mother tongue) in the system where is possible, it is the translation of the content itself, the presentation of error messages in the help documentation etc., preferably in the form of video or animation, ensuring access to children by through their first language;

II. Relative to the SignWriting, unfortunately it is still in a potential resource, because Brazil, it is not very widespread among both students and teachers, so their use is still optional, not being essential, but it is expected that this scenario changes in the near future. However, if it is used, it must verify that symbols used as interface elements or messages have no correspondence with the written symbols of sign language. Furthermore, define rules for selecting and representing to interface icons, differentiating them from the graphical form of the signals, since icons represent features of the system and the signals represent information in written form;

III. When using videos of LIBRAS interpreters, must pay attention to some aspects such as the size of the window that displays the video should be enough to show any sign run, avoiding the hands leave the scene, the child should retain total control of video, ie the video it can not be started automatically, without need to repeated its, we must ensure that existing technology allows the user to control the speed of the video

to be executed and if not possible, we should study the possibility of recording at different speeds, which implies a higher cost;

IV. The interpreter responsible for conducting the signal in video, should pay attention to the criteria of clothes defined in the Code of ethics of the Association of Professional Interpreters and guides-interpreters of sign language (APILSBESP, 2007). Thus, it is recommended discretion, opting for plain clothes (one color), and that contrast with your skin, and avoid the use of ornaments and accessories;

V. If there is a need for a glossary that translate the words to LIBRAS, the same should also display an image showing the meaning of words. If the word is abstract, it must provide a synonym or an explanation in LIBRAS;

VI. It is important to remember that a sign of LIBRAS can be interpreted differently depending on each context, just as there are words that are identical, with different meanings. Moreover, as natural languages, sign languages are related to the customs and cultural specificities environment of the regions where each deaf community develops their own language. Thus, the LIBRAS throughout the Brazilian territory has regional variants, which confirms its character of natural language, consequently it is influenced by the environment where it is used.

VII. In presenting menus of options, the maximum possible of metaphors to replace the labels in written Portuguese should be used; if it is not possible to apply a metaphor, we must consider the possibility of an auxiliary video display for translation in LIBRAS;

VIII. Illustration, photos and animations should be thought primarily as accessibility elements for understanding the content and not only as aesthetic devices, so we must analyze what can be included or left out according to the various demands context. Thus, it is necessary that these resources are carefully worked so that the effects that are caused are positive and without causing any questions or information overload;

IX. If it is desired to represent a signal by means of bidimensional illustrations or tridimensional models, it should be noted that not only can stick to the configuration of the hands, since the interpretation of a signal also depends on the point of articulation, of movement, of orientation and of facial and corporal expression;

X. Regarding the level of interactivity, it is recommended to opt for medium or high hypermedia interactivity because, as could be seen in participant observation with students, hypermedia of low interactivity for their linearity, tend to discourage students, limiting their creativity, initiative and their capacity for decision making. The hypermedia should foster the possibilities of interpretation and development of judgment through the active participation of users and not just a simple relationship of unilateral use;

XI. Visual signaling to the events of the system in use (such the states of the system, sending and receiving messages on the Internet, etc.) is necessary. The system should provide visual feedback to user actions in a predefined area on the screen. This recommendation aims to help the user to focus, from the moment we understand that the information will always appear in the same location (visual standardization);

XII. If a character is used to perform signal, it should limit its movements to the movements of signs to allow the user to turn his attention only to the movement transmitting information. Otherwise, by making an analogy would be like in a system based on oral language, a character who could say anything, making a grinding noise while waiting for some user action;

XIII. It should always be updated regarding available assistive technologies, especially software, generally lower cost or even free;

XIV. If hypermedia has been developed for teaching purposes, it is recommended that still in prototype stage be evaluated by the deaf children in order to verify and improve the efficiency of learning;

XV. Pay attention to Architecture and Design Information in order to avoid unnecessary screens and menus, and ambivalent labels that may cause frustration to the child in his interaction with the interface;

XVI. At least that hypermedia has the order to stimulate the learning of Portuguese written, should be prioritized games do not require the knowledge of this or that preferably involving the LIBRAS.

