

HF700: Foundations in Human Factors

Assignment One: Biological Factors

**Analysis of Selected WebLogic Commerce Server
Administration Tools Web Pages**

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Introduction

The BEA WebLogic Commerce Server Administration Tools home page (shown in Figure 1, attached) is a password-protected entry point into a number of Web-based administration tools and activities for both the Commerce and Personalization Server products. It is within these pages that designated users of a system can manage users/groups, portals, and various aspects of the ordering process. Since my documentation experience has focused on the Commerce Server tools, this paper will address the home page and a few of the Catalog Management and Order Management sub-pages. The Catalog Management Tools allow administrators to add, edit, delete, and hierarchically structure product items, while the Order Management Tools allow administrators to search and retrieve specific information about customers' orders. It is assumed that administrators have some experience using Web pages to set up and configure the various back-end components of an e-commerce site.

Critical Biological Factors

The biological factors critical to the present design of the Administration Tools Web pages are color, contrast, afterimage, and contour enhancement. This section contains a description of each, and identifies some issues with the present design.

Color

The designer of the Administration Tools Web pages is attempting to use color to help users navigate the Web site. For example, all Catalog Management pages (and the link to them from the home page) are green, while all Order Management pages are lavender. Because of the extreme colors associated with each option, it is likely that administrators can remember which tool they are working with. However, this is not all the design can or should communicate. Using color for this purpose is more harmful than it is beneficial, and does not ultimately match up with the needs of the users.

The primary purpose of the Administration Tools home page (and subsequent sub-pages) is to provide users with options, which they will search through to locate the one suitable to their task. Efficient searching requires that visual elements be arranged in a way that communicates how the elements relate to one another (Williams, 384). However, the variety of hues and high saturation levels used for options on the Administration Tools Web pages consistently undermine any clear structure for the tools or activities; each appears to have equal importance or power. This perceived equality occurs because of the way the lens in the eye works to focus incoming light on the retina. Depending upon a color's location on the visible light spectrum, the lens changes shape (curvature). Once the light is properly focused on the retina, the color sensitive cones can transmit this information to the brain, which then attempts to organize the information in a meaningful way (Physiological Principles). In the case of the overly colorful Administration Tools Web site, the lens must undergo constant adjustment to perceive the colors, fatiguing

the eye and concealing any structure that may be passed to the brain and unconsciously revealed. The eyes do not know where to look first, which is a critical component in achieving the user's main goal.

Because the human visual system is automatically programmed to seek structure in presented information, the use of color in the present design may prove frustrating for some users. Administrators do not immediately know that the colors used on the Administration Tools home page match up with the colors on the sub-pages; thus, they may attempt to infer meaning where there is little. As Williams notes, "Any arbitrary change in the visual characteristics of a display – a change in typestyle, ...a change in color... is very likely to be misinterpreted by the viewer as signaling something meaningful (388). Research has also shown that visual elements with similarities in attributes such as color will be interpreted as being related, even if they are not spatially located near one another (Williams, 386). It is therefore possible that administrators may feel that tools such as Order Management and Payment Management, or User Management and Portal Management are related in some way, due to their similarity in color and position.

Contrast

The contrast between the foreground and background colors used throughout the Administrative Tools Web pages can also be problematic. The use of white text on the black banners of the home page produces a high contrast that might hinder reading. Because white is an equal mixture of the three primary colors (red, green, and blue) and black is the absence of all three colors, viewing these extreme opposites together requires significant muscular activity from the eyes, and can quickly result in fatigue (Color Matters). In certain cases, this fatigue can also contribute to the appearance of afterimages (see *Afterimage*). On the sub-pages, the same problem is frequently encountered. Odds are that the variety of hues for the banner backgrounds and the consistent use of white as the text color will not always produce the most physiologically ideal contrast.

