The Paradigm of Meta-interface as a Facilitator of Websites Usability and Accessibility

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Abstract. This article aims to present an artifact based on a design paradigm called "meta interface", an interface for interfaces, as a useful mean of improving existing interfaces for the individual needs of various classes of users. As a proof of concept of this paradigm, a case study was implemented. It consisted in the development, implementation and application of a "Meta-interface" with the aim to provide better access for users with low vision. The results confirmed evidence of the feasibility of this paradigm and also generated evidences for its effectiveness in improving the usability and accessibility of websites.

Keywords: interface, accessibility, universal design, meta interface, usability.

1 Introduction

There are several design paradigms that aim to enhance the accessibility of websites, among them "the universal design" paradigm advocates that the design should be accessible to all classes of users, no matter what type limitations they might have.

This work presents an alternative to the "universal design". This alternative might even be called "individual design" paradigm, since it advocates that the design of websites should be thought to attend a specific class of users, in a highly optimized way.

However, the use of an "individual design" would limit the efficiency of the website usability and accessibility by users other than the ones within the class for which the website was designed. A practical solution would be the use of the concept of a meta-interface in way to provide a browsing experience individualized for each class of users, without the need to redesign or to create multiple designs of websites. This way, the users would be able chose an interface satisfactory to their needs without necessarily depending on the redesign of each webpage. The user would be able to tailor the browsing experience instead of tailoring the websites themselves.

To better understand the meaning of a meta-interface, it is first important to comprehend the concept of interface. Interface is a place where contact occurs between two entities [1]. This contact is established by how the interface is presented

A. Marcus (Ed.): DUXU 2014, Part II, LNCS 8518, pp. 81–91, 2014.

to the user. For example, the on / off switch of a lamp, may be presented in different forms, such as activation by pressure, by lever or by a rotary switch. The user will perform an appropriate action, depending on how the switch is presented. The action may respectively be to press the button, lift the lever or turn the switch.

This concept also applies to visual interfaces, used in websites. In this case, there are numerous ways in which these interfaces may be presented, due to the many functionalities presented to the users.

However, many of the design solutions created in visual interfaces enables greater access and comfort to certain groups, but at the same time may turn difficult or impossible the access by other specific group of users [3]. Examples may be seen at the interface of websites that use graphs, icons and symbols instead of text, and this can become restrictive for people with some degree of visual impairment.

One way around this problem is to make web sites "smarter" by using a meta-interface, which is an interface used to control, modify or interact with another interface. A meta-interface can also be understood as an interface to the interfaces, which aims to change the browsing experience of a specific class of users.

This article uses a case study to demonstrate a practical use of a "meta interface" that changed the browsing experience on generics web sites by an specific class of users.

To guide such demonstration, this article explains in section 2 the three types of interfaces used on websites, including the “meta interface”. Section 3 describes a case study of the use of a "meta interface” that tailors web sites to a color palette that favored an specific group of users who suffered from some degree of visual impairment, as referenced herein as low vision users.

Section 4 presents the findings of the case study along with the concluding remarks on the use of the concept of "meta interface."

1.1 Meta Interface

As previously mentioned, the user interacts with the contents of a system via a contact surface, the interface [2]. The interface (Figure 1) is provided with one or more windows and one or more controls. The windows serve as a means to output an specific contents, that may be visual or sound, and where the user will experiment this content. The controls serve as a means for the user to interact with the window content. McGuffin [2] assigns three types of control:

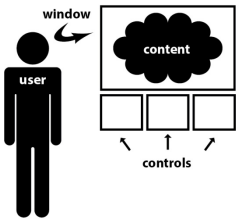

Fig. 1. Windows in a user interface

The control type 1 (Figure 2), acts directly on the content. In this case, controls that create, edit or modify contents fall into this category. An example of such control can be seen when the user presses the Google search button.

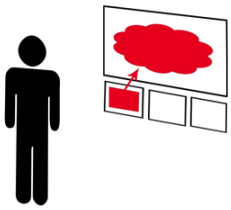

Fig. 2. Visual representation of the control type 1

The control type 2 (Figure 3), changes the way the content is viewed, experienced or presented. The change is not permanent, it is actually typically transient. This type of control changes temporarily the behavior of the user interface.

