Improving Interaction via Screen Reader Using ARIA: An Example

Marina Buzzi, M. Claudia Buzzi
IIT-National Research Council
via Moruzzi 1
I-56124 Pisa, Italy
+39-050-3152632/1

{Marina,Claudia}.Buzzi@iit.cnr.it

Barbara Leporini
ISTI-National Research Council
via Moruzzi 1
I-56124 Pisa, Italy
+39-050-3152034

Barbara.Leporini@isti.cnr.it

Caterina Senette
IIT-National Research Council
via Moruzzi 1
I-56124 Pisa, Italy
+39-050-3152195

Caterina.Senette@iit.cnr.it

ABSTRACT

An interface conforming to W3C ARIA (Accessible Rich Internet Applications) suite would overcome many accessibility and usability problems that prevent disabled users from actively contributing to collaborative knowledge. In a previous phase of our study we first identified problems of interaction via screen reader with Wikipedia, then proposed an ARIA-based modified Wikipedia editing page. At this stage we only focused on the main content for editing/formatting purposes. To evaluate the effectiveness of an ARIA-based formatting toolbar, we only dealt with the main content of the Wikipedia editing page, not the navigation and footer sections. The next step using ARIA is to introduce landmarks (regions) and use the "flowto" property to be able to change the order of how page content is announced via screen reader. In this way the new user interface (UI) is functionally equivalent to the original Wikipedia editing page, and its appearance is very similar (apart from an additional combobox instead of a list of links), but usability is greatly enhanced. In this demo we will show interaction via Jaws screen reader using both the original and the proposed Wikipedia editing pages.

Categories and Subject Descriptors

H.5.2 [**Information Interfaces and Presentation**]: User Interfaces – *Graphical user interfaces (GUI)*. K.4.2 [**Social Issues**]: Assistive technologies for persons with disabilities.

General Terms

Design, Human Factors.

Keywords

Wikipedia, accessibility, usability, ARIA, blind.

1. WIKIPEDIA AND BLIND USERS

Web navigation is quite difficult for blind persons using a screen reader, since the pages are read sequentially, one row at a time according to the page code structure, starting from the top left corner of the page and losing all layout, style and font information

[2].

The Wikipedia editing page [3] presents three main usability issues for totally blind users, as described in greater detail in [1]:

1. The formatting toolbar may be difficult to access. Navigating via Tab key, the user never perceives the presence of a toolbar on the page since its graphic icons are generated by JavaScript, so the browser is unable to recognize them as active elements.

2. It is difficult to select special characters and symbols. To insert a special character, the user must select an alphabet from a combo-box, and on the right side, a list of links displays its characters. Since this list may contain more than one hundred links, it is not suitable for navigation via Tab key. More, Jaws does not recognize uncommon characters and announces ambiguous text. For instance Jaws announces "link a" for each character in the group à, á, À, Á.

3. The user may lose the focus when editing and formatting text. The focus is managed via JavaScript: when one or more words in the text area are selected, all related values are stored by the script in order to apply the formatting correctly. When interacting via screen reader a user may not understand how the focus is processed since the screen reader operates with a "virtual focus", which may not coincide with the system focus (see in [1] for further details).

2. The new Wikipedia editing page

The World Wide Web Consortium promotes accessibility on the Web through its Web Accessibility Initiative (WAI). Recently (Dec 2008) the WAI group has produced a new version of the Web Content Accessibility Guidelines - WCAG 2.0 [5], which greatly improves the 1.0 version, including usability as a key factor to be closely coupled with accessibility. Furthermore, usability aspects concerning navigation via screen reader (such as overview of the page, a different flow of the reading compared to the sequential announcing of the page source code, interface navigability) are provided by W3C Accessible Rich Internet Applications specification (ARIA). ARIA aims to make dynamic web content and applications (developed with Ajax, (X)HTML, JavaScript) more accessible to people with disabilities [4]. Using ARIA, web designers can specify roles to add semantic information to interface objects, can mark regions of the page so users can move rapidly around the page via keyboard, etc. [4].

To create the formatting toolbar using ARIA, we defined roles and properties as shown in Fig. 1. We used the *activedescendant* attribute in order to make the toolbar navigable via arrow keys when the editing modality is activated. Once the toolbar receives the focus via TAB key, the child elements -- i.e. each formatting widget -- can be accessed by left and right arrows, and can be activated by pressing the ENTER key, which applies the associated formatting function (Bold, Italics, etc.).

