Criteria for Usability of Accessible Web Sites

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Abstract. The application of appropriate web site design and evaluation methods help to ensure more usable and accessible web sites. While in the literature guidelines and evaluation methods for accessibility and usability are given and discussed separately, we aim to identify the relationships between these two concepts, in particular considering usability criteria for accessible web sites. In this work, we propose a set of usability criteria for accessible web sites in order to improve the navigability for special users, i.e. the vision impaired. The identification of the 16 criteria suggested herein was performed through empirical feedback, in which simple hypotheses were formulated, then tested. Subsequently, a systematic method was developed on the basis of the tests, resulting in a classification of the criteria according to usability aspects. The proposed criteria have been applied to an existing public administration web site.

1 Introduction

In recent years the use of web sites has been widening, and the number of users who access them is increasing more and more. For this reason it is important that the information be easily reachable by all, including people with disabilities. The difficulties in providing such universal access are matters that can be addressed through application of the principles of usability and accessibility. A web site is accessible if it can be used by everyone, with special care to people with disabilities. Usability is a multidimensional concept, since it can refer to several aspects and the importance of each aspect depends on the application domain. We can note that accessibility and usability are closely related, but while accessibility is aimed at making the website open to a much wider user population, usability is aimed at making the target population of the website more efficient and satisfied. Usually usability and accessibility issues are dealt separately. We want to identify their relationships: in particular we want to address the meaning of usability when accessible web sites for disabled users are considered. Often, when we refer to people with special needs, we tend to consider only accessibility issues, and to ignore those regarding usability. Technical accessibility is a pre-condition for usability. However, even if a site is theoretically accessible because it completely complies with the technical accessibility standards, it can still be very hard to use for people with disabilities, so that they could not succeed to reach their goals. In our work we consider, in particular, accessibility usability issues for people who are blind or who

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have vision impairment. So, we have to consider the context in which these users work, i.e., browsers, particular devices (voice synthesizer or display Braille), particular programs (screen readers, screen magnifier) and so on. When interacting with a screen reader, how the information is located in the page code is very important because it is interpreted differently from when users read the page from the screen. Therefore, during the phase of criteria identification, some blind and vision impaired people were involved to test some selected examples.

In the paper, we first discuss the previous work in the area to better position our contribution. Next, we introduce our proposed criteria to improve usability of accessibility aspects, organizing them according to the standard usability definition. Then, we provide some examples resulting from the application of the criteria. Lastly, we provide some concluding remarks and indications for further work.

2 Related Work

Usability and accessibility are two concepts that can apply not only to web sites, but in general to all interactive systems. In literature several evaluation techniques have been proposed, some of which have been widely used. A review of evaluation methods with automatic support is available in [1], where a classification is proposed. In order to obtain a more usable and accessible web site, the developer has to follow well defined criteria and guidelines. Several usability guidelines have been proposed. Most accessibility issues are taken into account especially by W3C (World Wide Web Consortium) in the project Web Accessibility Initiative (WAI) [8]. They pointed out a number of recommendations and guidelines to promote web accessibility: "Web Content Accessibility Guidelines 1.0" (WAI 1999). The guidelines are intended for all Web content developers (page authors and site designers) and for developers of authoring tools. Such guidelines focus mainly on web accessibility aspects for people with disabilities, but, in our opinion, they do not consider much usability in this context. Hence, we intend to investigate those aspects which act on the organization and rendering of information in the page. Practically, we would like to extend the accessibility guidelines, aiming also to improve and facilitate the task performance. WebSAT (Web Static Analyzer) is a tool that verifies, referring to several guidelines, the HTML code of web pages, in order to point out potential usability problems [5]. This tool carries out a usability evaluation, but does not provide any suggestion to the developer. In the field of accessibility evaluation based on criteria and guidelines, there are some tools, such as Bobby [2] [3] and LIFT [4]. Although such tools find out accessibility problems, they show several drawbacks, such as rather long reports whose understanding is not easy for developers not experienced, no automatic support for the repair of the problems identified, identification of a limited number of potential aspect of non-accessibility, etc. This kind of tools find out accessibility problems, regardless of usability aspects for persons with some disability. In fact, although LIFT does partially support usability evaluation, we must state that such aspects are not sufficient to outline usability for special users (e.g., consistency of text and background colours, but not specifically for vision impaired people).