6. CONCLUSION

The research in an inclusive school and one special education did not seek in any way to make comparisons between their teaching methods, however, availed of both institutions have in common, which is the pursuit of education and empowerment of deaf children in order to enrich the content of this work.

If an adult deaf, reading of written Portuguese is already difficult, imagine how it is for a deaf child. Therefore, it is essential the use of LIBRAS in hypermedia aimed at this audience, because only their first language is respected and recognized that the child can learn all the initial concepts and use it as a mediator in learning writing.

Being the LIBRAS a visual-spatial language, its use in digital environments depends on the viewing of video, animations or illustrations. However, it is not always possible to use such resources; thus, it was found that there is an alternative representation of the sign language in written form, the Signwriting. In the country, although its use is still not much explored, there is controversy about the topic. It should not discard the possibility of its application, since the information provided in different formats allow growing the digital inclusion of deaf users, optimizing the use of information systems for them.

In addition to recognizing the mother tongue of deaf children in developing the same accessible hypermedia through the use of LIBRAS and SignWriting, the final recommendations involving other elements of accessibility. It is important to highlight that these recommendations are based on accessibility aspects to usability, whereas only a hypermedia be accessible to a given audience, this should also be easy to use, since different usability aspects of a profile user to another.

Analyzing the profile of students participating in the research, we looked to the need for a study regarding hypermedia aimed at students in the literacy process in LIBRAS. Another interesting topic to be researched it is another type of interface, in addition to GUI has already been addressed here, the VRUI, based on virtual reality and its current possibilities of interaction with deaf children. Finally, it is expected that this work can really help the future development of accessible hypermedia to deaf children, and encouraging more researchers who are interested in the subject matter presented.

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COMPARISON OF USABILITY TESTING TOOLS FOR WEB GRAPHICAL INTERFACES

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ABSTRACT

Usability testing tools can help software development teams to organize and perform their work on a user-centered interaction design approach. There are many of such tools available nowadays, with different features and capacities. This paper is an attempt to organize the concerned information and choose a suitable usability testing tool for web interfaces, with particular emphasis on graphical interaction. A multi-criteria additive utility function is proposed as evaluation method and for establishing a ranking of a selected set of usability testing tools. Results are presented and discussed.

KEYWORDS

Usability testing tools, user-centered interaction design, graphical web, multi-criteria decision analysis.

1. INTRODUCTION

The user-centered design process relies on the involvement of users in every dimension that could be related to the success of the product. As human issues are always a main source of complexity for engineering, the size and heterogeneity of the team of designers is often a requirement and another source of problems in itself. In order to overcome this small additional source of complexity, designers should cooperate according to some common guidelines built on their experience and a vast literature of recommendations, in a productive way that should provide convergence of results toward the final product (Norman, 2002).

Long lasting design teams have their own stabilized strategies, tactics and tools, partly established on the acquired experience with previous projects. New teams or teams with several new collaborators can take extra benefits from commercial off-the-shelf, well documented frameworks of integrated computer tools. When it concerns user-centered design of web interfaces, advanced prototypes, the final product and the users, can be directly accessed by robust common frameworks. As these frameworks are repeatedly used, project after project, by the same teams, even when they are often remixed in their composition, a decrease can be expected of the distance in the gulf that separates the evaluation protocols and collected data from their common intuition about what problems are beyond bad results and about ideas for new solutions.

Evaluation of a product relying on users tests (usability testing) is an irreplaceable technique in user-centered design (Shneiderman, 1998; Nielsen, 1993), since it gives direct input on how real users interact with the system (Nielsen, 1993).

There are many usability testing tools (UTTs) available nowadays, with different features and capacities. This paper is an attempt to organize the concerned information and choose a suitable usability testing tool for web interfaces (Nielsen, 1999) (Dix et al., 2003), with particular emphasis on graphical interaction.

The evaluated UTT issues and features and the corresponding preferences were established with the aim of conveying the usability tests of interfaces designed for prototypes developed by the World Search Project (2010). This is an important Portuguese project which is responsible for the design of web search interfaces for dedicated areas of public concern, namely in the health area. The goal of the World Search Project is the research and development of innovative web search technologies in Portugal as well as the research and development of generic and business information with semantic relevance and with the proper knowledge of the Portuguese language, culture and market.