

USABLE ACCESSIBILITY FOR DL: ADVANCES AND RESEARCH AGENDA

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ABSTRACT

Web applications, interactive applications in general, and ICT (including DL's) applications in global sense may put users with disabilities outside the mainstream of society, if they are not "accessible", i.e. usable to them. This is socially and economically unacceptable and, moreover, pieces of legislation are being approved everywhere in Europe (and worldwide) in order to make accessibility mandatory (in some sense and at some extent). DL's represent a way to preserve our past and to make it available to present and future generations; necessarily they need to be accessible, representing a public effort, with a concern for all the segments of society. Current research on DL's has shown, so far, little advances on accessibility besides the (limited) recommendations proposed by international organizations. This paper presents some advances in accessibility design that can be used for complex interactive DL and outlines future research actions in this crucial domain.

1. INTRODUCTION

Digital Libraries may be considered as communication tools which are the results of a public effort to serve the society. Given the current technological scenario, digital libraries risk to be (and most already are) "inaccessible" by users with special needs. Different kinds of disabilities should be considered having the right of access, assuming that a public service cannot silently exclude these users from accessing important service for their everyday life.

Accessibility issues concerning Digital Libraries should be coped within the overall accessibility scenario characterizing web applications today. Different kinds of people with special needs can interact with the web in different ways. There are disabilities concerning motor capabilities (for example users unable to use hands and, consequently, an interface pointer like the mouse). There are also disabilities concerning physical capabilities

(visually-impaired or audio-impaired users) or cognitive capabilities (users not able to receive process and understand complex messages).

In particular, people with *visual* disabilities (blind or visually-impaired people) have difficulties in using the graphic interfaces of modern web applications, and consequently the complex DL interaction mechanisms which are based on the visual paradigm (forms, buttons, indexes, icons, menus, ecc). The problem is even greater if we consider that DL provide access to content and services that could not be accessible in any other traditional ("offline") way (carrying out scholarly research on very large databases, getting rich information about cultural attractions far away from home, ecc.). The risk is high to deepen a social gap between people who can get access to a wide range of DL-provided content and services, and people who cannot.

The paper is structured as follows: section 2 provides some hint to the open issues in the field of accessibility for visually-impaired users, which are strongly relevant to DL as well as for publicly-accessible interactive applications. The effort of the accessibility community in shaping standards and guidelines for more accessible designs is discussed in section 3 along with the need of delivering applications which are only accessible but also usable and satisfying. Section 4 and 5 presents an important first step towards enhanced accessibility, which is the effort of the WED (Web As Dialogue) project and the resulting application case study. Innovative design features are illustrated and commented by example to show the directions of the needed research towards usable accessibility. Section 6 draws some conclusions and outline important elements of the research agenda.

2. OPEN ACCESSIBILITY PROBLEMS

Access and interaction with DLs and web applications services are heavily based on the visual channel. The "graphic interface" glues all the elements necessary for the user to access the content, services and functionality,

understand them, manipulate them, operate with them and enjoy them.

Today, people with visual disabilities access the Web through software tools called “screen readers”. Screen readers interpret the HTML code, reading pages aloud from up left to bottom right. Due the visual nature of the Web, this direct translation into the oral channel turns out to be far from satisfactory, making the use of the Web a very cumbersome operation [3].

With regards to the translation of a website into the oral channel, we can identify three different kinds of problem, related to 1) content, 2) layout, 3) navigation/ interaction [1].

1) Both texts and images are “content” in a strict sense; in case of images, a suitable verbal translation should be provided to those who can’t see them. A special attention must be also paid to texts, very often strongly dependent on the visual context in which they are located: in case of visually impaired users, a text cannot refer to the “image on the right”, nor in general to any visual feature of the page. Descriptive texts that go with images must be conceived bearing in mind a user who cannot rely on the visual complement of the meaning.