To avoid many links that make navigation difficult and can disorientate the blind user, we grouped characters from each group in a combobox located close to the first one, as shown in Fig. 1. Users first choose a 'language' and then select the desired character of that language. This compact solution is faster, since when navigating the combobox with arrow keys, the screen reader announces the character name directly while in the original interface every character read is preceded by the word 'link' (e.g. "Link è", "Link é" and so on). The latter modality is annoying, due to hearing the word "Link" over and over. Furthermore, the combobox can be skipped by just pressing the tab key once, while in the original interface it is necessary to run through all the links. We also associate a label with each character in the second combo-box, so the screen reader can announce this "clearer" description.

The focus problem is partially resolved by our new Wikipedia Editing Page. With Jaws English Version 9, the new interface allows users to insert and edit text without having to switch to navigation modality in order to find the active elements (widgets and comboboxes). The user activates the Editing modality and this remains for the entire editing/formatting process, reducing the number of steps needed to complete the entire task. Instead, with Jaws Italian Version 9 the focus is in the correct position but Jaws loses the editing modality.
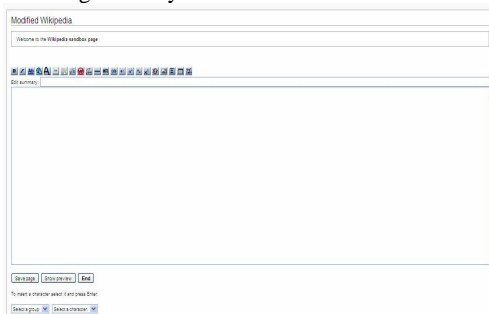

Figure 1. The new Wikipedia editing page

Different browsers may have different rendering and behaviors. The new Wikipedia editing page performs well with Mozilla Firefox v. 3.0.5, while at the moment, IE 7.0 does not interpret ARIA specification, which will be included in IE 8.

Once the prototype was tested and revised by the blind author of this paper, we conducted qualitative usability testing with a group of blind users who navigate via screen reader, in order to gather comments and suggestions and highlight any interaction problems. Our results show that it is possible to have a nice interface "look & feel" while assuring satisfaction and efficiency of use for all, and in particular for a blind user interacting via screen reader with a voice synthesizer. As an example, we chose Wikipedia to show that UIs interactions can be improved while maintaining a very similar graphic layout.

3. USABILITY TEST

A test description was sent to each participant in electronic format by e-mail. The test is accessible via web.

The protocol included a preliminary questionnaire, a set of tasks, and a post-test questionnaire:

1) In the preliminary questionnaire, participants provided information about their technical expertise, age, and knowledge of Wikipedia as well as of screen readers.

2) The remote testing procedure involved two simple tasks: (1) applying a formatting style, and (2) inserting a special character, to be completed on both the original and modified Wikipedia interfaces. We decided to perform a remote test in order to allow users to use their own computers and assistive technologies. The environment for executing the search tasks was available online at a specific URL and contained only a text box for the login (password was not required) and two buttons: one to the user interface reproducing the original Wikipedia Editing Page and the other to our Modified one.

3) The post-test questionnaire consisted of 16 questions divided into three sections: information regarding the subject's experience performing the assigned tasks, difficulties in carrying out the task, and degree of satisfaction.

The sample comprised 5 women and 10 men, age ranging from 18 to more than 75 years (only 1 person) as shown in Fig. 2.
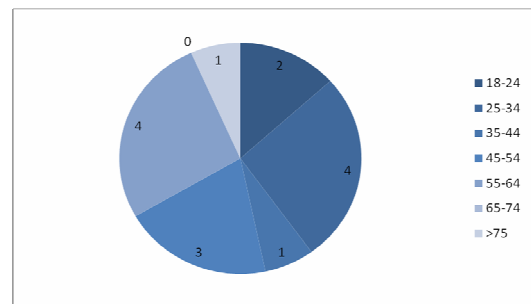

Figure 2. – User Age

Regarding Internet use, three subjects were novices, seven intermediate and five had experience. Only one of the users knew Wikipedia very well while five were fairly familiar, six mostly unfamiliar and three did not know it at all. Almost all the sample was using JAWS on Windows: six used v.8.0, four v. 9.0 (or higher) and five used v. 7.10 (or lower).

Preliminary data concerning test results of 15 totally blind users revealed that most users appreciated the simplified interaction; in particular 87% of users declare that applying a formatting style is more rapid in the modified UI (13% believe the 2 UIs are equivalent), and 73% declare that selecting of a special character is faster in the modified UI (20% users believe the two UIs are equivalent and for 7% original one is more rapid).

Concerning task performance, 80% of the sample completed the test in the modified UI respect to 47% on the original one; correctness of test results also improved: 33% for modified UI and 13% in the original one. Average execution time was decreased by 11% (from 7.1 min in the original UI to 6.3 min for the new one).

4. REFERENCES

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