There are various international projects involving accessibility and usability of user interfaces for people with special needs. Stephanidis' group has long been working on user interfaces for all, by finding methods and tools allowing the development of

unified user interfaces [6] [7]. Although guidelines and tools have been taken into account, they are mainly related to accessibility issues. In our approach, we want to consider not only accessibility, but also usability for accessible web sites, in the context of common web browsers.

3 Proposed Usability Criteria for Accessible Web Sites

In this section we discuss the proposed criteria to improve usability of accessibility in web sites. We suppose that a web site is already accessible (i.e., it complies with accessibility guidelines), and we describe those aspects of web pages that have an effect on navigability by users with special needs, i.e. blind or vision impairment users. We propose a set of criteria that can be used to support both design and evaluation. We have focused on web page code, taking into account HTML/XHTML language, JavaScript and Style Sheets (CSS). Accessibility guidelines advise not using Javascript because some browsers may not support them. Even though we share such principles, we aim to provide possible suggestions which also involve Javascripts. We would like to improve usability even when developers still intend to use scripts. This is important especially when the site already exists and it has to be modified in order to fix potential usability problems. Our goal is to create a semi-automatic environment supporting the designer rather than a completely automatic solution that would be too restrictive. In fact, developers may often decide not to repair web sites because of the effort required, which depends on the number of changes necessary, and sometimes requires a general reorganization of the web site.

In defining the proposed criteria, we aimed to identify the main aspects that can cause usability problems in accessible web sites. Then, for each criterion we provide more technical solutions to reach that goal, taking in account developers' choices in building the web site (e.g., frames or javascripts, …). So, we refer to these aspects in terms of the associated criteria and to technical solution in terms of checkpoints.

3.1 How the Criteria Are Organized

We consider the aspects which can be potential usability problems, and checkpoints associated to those criteria. We have one first more general set of criteria, and a second one made up of checkpoints which are more detailed and precise. This organization differs from that of W3C accessibility guidelines which are arranged in 3 layers: guideline statements (i.e., general principles of accessibility); checkpoint list (i.e., how the guideline applies in typical content development scenarios); and a techniques section (i.e., implementations and examples for the checkpoints). Our approach aims to provide developers and evaluators with a more compact version of criteria in order to simplify their use.

Moreover, similarly to three priority levels assigned to checkpoints based on impacts on accessibility, we group our proposed criteria according to usability definition. More precisely, first of all we classify the proposed criteria depending on effectiveness, efficiency and satisfaction principles; secondly we catalogue them depending on the type of impact on the user interface.

Classifying criteria according to usability definition (ISO 9241) means that we identify those that are most important to reach the users' goals (effectiveness), those that allow reaching them more quickly (efficiency), and those that best satisfy users (satisfaction). Taking into account the type of users considered (i.e., users with special needs), we identify three levels of importance. We consider effectiveness criteria more important than those based on efficiency and satisfaction, because failure to satisfy such criteria could lead to users' not being able to accomplish their tasks. Thus, we consider more important effectiveness (level 1), then efficiency (level 2), and finally satisfaction (level 3).

The other parameter used to classify the criteria is the user interface aspect involved. A user interface is composed of two main components: the presentation, indicating how the user interface provides information to the user, and the dialogue, describing how the actions that users and system perform can be sequenced. According to this, we label with "a" the presentation criteria, and with "b" those of dialog.

3.2 The Proposed Accessibility Usability Criteria

In our work we determined 16 criteria to improve accessible web site usability for users who read web pages by a screen reader. As mentioned above, the criteria have been grouped in three sub-sets: effectiveness (5 criteria), efficiency (9 criteria) and satisfaction (3 criteria). For each criterion several checkpoints are proposed in order to indicate how it can be applied. To identify the criteria our study followed various phases:

- *Empirical phase*. First of all we have taken into account those aspects (see below) that can be potential navigational problems for special users who use a screen reader or magnifier. Then, according to those aspects, we have analysed HTML specifications and javascripts, to determine possible solutions.
- *Simulation phase*. We have built examples considered valid for our purpose, and we have tested them by a screen reader, i.e. by user context simulation. More precisely, since our hypothesis on possible criteria as solution to the problems mentioned, some simple application examples has been built and then tested by a certain number of blind users (including one of the authors).
- *Systematic phase*. Lastly, the chosen criteria have been classified by a systematic way, according to usability definition, UI components and page elements involved.