2) Modern graphic interfaces allow storing a lot of information in the same page. Moreover, graphic itself becomes a vehicle of specific meanings, through font sizes and relative proportions (e.g. the larger the font, the more relevant the link), colors (e.g. links of the same color are likely to be of the same kind or belong the same semantic area), position on the page (e.g. links on the bottom of the page are considered less relevant, often a repetition of previous links; links gathered together on the same place are again likely to be of the same kind, etc.). We call these non-verbal aspects “graphic semantics” of the web. If the web page is simply read aloud, all these messages are lost.

3) As to the navigation, problems are even greater. As log files analysis has well pointed out, users generally move a lot backward and forward in a site not because they want to read content again but to resume their navigation from a previously visited node. Sighted users can quickly skip over already visited pages or catch at a glance where’s the link they’re looking for; actually, they never read all the content of a page, but immediately select the relevant part/s they’re interested in “skimming” the page, thanks to graphic semantics. In contrast, a visually impaired user, when re-visiting a page, will have to listen to the screen reader reading again the list of links, content, images, forced to wait patiently for the item s/he’s looking for.

These and other issues represent hard obstacles for visually-impaired people who are struggling for a satisfactory user experience on the web. Current technology and standards are just a first step towards the optimization of websites for visually-impaired individuals but they are far to solve the abovementioned problems.

3. THE ROLE OF CURRENT STANDARDS AND THE NEED FOR “USABLE ACCESSIBILITY”

The W3C standards for accessibility [4] made the first fundamental steps in order to overcome the above problems and guarantee web access to visually impaired users. A set of guidelines have been defined and addressed to designers who want to make their site “accessible” for users with visual disabilities.

For example, a proper alternative text for each image is prescribed, and suggestions for correct contrast between the background and the texts are provided. Guidelines are also defined for designing tables on the web page that might be read by screen readers in a more meaningful way for the user.

Besides specific and detailed indications on in-the-small components of the page, guidelines for effective navigation and layout design are poor and often too vague. Especially with regards to layout and navigation, many of W3C recommendations need to be interpreted and expanded in new, more detailed guidelines, affecting the content and the design of the site.

As a matter of fact, “Accessibility” does not guarantee “usability”. In other words, accessibility – as the one suggested by W3C - is a necessary but not at all sufficient condition for usability.

Whereas accessibility is often interpreted as making things available and possible to use, usability has to do with supporting user’s goals and with user satisfaction.

According to ISO standard (ISO 9241-11), usability (in one of the many definitions available) is considered as “the effectiveness, efficiency and satisfaction with which specified users can achieve specified goals in particular environments”. W3C standards focus on having content and navigation “available” to visually-impaired individuals, but not at all usable. Besides making great lengths to make “accessibility” possible, research should go towards “usable accessibility”. Whereas accessibility might “guarantee” that services and content are somehow “perceivable” by users with special needs, “usable accessibility” is a quality of a DL that makes it actually satisfactory for the user.

But how about making content, site structure, and navigation satisfactory and usable for such users?

As an important – though initial – step on the way to fulfil this agenda, an on-going research effort carried out between the University of Lugano and Politecnico di

Milano is worth reporting, and it is presented in the next section.

4. WED (WEB AS DIALOGUE): A DIALOGUE-BASED APPROACH TO ACCESSIBILITY

The WED project (Web as Dialogue) funded by a grant of the Swiss National Science Foundation aims at sketching new guidelines to transform the web experience for visually impaired people from “possible” into “satisfactory”. The original research of the WED project assumes that the interaction between a user and website can be interpreted as a sort of dialogue. Although this statement is shared in principle by the design community, wed tries to push forward this dialogic interpretation to create effective web dialogues with visually-impaired users. Visually-impaired individuals, in fact, need oral dialogues just because they can’t rely on the visual channel. Trying to investigate what makes a dialogue effective and satisfactory, WED research developed original design gems to improve website usability paying particular attention to the needs and requirements of users with visual disabilities.

WED results started to show their effectiveness during the design and deployment of the website for an exhibition of Munch’s prints, held at the State Museum of Berlin (www.munchundberlin.org). The exhibition took place in Berlin in Spring 2003 and the website received very positive and encouraging feedbacks from German visually impaired users. The application developed is not a proper full-fledged Digital Library: it is a working web application offering rich and structured content on Edvard Munch’s prints. However, besides the specific case study, we are convinced that key design solutions devised in this experience to enhance accessibility may be well exploited in the Digital Library domain.