Similarly, because the color for the icons on the home page is consistently red and the background varies by the tool, this aspect of the design also lacks good contrast. The most serious example of this is in the case of the Portal Management tool, where the icon background is blue. First, the low number of cones that perceive the color blue (a mere 4% compared to the number that perceive red – 64%) makes it inherently difficult to see. Second, blue has the shortest wavelength on the visible light spectrum and is perceived by the cones on the periphery of the retina, while red has the longest wavelength and is perceived by the cones nearer to the center. As described in *Color*, aligning the retina to send a focused image to the brain requires the lenses in the eyes to change curvature based on the color's wavelength. Moreover, different cones must be utilized to interpret and make sense of the reflected light. In this case, the user's eye must simultaneously perform two different kinds of focusing, which again results in eye fatigue (Tutorial, Physiological Principles).

Afterimage

As seen in Figures 1 and 2, each tool or activity that administrative users can perform is shown in a banner. Each banner contains highly saturated colors and a button-shaped icon toward the end. Depending upon which side of the page the banner is on, a piece (seemingly in the shape of the button) is cut out. Together, the color and beginning/end shapes of each banner create a strong pattern that produces an afterimage of buttons down the center of the screen (this is more noticeably seen on a monitor than on the printout).

Afterimage results from prolonged stimulation of the photoreceptors in the retina, which receive and respond to incoming light. Such over-stimulation of the photoreceptors causes them to become desensitized, even for a user who fixates on the screen for only a short period of time. The design issues discussed in the sections on *Color* and *Contrast* combine to place this high and continuous level of stimulation on the eye. When the user then looks to a blank area of the screen (in this case, the center where there is just white), the cells that were over-stimulated have difficulty responding to the new light input; cells that were the least desensitized respond more strongly, thereby producing the afterimage ([IllusionWorks](#), [Exploratorium](#)).

Contour Enhancement

The existing design of both the Administration Tools home page and the Catalog/Order Management tool sub-pages utilizes a number of small images. Depending upon which page the user views, the image is either used to identify the tool (for example, a book for Catalog Management – see Figure 3) or to describe the activity the user is currently performing (for example, the hand-held tools in editing categories – see Figure 4). While this inconsistency and the appropriateness of each image are usability issues that will not be discussed here, the level of detail (or contour enhancement factor) for each image is important. One of the first activities in human visual perception with regard to image/object recognition is focus the eye at the most informative, outer areas of the image in an attempt to locate a recognizable pattern ([BMV](#)). Such “edges” must be created by a noticeable difference in both hue and brightness (contrast), but are really all humans need to detect change ([HCI, Physiological Principles](#)). This perceptual phenomenon is beneficial for a number of reasons. First, this discerning of patterns occurs unconsciously, protecting our brains from information overload. Second, it allows our conscious mind to focus on matching the pattern with an image/object stored in our memory (internal classification system) and to associate meaning(s) to it. Recognition and identification of objects in this distributed way is extremely efficient and allows human beings to manage the level of detail present in our world ([Cooper, 41-43](#)).

In light of this research regarding contour enhancement and the human visual processing system, the simple outlines of the people (users), computer monitor, book, and hammer/ruler images used throughout the Administration Tools Web pages provide just enough information to identify the objects shown. However, it is uncertain whether the image for Order Management would be easily identifiable. Another area of concern (for the home page only) is whether or not the user would be able to identify the icons as buttons that can be clicked with the mouse. A button-like image has certain features that allow users to recognize that it can be pressed (clicked), but it is doubtful that

this expectation is set given the flatness of the images used. The varying levels of success in image recognition for this simple site illustrate how the biological factor of contour enhancement can prove a delicate balancing act for designers.

Suggestions for Improvement

Based on the information presented in the previous discussion, this section elaborates on the negative effects of the present design while making a business case for change, provides suggestions for improving the BEA WebLogic Commerce Server Administration Tools Web pages, and describes some potential benefits of making these modifications.