The main aspects we found, which can be potential navigational problems by using a screen reader or magnifier, are the following:

- *Lack of context* – reading through the screen reader or a magnifier the user can loose the overall context of the current page and can read only small portions of texts. For example, skipping from link to link by tab key, a blind user reads on the display braille or hears from synthesizer the link text, but not what is written before and after (e.g. ".pdf", "more details", etc.). A similar effect occurs when using a magnifier: in a certain moment, only a small portion of enlarged text can be visualized on the screen.
- *Information overloading* – The portions of the page that are static (links, frames with banners, etc.), overload the reading through a screen reader, because the user

has to read every thing almost every time, thus slowing down the navigation. For instance, let consider the case in which the user wishes to send a sms message; after having filled in the form and sent it, he wants to read the success or failure response. Often that output message is visualized in some position in the page, among other content which, probably, is the same as in the page before sending it. So the user could spend a lot of time to find it because he has to read the information before the message, even if is still the same of the previous page. An appropriate frame and link number, a specific content marking, a more organized hierarchical structure of pages, can be possible solutions to this issue.

- *Excessive sequentiality in reading the information* – the command for navigating and reading can constrain the user to follow sequentially the content of a page. Thus, it is important to introduce mechanisms to ease the identification of precise parts in the page. An example is the result page generated by a search engine. Usually, in the top of such pages, there are several links, advertisements, the search fields and buttons, and so on, and then the search results begin. Furthermore, if the web pages contains more information blocks (e.g., paragraphs, short news, review lists, etc.), in order to read a specific block, the user has to read also the previous ones. A careful partitioning or structuring of the content could allow special users to find more quickly the desired information.

As result of this process 16 criteria have been identified grouped in three sub-sets.

To identify each criterion we use the format I.J.L where: I denotes the criterion kind, that is 1 for effectiveness, 2 for efficiency, or 3 for satisfaction; J is a progressive number to enumerate the criteria; L can be *a* (presentation) or *b* (dialogue) to indicate the aspect type to which the criterion acts. Moreover, the checkpoint associated to a certain criterion is identified by adding a forth index, thus obtaining expressions such as I.J.L.K, where the first part indicates the criterion to which the checkpoint is referred, and K numbers checkpoints for a same criterion.

Table 1. List of criteria classed according to the objects they affect

Objects	Criteria
Links	1.2.a, 2.1.b, 2.4.b, 2.5.b, 2.7.b, 2.8.b, 2.9.b, 3.1.b, 3.3.a
Frames	1.1.b, 1.4.b, 2.1.b, 2.2.b, 2.3.a, 2.8.b
Forms, buttons and fields	1.5.a, 2.4.b, 2.5.b, 2.6.a, 3.3.a
Pages	1.1.b, 1.3.a, 2.3.a, 2.8.b, 2.9.b, 3.1.a, 3.2.b
Sites	1.1.b, 1.3.a, 1.5.b, 2.7.b, 2.8.b, 3.1.b
Java scripts	1.4.b, 3.1.b, 3.3.a

3.2.1 Effectiveness Criteria

We consider a criterion belonging to the effectiveness sub-set if it is important to reach the user goal. This means that if it is not adopted then users could not be able to accomplish their tasks because they would encounter difficulties to identify important information.

1.1.b. Logical partition of information.

Use of markers or frames or headings to group texts, links, forms, etc. according to a logical division; e.g. frames "index", "search", "search results", etc.

1.2.a. Proper link text.
Singling out of texts that would barely be used in links. E.g., "click here", "download", "file.zip". We must warn the designer that such texts can make the site of scarce usability, because they are not very clear or they are too "poor".