5. TOWARDS ENHANCED ACCESSIBILITY: THE MUNCH’S EXHIBITION WEBSITE

The design of the website www.munchundberlin.org represents the first practical result of the WED approach. The web application complies with – almost – all the accessibility rules of W3C. Besides being accessible, the website presents some features that make it optimized for visually impaired users – and very comfortable for any kind of user. A set of strategies properly orchestrated in the design phase greatly enhanced the accessibility of the website, thus improving the quality of the experience for visually-impaired users. Let us see now in details these features of the website.

5.1. INFORMATION ARCHITECTURE

The website was designed using the W2000 design methodology. W2000 is a structured design model which enables to shape the information architecture of a complex web application taking consistently into account the following aspects: information design, navigation design and publishing/presentation design. Thanks to the concepts provided by the W2000, the design of the website was organized consistently across the whole application, defining a few simple page schema for the whole site. A page schema is a recurrent organization of the elements of a page which is valid for all instances of the pages of the same type. As a consequence, designing page schemas enabled to have constant and recurrent structures of the pages in the entire website.

5.2. PAGE SCHEMA

The page schema is not only the designer’s description of the structure of the page, but it may also become very relevant information for the visually-impaired user.

In this website, in fact, we make the screen reader read the “page schema” first, which is a short summary of the basic sections of the page. In this way, the user can immediately perceive the overview of the key elements of the page and then choose which section s/he’s interested in (using available commands provided by the screen readers). Overtime, the user easily memorizes the structure of the pages, and thus can more efficiently select the relevant elements of the page as soon as the page schema is presented on every page. Note that the page schema is a purely oral feature: it reflects the page’s organization but it is not visualized as text anywhere on the screen.

The page schema reifies the recurrent structure of the pages include the following elements (for the all pages containing the core information objects of the applications, i.e. Munch’s prints):

- Main content
- Links leading to prints related to the current one
- Links leading to detailed information about the current print
- Overall lists of prints
- Service links
- General links

Figure 1 and 2 depict respectively the visual elements of the page schema and its codification read by the screen reader.

5.3. READING ORDER OF THE PAGE’S CONTENT

The screen reader reads the main content of the page first (immediately after reading the “page schema”), even if it is not the first content “graphically” represented on the page. Therefore, the oral reading strategy has been

completely decoupled by the visual one, trying to keep the same overall meaning and communication purpose.

Unlike many websites which are not optimized for accessibility, this oral strategy enables overcome one of the major pitfall of using screen readers when accessing a complex website: dozens of links are always read first as every page is loaded. As a consequence, the impaired user gets frustrated as relevant content is among the last element to be read (while it often is the most relevant).

In our approach, we have content always read first, so that the user can immediately catch the purpose and main message of the page. However, this content is not just put forward in isolation: the page schema has been already read to the user, in such a way that if the user went to that page just to retrieve some links (and not for reading content), this can be done efficiently.



Figure 1. The visual correspondent of the page schema.

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<h1>This is the first section (page schema).</h1>
On this page you will find:
in the first section the page schema,
in the second section the main content,
in the third section additional informations about the print The Sick Child (Sick Girl),
in the fourth section other content related to the print The Sick Child (Sick Girl),
in the fifth section the links to highlights,
in the sixth section the landmarks,
in the seventh section the service links.
<h1>This is the second section (main content).</h1>
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Figure 2. An instance of the “page schema” read by the screen reader.

5.4 LINKS' NAMES

The screen reader allows immediate access to the complete list of the page's links. In order to still “mirror” the page's organization (“page schema”), we also enriched the link names, communicating to the user the position of the single link within the page schema section it belongs

to (see Figure 3). This may provide to the user a further support for orientation within the structure of the page.



Figure 3. Enriching link names with position within the page schema.