Business Case

Although a few design flaws regarding the biological factors of color, contrast, afterimage, and contour enhancement might be categorized as “tolerable”, it is clear that in the Administration Tools Web site, the four factors work together to produce a seriously confusing and extremely fatiguing user experience. Although the ideal situation would allow for quick selection, it is likely that the present design will impair an administrator’s ability to locate the proper tool/activity, decreasing the administrator’s overall efficiency. It is true that looking away from the screen periodically can reduce eye fatigue and will eventually eliminate afterimages, but these biological factors have serious implications for the usability of the Administration Tools Web pages and the e-commerce Web sites that rely upon them. If administrators are required to look away from the screen on a regular basis because of eyestrain, they may frequently lose their place and are not likely to be very productive. A brief period of eyestrain may not seem like a serious problem, but continuous refocusing of the lens due to poor color choices (especially on pages where a significant amount of time is spent, such as the Catalog Management Tools) can have serious medical repercussions. Perhaps most importantly, the extreme eye fatigue experienced by an administrator can cause them to lose focus on their task and thus increase the probability of error. In a worst case scenario, the consequence of such errors might be data loss that directly affects the information or interaction customers have on the dependent Web site(s). Without question, any disruption in service or unpleasant experience in an e-business situation is critical and could negatively impact the company’s bottom line. Together, these factors can also result in decreased product satisfaction and negatively affect sales.

Resolving Issues of Color, Contrast, and Afterimage

Figure 6 (a paper prototype) illustrates how some of the issues regarding color, contrast, and afterimage might easily be rectified. First, the reversed white text on black or other intensely colored banner backgrounds can be eliminated. On the home page, the management tools are grouped into the Personalization and Commerce Server products, and labeled in a second level header font (black, approximately 14 pt.). Keeping with the original designer’s idea that color can be used as a signal, the Personalization Server tools are also grouped together on a shaded background that

is different from the one used for the Commerce Server tools. Within each group, the specific tool titles should be in a third level header font (black, approximately 12 pt.) and alphabetized to aid in searching. The background color for the icons in each category can be a neutral white, while the icon foreground can either be an entirely different color with appropriate contrast or a slightly higher saturation of the color used for the shaded background (see examples below). Additionally, the icons for each tool should be different from one another, appropriately chosen, detailed, and shadowed to produce a button-like appearance (see *Contour Enhancement*).



On sub-pages, the theme may be continued in a variety of ways, possibly by making the tool title the level one heading, including a non button-like version of its icon nearby, and following through by making the tool's activities header level two.

Resolving Issues of Contour Enhancement

This author believes that for the most part, the images throughout the pages are well designed (though perhaps inappropriately selected). However, for some images described in *Critical Biological Factors*, the recommendation would be to add (rather than remove) detail to ensure that users can quickly identify the object being represented and that the correct expectations for interaction with the icons are set.

Benefits of Redesign

Since the issues of color, contrast, and afterimage are closely related, the simple modifications described here will simultaneously eliminate a number of difficulties in the design. First, the signals produced by the size of the headings, the subtly colored backgrounds, and “just noticeable difference” in the icons will help guide the user's eyes to the appropriate sections of the screen. The size of the heading text – coupled with adequate white space between items – provides users with enough information to determine the structure/hierarchy of the Administration Tools home page, and is more beneficial than varying multiple visual attributes (Williams, 390). As noted in the design guidelines at Human Factors International, the use of a limited number of colors can help speed up search tasks (HFI). Increased effectiveness in completing search tasks will reduce the number of navigation errors, and instill the users with confidence. Furthermore, the decrease in color saturation throughout the site will help minimize eye fatigue for both short and long-term users, while eliminating decorative aspects (gradients) on the home page that provided little value to the overall design. Next, this redesign will eliminate the afterimage produced, reducing fatigue, increasing attentiveness, and reducing potentially costly errors. Lastly, modification in the area of contour enhancement will most likely allow both first-time and repeat administrative users to identify the areas relevant to their activities more quickly, and consequently, increase both productivity and user satisfaction. In sum, the suggestions provided here will create a more successful, efficient, and attentive user of the Administration Tools that will most likely have a better overall impression of the product.

Conclusion

Undoubtedly, many Web sites will have a number of biological factors for designers to consider. These may occur on the visual, auditory, and/or tactile areas of perception, depending upon the case being studied. For Web sites such as the Commerce Server Administration Tools, certain aspects of the visual sensory system are likely to be the most important areas for discussion. With the fast-paced time-to-market for many technology companies (such as BEA Systems), it is unlikely that all factors affecting the design can be evaluated or modified. It is therefore important that human factors professionals identify the most critical factors, provide specific advice on how these areas can be improved, and explain how such modifications can directly improve the company's product and bottom-line. It is this author's hope that this paper is a starting point for evaluation and a catalyst for better design.

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