1.3.a. Loading of proper style sheets.
Browsers can load specific sheets for different items using a particular tag (@media types). E.g., for braille display, braille printer, speech synthesiser, etc. This enables the definition of a style sheet for each requirement, thus improving the layout of web pages.

1.4.b. Messages and dynamic data management.
A remarkable difficulty that special user meet is represented by yielding of confirmation or error messages about accomplished operations, or by information extracted from a database and showed not properly, such as in the middle of the page, among a lot of other information and links. This actually forces users to spend some time and execute some commands of the screen reader before reaching and reading these messages, not to mention that they could even fail at all.

1.5.a. Terminological Consistency and layout.
Button features have a very important impact over the user: it is important that all the pages of the whole web site do not use different labels for buttons performing the same function (e.g. OK/Yes, quit/exit, next/forward), and that all pages have the same layout (e.g., dimension, form and colour). These two aspects have an important meaning both for users of screen readers with speech synthesiser or braille display, and for visually impaired users, who mainly rely upon dimension/colour references.

3.2.2 Efficiency Criteria

An efficiency criterion is a rule which allows users to find the desired information more quickly. We consider this rule less important then effectiveness, because if such criterion is not satisfied, users can still perform their task, although it may take more time.

2.1.b. Number of links and frames.
It is important that a page does not contain too many links and frames, this makes difficult for the user to skim through all them.

2.2.b. Proper name of the frames.
All frames should have a name and that the name should be a proper one. E.g., frames with names such as "top frame", "mid frame", "Left frame", are not helpful for the user. On the other hand, names such as "index", "search", "content", can make easier for the users to reach their goal, because of the possibility of skipping frames reduces the amount of information to read.

2.3.a. Location of the navigation bar.
The so-called navigation links (i.e. the links appearing on each page and enabling users to reach the main parts of the site) represent a source of delay and inefficiency for the screen reader user. Since such links appear on each page (and often even twice), the user who is forced to read the contents in an almost sequential way (by means of a speech synthesiser or a braille display) is every time compelled to skim them, without being able to interpret the contents of the current page. Helping in a more logical and organized development of

this aspect can increase navigation efficiency for these users. We need therefore to select criteria making navigation easier for people using a speech synthesiser (e.g., by graphic and/or text references or frames), and, on the other hand, for visually impaired people (e.g., by different colours and dimensions).

2.4.b. Importance levels of elements.
It is possible to assign different importance levels to buttons, fields and links, so that, one reaches at first the most important, and later the less important, regardless of their location on the page. This helps the user to find quickly the needed buttons and links. E.g., in the case of filling in a form, it would be useful to reach, by tab, first the compulsory fields and later on the optional ones.

2.5.b. Assignment of hot keys.
It is advisable to assign hot keys to the most important buttons, links and fields, so that the user is able to reach them quickly through a simple key combination. We classify this aspect among the "efficiency" criteria because it enables reaching an object more quickly, but we could also consider it within the "satisfaction" group, mainly for those users accustomed to using a lot of key combinations.

2.6.a. Proper formatting of forms.
In forms dealing with several groups of data, we must properly lay out group titles and fields to achieve greater clearness, e.g., simply by using the return tag in the proper place.

2.7.b. "Last update" section.
In sites dealing with frequent updating of information and/or new resources to download, we can help the user to find more rapidly the new elements by providing a specific section listing the new elements by date, sparing the user the trouble of going all over the site.

2.8.b. Indexing of contents.
In pages containing information of different kind (paragraphs, news, etc), we can help the user to find information more efficiently by indexing and pointing out the different blocks, so sparing the need of a page skimming.

2.9.b. Navigation links.
In order to reach more easily some location of the page (or of the site) we can insert local navigation links, referring to bookmarks in the ambit of the page (e.g., go to content, go to top, etc.).

3.2.3 Satisfaction Criteria

Satisfaction criteria help to produce a web site being more pleasant to navigate during the page visit or the site exploration.

3.1.b. Addition of a short sound.
Associating a short sound to different elements and in different multimedia environment, can make the user more "satisfied". E.g., associating each page with a short sound indicating when the loading of the page is completed, so sparing him the need of repetitive control of the state bar. Associating different sounds to different links makes easier to identify the link type during the skimming.