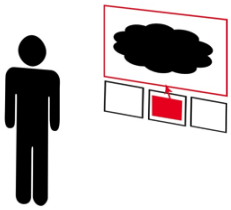

Fig. 3. Visual representation of the control Type 2

The control type 3 (Figure 4), are those that changes the configuration or the behavior of other windows control. Examples that fall into this category are commands that make other controls appear or disappear, or that alternate entry mode. These are strong changes in the behavior of the user interface. These are more profound changes than the ones with the control type 2.

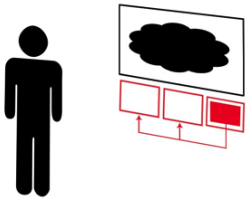

Fig. 4. Visual representation of the control Type 3

Once the control Type 3 operates on other controls, they might be called meta-commands, which leads us to the notion of a "meta-interface": an interface used to control, alter or otherwise interact with other interface.

A meta-interface is an instrument able to change or interact with other interfaces in different aspects such as color, controls, information organization, hierarchy of controls, as for example interfaces to select keyboard shortcuts, to change the color or "skin" of an application. Such changes may occur in varying degrees of pro-user activity. An example where the changes happen almost automatically are browsers for mobile operating systems, such as Internet Explorer and other natives browsers where the page content might be reorganized in a vertical way for example. Thus, a meta-interface works as a tool capable of interacting with system interfaces, to the degree of changing its purpose or even correcting possible errors.

One possible solution to implement this tool is using CSS (Cascade Style Sheets) for websites. CSS is a simple mechanism for adding style (eg fonts, colors, spacing) to web documents [6]. Since its introduction in 1996, it caused a positive impact in the process of designing web pages. Currently, most web pages use CSS, and many designers base their layouts entirely in CSS.

The following section presents a case study where CSS was used to implement a meta-interface that provides accessibility to a group of users through a customized browsing experience.

2 Case Study

The case study presented in this section target to address a problem of a particular type of user, the user with low vision.

In a more specific way, low vision is a serious vision loss that cannot be corrected by the use of conventional glasses, nor for medical or surgical treatment. The ability of a person with visual BV is situated between 20/40 and 20/200 after correction. The low vision includes problems such as dimming of vision, blurred vision, fog (film) on the eyes, vision only objects extremely close to or loss of distance vision, distorted vision, spots in front of vision, distortion color or color blindness, visual field defects, tunnel vision, loss of peripheral vision, abnormal sensitivity to light or glare and night blindness [3].

Despite having a profound vision loss, a person with low vision is not treated as blind, since this person is able to see enough to allow the execution of a task.

One technique to improve the way that these users experience digital systems is through the proper use of color in the interfaces [7].

This information was the key to understand that by creating an interface that would adapt the colors of the websites would possibly facilitate the viewing by users with low vision.

The following section presents the initial step towards building this interface, the generation of solution alternatives.

2.1 The Process of Generating Alternatives

The first step in creating the interface was to define the proper use of color combinations. The state of the art, in regards the guidelines for designing web sites

targeted for accessibility, is presented in the work of Kulpa [5]. Based on that, the color combination, with the chromatic patterns, was defined.

The following step was then to define the design of the interface that would allow the users to choose the best color scheme for displaying the web sites contents, or in other words, this interface would allow the identification and selection of standard color desired by users.

In order to create this interface, it was taken into consideration aspects to facilitate the inclusion of people with low vision. These aspects were the use of minimalist design, easy language, user control, consistency and easy recognition and memorization, and information with high contrast. The figure 5 below presents some initial alternatives to the interface.

This first alternative (Figure 5) would appear as home screen when starting the browser for the first time.

Fig. 5. Alternative 1

The instructional text on the left upper side of the screen: “selecione o padrão melhor visualizado”, which means, “chose the best visualized pattern”, appeared in blue (in typography Arial, body 48) on the black background of the meta-interface, for presenting a good contrast for reading.

To choose a color pattern the user should click on the preview picture that corresponds to the chosen scheme. In doing so, the home page would be loaded in the browser configured already in default color chosen by the user.