5.5. PRINTS' DESCRIPTIONS

All the descriptions of the prints were prepared trying to keep in mind a user who can't see the prints: the elements of the prints are introduced and then commented. Content in fact is a crucial concern for accessibility. In case of an image library, it is important to consider that the blind user needs a different description of the image that the one needed by a user without visual impairment. In our application, we firstly provide (as default) a comprehensive factual description of the print (to facilitate the blind user to get an idea of the subject) followed by a more in-depth commentary.

5.6. NAVIGATION FEATURES

We also introduced some design features that make the navigation experience more efficient not only for visually-impaired user but for any kind of user.

a. "Visited & missing"

Sometimes a user wonders: "what have I already seen? What's missing?" The "visited & missing" command allows answering to these questions: all the pieces of information already seen or missing are shown in a very efficient synoptic view.

b. "Just visited"

Sometimes one topic is developed through many pages; therefore, if the user wants to go back to another previously visited topic, s/he normally has to use the "back" of the browser. The "just visited" command aims at offering a shortcut, taking the user directly back to her/his previous "semantic" step.

c. Up to last decision point

This command is similar to the previous one ("just visited"); it allows going back directly to the last "menu" of choices (for example, the last list of prints) visited.

d. My history in the site

The command "My history in the site" offers a list of the "semantic" steps the user has made so

far, allowing a quick re-selection of a previously visited content. With respect to the traditional way of providing history mechanism (tracing back all the "physical" steps done so far), this feature adds a semantics to the history, filtering and categorizing the relevant previous steps according to their purpose (back to the "prints" visited, back to the "artistic movements" visited, and so on), thus skipping unnecessary and syntactical steps (always reachable via the browser back button).

These design features enabled to shape a website, which visually-impaired individuals can experience in way far less frustrating than most of existing websites claiming to be accessible. In fact, enhanced accessibility for Munch's website brought key advantages for the users, including: clearer navigation, improved orientation in the page, more straightforward communication of the site structure and interaction capabilities and diminished waiting time for spotting relevant content.

6. CONCLUSIONS AND FUTURE WORK

The WED research has already allowed a significant step forward towards the optimization of websites for visually impaired users. We have received very positive feedback from "real life", (visually impaired) users. A German blind user, for example, has sent in the following email:

"The first impression of the site is very positive. Pages are clearly structured. All the links have detailed titles which allow an informative and nice internet session. With my favourite screenreader Jaws (version 4.51.212) I needed about 1,5 minutes to get a general overview for all further actions. This seems to me an acceptable time, considering that this form of documentation of such an exhibition is quite unusual at the moment".

In essence what we have done is to define precise solutions for problems vaguely addressed by the W3C standards; in particular we have tackled those generic recommendations where “good structuring” is suggested, without specific ideas about what to do.

To sum up, our approach for enhanced accessibility based WED provides the following innovations:

- definition of an overall design strategy for the whole application;
- definition of page schemas optimized for “being read”, as parallel with respect to page schemas optimized for “being seen”;
- definition of “oral browsing” strategies, allowing a blind user to quickly understand the overall pattern of the application as a whole, of each section and of each page

Future work, which should be reflected into a long-term research agenda towards usable accessibility for DLs should include the following objectives:

- a) Define guidelines for project managers and designers enabling them to *craft* accessible DLs which deliver a “satisfactory” user experience to people with special needs (starting from people with visual impairment).
- b) Integrate guidelines for “usable accessibility” in the mainstream families of approaches, methods, and techniques for usability evaluation.
- c) Define guidelines for project managers and usability experts to *evaluate* “usable accessibility”, i.e. to verify whether not content & services are made accessible *and* usable to people with special needs.
- d) Produce results which may have a significant impact on the improvement of current international standards (e.g. W3C WAI initiative).
- e) Develop tools to support the design and evaluation activities for “usable accessibility”.

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Online resources:

<http://www.w3.org/WAI/>: Web Accessibility Initiative

<http://www.w3.org/2001/di/>: Device Independence Activity

<http://www.w3.org/2002/mmi/>: Multimodal Interaction Activity

<http://www.w3.org/Voice/>: "Voice Browser Activity - Voice enabling the Web!