3.2.a. Colour of text and background.
This aspect can make easier the navigation of visually impaired people who, with a particular type of contrast, may feel less tired by navigation. It is therefore advised to avoid colour combinations giving a poor contrast.

3.3.a. Magnifying at passing by mouse.
The use of this feature can help people with a good visual residue to better focus the pointed object.

3.3 Criteria and Checkpoints

As mentioned above, for each criterion more checkpoints are proposed in order to indicate how it can be applied and to facilitate developer's task. A checkpoint is a specific fragment of code. While for a certain criterion only one checkpoint may exist, for another there could be several. More precisely, the criterion application can differ from web site implementation (e.g., usage of frames or not). By reason of space, we can not report all checkpoints for every criteria. In the table below two examples of criteria-checkpoints association are showed.

Table 2. Examples of checkpoints associated to criteria

Criteria	Check points	Code
C_{11b} Logical grouping of information	C_{11b1} Marking blocks	`<a title=”” > </a>`
	C_{11b2} Grouping by headings	`<h1> … </h1>` `<h2> … </h2>`
	C_{11b3} Grouping by frames	`<frame name=”” title=””`
C_{23a} Navigation bar identification	C_{23a1} Marking the begin and the end	`<a title="navigation begin"> </a>` `<a title="navigation end"> </a>`
	C_{23a2} Using iframe tag	`<IFRAME title="navlink" name="navlink" src="navlink.htm" width="" height="" frameborder="1"> </iframe>`
	C_{23a3} Using frame	`<FRAME name="navlink" src="navlink.htm" scrolling="no">`

In the example showed in the table we have indicated criteria and check points by using full notation $C_{i.j.l}$. As mentioned in 3.2, to identify every criterion we use the notation like I.J.L (where I denotes the criterion kind, J is a progressive number to enumerate the criteria and L can be *a* or *b),* and checkpoints associated to a certain criterion are marked with I.J.L.K (where K denotes checkpoint numbers for a same criterion).

4 Some Examples

In this section we want to show some examples of usability issues in accessible web sites detected when users interact through the screen reader Jaws. The examples shown in this section are taken from the web site of the Florence City Council. This web site provides information and services to citizens. We considered "The services" section, paying particular attention to the social security department. Moreover, this is the first empirical test in order to assess how developers deal with usability when developing accessible web sites and how the criteria are suitable to apply to an existing web site. For each example we show how the page is visualized on the screen, how that page is read by the screen reader before and after our suggested changes, and the code fragments involved. In the table showing how the web page is interpreted by the screen reader, the italic text with [1] indicates changes, while the italic text with [2] refers to the parts that are read by the synthesizer, but not visualized in the web page.

4.1 Significant Text: Names of Frames

An important issue of usability for special users who read the web pages by a screen reader is the text associated to links and name attribute of frames. The reason is that while exploring a page by a synthesizer or display braille, the user could not have a general view of the content. Therefore, if the name of frames or the text of links are significant, users can better orient themselves.

For instance, often the names of frames are like SX, DX, CENTRAL, MAIN, etc., and so they are not much meaningful. This is particularly important when users read by a screen reader. For a better usability the name of a frame is important for an easier understanding about both the page structure and the frame content. Usually this is not important, because the names of frames are not shown in the page visualized in the browser and so developers do not pay attention to them.

If we consider the web page in Fig.1 where services offered to people by city Council of Florence are listed. The structure of that page is composed of several frames which are not entirely visible.

In that page information and links to skip to other sections, are logically grouped in more nested frames. The picture shows how the page content is rendered on the screen. A screen reader reads that content in different way. In order to try to understand how the synthesizer or display braille considers the page, we provide a fragment of the web page text read by the synthesizer (see Fig. 2). As we can observe, the screen reader identifies clearly begin and end of every frame, thus the use of appropriate names is important.

As we can see in the figure, the screen reader distinguishes the frames of the page, and also their beginning and ending. Therefore it is useful to have significant names. Note that "main" frame is not very important, because it is actually used to contain the others.