One of the problems with this alternative was that the pictures show the preview of how the web site would look like, contained information on very small size, making it difficult the reading by the user with low vision.

In option two, presented in the figure 6 below, showed the text (in typography Arial, body 48) in a white on a green background, presenting a contrast more subtle, and increased the size of the pages in frames preview.

However, this approach was still not appropriate since it was difficult to read by user with disabilities.

Fig. 6. Alternative 2

The alternative 3, showed in figure 39, present information from previews even larger than the alternative 2, in order to allow a better readability. However, another issue raised, these site previews represented only an illustration of how the color scheme may behave on sites, but did not allow the viewing of the real functionality of the site.

Fig. 7. Alternative 3

Different from the alternatives 1, 2 and 3, the fourth alternative, shown in figure 8, appeared as a bar above the browser on the web site to be accessed by the user.

The instructional text on the left upper side of the screen "selecione o padrão melhor visualizado", which means "chose the best visualized pattern", appeared in Arial body 30, in white color on a red background. In this alternative, the choice of the color scheme appeared as buttons located on the bar itself using the letter "A" as an example.

Still in the alternative 4, the buttons for selecting the desired color pattern did not faithfully represent all details of style sheets.

Another problem with this alternative was that the bar is located above the site accessed, covering part of the page content and thus impairing user navigation.

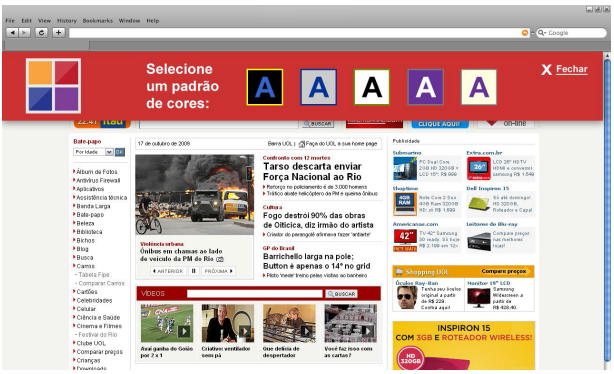

Fig. 8. Alternative 4

Fig. 9. Alternative 5

The alternative 5, shown on figure 9, presented the instructional text “clique nas setas” which means “click on the narrows” in white over a black background, providing a high contrast. In this alternative, the operation of the meta-interface would occur through the use of arrows (as instructed by the text) to switch color schemes.

Each color scheme would be represented by a number, ranging from 0 to 5, with "zero" the style of the original site. To select the desired style, the user would click on the confirmation button "OK" in the black operation bar. The operation bar would then be reduced in size, as it is showed in figure 10. The typography chosen texts is Arial, body 42 to "click the arrows" and 72 for numbers of style sheets. This choice is due to be a sans serif typography, which makes reading easier for users with vision difficulties.

In this alternative the bar would not be covering the site contents. Also, it the bar had a small contour line in white, between the meta-interface and the interface of the site, separating and highlighting where the bottom of the site to be accessed in black. The option for systems interaction "arrows and numbers" was more intuitive than buttons illustrative of alternative 4, since it makes possible the combination of style sheets with numerals, facilitating memorization and enabling keyboard shortcuts possible. For these reasons the alternative 5 was chosen to be implemented.

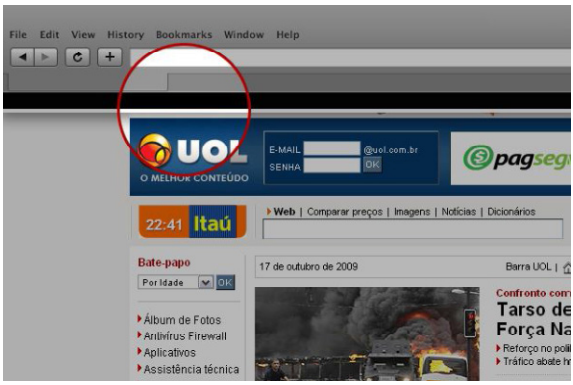

Fig. 10. Operation bar would then be reduced in size

The next step was then to see how the meta-interface would be evaluated by a group of real users, more specifically to understand if it would help these users to browse web sites. The next section provides a case study for this proposal, by conducting a usability test with users with low vision.