Fig. 1. Page of web site of Florence's Council where services offered to citizens are listed (http://www.comune.fi.it/inglese/)

Main[1] *frame*[2] ***top***[1] *frame*[2] Florence's council web site *link*[2] italian version *link*[2] the mayor	***main***[1] *frame*[2] ***navigation bar***[1] *frame*[2] Florence's council web site *link*[2] italian version *link*[2] *the mayor*
… *link*[2] home ***top***[1] *frame end*[2] ***left***[1] *frame*[2] *link*[2] documents found *link*[2] immigrants	… *link*[2] home ***navigation bar***[1] *frame end*[2] ***navigation sub-bar***[1] *frame*[2] *link*[2] documents found *link*[2] immigrants
… ***left***[1] *frame end*[2] ***central***[1] *frame*[2] ... ***central***[1] *frame end*[2] ***bottom***[1] *frame*[2] search in our server *edit*[2]	… ***navigation sub-bar***[1] *frame end*[2] ***content***[1] *frame*[2] ... ***content***[1] *frame end*[2] ***search bar***[1] *frame*[2] search in our server *edit*[2]
button[2] search ***bottom***[1] *frame end*[2] ***main***[1] *frame end*[2]	*button*[2] search ***search bar***[1] *frame end*[2] ***main***[1] *frame end*[2]

Fig. 2. Fragment of web page content read by the screen reader: The left part shows the reading of the page before changes, and the right part after the changes

The user can read the content of the page in sequential way, or skipping directly to a certain frame. In fact, some screen readers (like Jaws), have special commands to list available frames, and to activate one of them. The user can choose one frame

access it. For instance, selecting “search bar”, the user accesses the search frame so that he is able to find the search field more quickly.

In order to show the code related to names of frames, we consider the fragment of the web page taken into account. The code of the page associated to “main” frame and to others is in the Fig. 3. In particular, we consider the FRAME tags: first of all, the presence of both NAME and TITLE attributes , then their content.

```
<html>…<frameset cols="*,750,*">
<frame name="main"[1] src="main3ing1.htm" title="main"[1]
frameborder="0"> <noframes>…</noframes> </frameset> </html>
```

```
<html>…<frameset rows="84,*">
<frame name="navigation bar" title="navigation bar"[1]
frameborder="0" scrolling="NO" noresize src="top5ing.htm">
```

```
<frameset rows="*,29" > <frame name="content" title="content"[1]
src="home3ing.htm" scrolling="yes" frameborder="0">
    <frame name="search bar" title="search bar"[1] scrolling="NO"
noresize src="bottom2ing.htm"
frameborder="0"><noframes>…</noframes> </frameset> </frameset>
</html>
```

Fig. 3. Code of web page at http://www.comune.fi.it/inglese/ (top), and at http://www.comune.fi.it/inglese/main3ing1.htm (bottom)

In order to evaluate the frame name we could use a dictionary in which the evaluator can store unsuitable terms, such as SX, DX, CENTRAL, MAIN, etc.. Using an external dictionary we can have two advantages: first, the evaluator can add new terms customizing the evaluation, second, there may exist different dictionaries for different languages.

4.2 Significant Text: Link Content

A similar problem occurs with links: links like “CLICK HERE”, “.PDF”, or “GO TO PARAGRAPH” are not very useful. Often the link text is referred to context so that if we consider links separately, we might not be able to understand the related content.

A user who cannot see the screen, many times uses the Tab key to search in the page the link wanted without reading the whole content. Another way to select a specific link is to use a particular command of the screen reader to open the link list. In both cases, the user reads only the text of the links, so a significant content is important.

In Fig. 4 an instance of this issue is showed. In the pictures there are the list of links associated to each topic belonging to an online guide organized in more paragraphs. There is one graphical link before every paragraph item. Since the links are images, the use of ALT is necessary. In the original version all links have the same text: ‘go to paragraph’. In the fixed version, the ALT attributes contain also the name of paragraph (e.g., ‘go to paragraph presentazione’).