2.2 Tests

To evaluate the performance of the meta-interface, usability tests were performed with six low vision users. Five of the tests were conducted in the workplace of the participants, in the Pernambuco Association of the Blind (APEC). The idea was to test the meta-interface in the user customary environment, having the meta-interface operating in a context closer to the real [4]. One of the six tests was performed at the Laboratory of Intelligent Artifacts of the federal University of Pernambuco, due to the restrictions in the availability of the user.

Before the tests, some data from the participants were collected in order to understand some of the users characteristics, in particular, their degree of familiarity with the use of the internet. It was found that the participants sample had different characteristics, such as age and education, as well as different levels of internet experience. More specifically three of the participants had good experience in using the Internet, while the other 50% access rarely or were starting to learn how to use it.

The tests were performed individually in the user workplace, after the study participants had been previously made a brief explanation of the test. Users were instructed to perform a roadmap of activities that included to access a site of their choice or indicated by the observer, and then use the meta-interface to change the default color of the site in accordance with the best scheme displayed. After selection, the user should access any page link and return to the original color pattern site.

Participants took an average of 20 minutes to perform the tests without any difficulty during execution.

Four of the participants were sensitive to light and they were uncomfortable with the glare reflected from the monitor, which increased their navigation average time.

All the users perceive the presence of the meta-interface as soon as they opened a browser. They were able to type the address of the site they wanted to browse without any problem. When using the tool, the text instructed them to click the buttons, as shown in figure 11. By doing this action, they easily perceive the change in the interface of the website being accessed and they all understood how to operate the tool.

Fig. 11. Text of the meta-interface indicating the action of “click on the narrows”

Only two of the six users realized immediately that it was necessary to click on the confirmation button "OK", see figure 12, in order to the changes take place in the website. One participant took some time to understand the functionality of the “OK” button. All participants navigated through the site without any problem.

At first, all the users had difficulties in finding the operation bar when it was reduced in size, as it is showed in figure 10 previously showed in this document, once they changed the default color for the first time. However, after directing the mouse to the top of the site, they all perceived enhancement of the bar color change to a bright yellow, causing them to click to access it again, as in figure 13.

Fig. 12. Confirmation button

All participants understood the original color of the site was represented by the number "0". One user misunderstood the meta-interface icon, see figure 14, and tried to click on it as if it was a button.

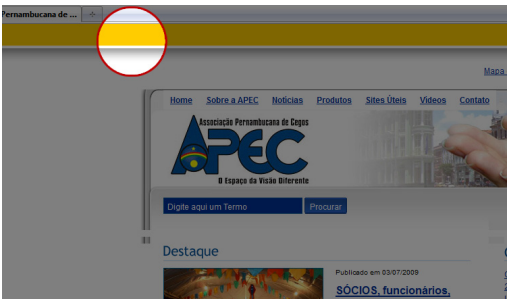

Fig. 13. Bar color changed to bright yellow

All users understood the functioning of the meta-interface and they all managed to read the information contained in it. Participants also agreed that the change in the color pattern of the site accessed helped them in reading the information in the site.

The default color # 1 (black background, light blue and yellow text link) was preferred by four of six participants, see figure 14.

Fig. 14. Color Pattern Number 1

In general, the participants were very pleased with the outcome of the meta-interface, especially because it facilitated their access to the web sites. Without the tool they would have more difficulties in trying to use the original interface.

3 Conclusion

As stated previously, a design based on “universal design” does not ensure that different groups will be able have all their specific needs addressed by a common interface. Moreover, it becomes almost impossible to teach principles of accessibility to all designers, and having them customizing all the web sites, or even make redesign and interventions in existing web sites.

One way around this problem is through the use of a meta-interface, which was explained earlier, that aims to be an interface for interfaces.

The case study presented in section 3 demonstrated that the application of meta-interfaces improved the browsing of web sites, in the case of users with low vision.

Thus, the study it was found that the application of the concept of meta-interface is able to promote better usability of digital devices through the modification of existing interfaces.

Although the object of the case study was accessibility, the concept of meta-interface can be applied whenever there is a need to adapt or to provide an individualized navigation to a specific class of users, without the need for multiple designs of websites.

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