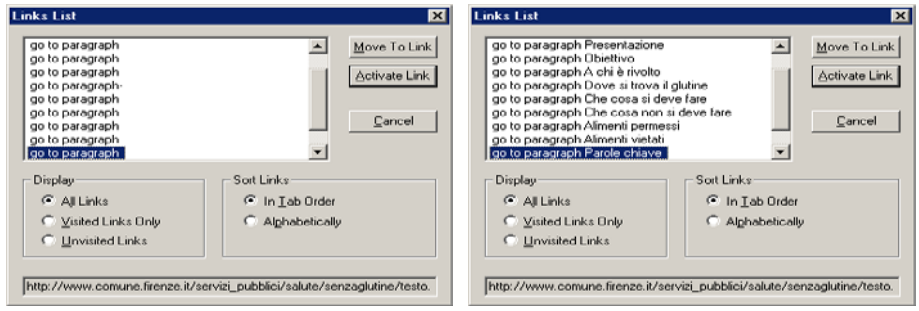

Fig. 4. List of links (produced by a specific screen reader command) available at http://www.comune.firenze.it/servizi_pubblici/salute/senzaglutine/.
On the left the original version, on the right the fixed version.

In order to improve the usability of links, we can suggest some solutions. First, for graphical links, we have to apply the alt attribute, putting a significant description which has to refer to the meaning of the link rather than describing the image in itself. Second, for textual links we can change the entire text, or we can use ALT or TITLE attributes. This second alternative may be used if developers do not want to modify the writings visualized on the screen. In fact, the text associated to alt or title is read by the screen reader, and it is visualized in the status bar by passing mouse over links.

Reading the web page by a screen reader, the original links are like '*link*[2] ***go to paragraph***[1]', while those modified are like '*link*[2] ***go to paragraph presentazione***[1]'. So, in the original page there are too many links with similar text, such as 'go to paragraph'. In presence of many links of this kind, if users skip from link to link by using the tab key or by a special command of the screen reader which gives a link list, they read similar texts without knowing the context to which they refer. Therefore, in order to know which is the appropriate link to choose the correct guide chapter, a user has to explore the page reading line by line.

In order to solve this problem, we should modify the text of the links by adding the name of the chapter to which the link points (e.g., presentazione, obiettivi, etc.) to 'go to paragraph'. This effect can be obtained changing the link text, or using the ALT and TITLE attributes. This second possibility, among other things, allows two rendering: one visual and one for the screen reader. In our example, the links are graphics, therefore we have to modify the alt and title attribute text: on the screen the links are still graphics, while the screen reader reads the text 'go to paragraph presentazione', etc.. So, for each link the evaluation has to check if the text is non-recommended. Similar to frames, we suppose there exist external dictionaries in which non-recommended terms are listed. The evaluation criterion extracts text of links - including ALT and TITLE value - and checks they do not belong to that terms.

5 Conclusions and Future Works

In recent years there has been an increasing interest in accessibility and usability issues, because it is more and more important that the information be easy reachable

from all. In this paper we have combined both concepts, and in particular we have considered usability for accessible web sites. Therefore we proposed criteria in order to improve user navigability, from potential usability problems encountered reading the web pages using special devices. We have identified 16 usability criteria for accessible web sites which we partitioned in three sub-set in according to usability aspects: effectiveness, efficiency and satisfaction. Proposed criteria can be used both in the design and the evaluation phase. Some examples that show how criteria can be applied and how they can be used to improve a site have been discussed. Since evaluating and repairing web sites by using the proposed criteria requires several efforts and a lot of time, a tool supporting this activity can be a valid help for evaluators and developers. Thus, we have started the implementation of a tool supporting the criteria introduced in the paper.

```
… <A target=content
href="http://www.comune.firenze.it/…/testo.htm#presentazione"> <IMG height=19
alt="go to paragraph Presentazione"[1] src="sommario_file/spunta2.gif" width=20
border=0></A> Presentazione <BR> <A target=content
href="http://www.comune.firenze.it/…/testo.htm#obiettivo"> <IMG
height=19 alt="go to paragraph Obiettivo"[1] src="sommario_file/spunta2.gif"
width=20 border=0></A> Obiettivo <br>
...
```

Fig. 5. HTML code of online guide web page; the piece of code corresponding to contents evaluated and already changed is in italic bolded

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