

Effects of Color and Gender on the Perceived Attractiveness of Websites

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INTRODUCTION

As the World Wide Web continues to grow in popularity, currently estimated to exceed 1.2 billion users (Nielsen 2005), websites have become core extensions of a business practice rather than a consideration of a new channel (Ravi 2005). Companies seek new insights on how to create more effective websites and entice online customers. Extensive literature exists on the acceptance of a new technology, but the former has centered on utility-related dimensions that drive this acceptance. Limited research exists on the hedonic dimensions of HCI and their relevance to usability and an even smaller set of this research is empirical in nature (Zhang and Li 2005). Furthermore, it appears that there are gender differences regarding perceptions of attractiveness, usability, and the consequent affective state of satisfaction, in website design. However, more research is needed to understand the nature of such differences as in most past studies there were many confounded design variables. Thus, this research-in-progress aims to address the above gap by studying the effects of color and gender on the perceived attractiveness of websites.

LITERATURE REVIEW

Hedonic Effects of Color

Hedonic, derived from Greek where "hedonism" means pleasure, dimensions include factors such as color, graphics, animation and other design elements that either implicitly or explicitly cause an affective state of pleasure. Zhang and Li (2005) argue that the more pleasing or attractive a website is, the easier it will be for the individual to learn how to use it and the more likely that this individual will continue to use it. Past studies have primarily looked at website design as the aggregate product of these hedonic dimensions and the users' consequent affect. However, a closer look at the impact of each hedonic dimension on affect is warranted.

Empirical studies on the impact of color on the perceived attractiveness and usability of websites are extremely limited. Most studies focus on the role that aesthetics play in usability and treat color in an overly subjective and qualitative manner. However, based on the limited number of empirical studies on the subject, it appears that color (and more specifically color combinations and schemes) have a significant effect on the perceived attractiveness and aesthetic appeal of a website. Brady and Philips (2003) suggested that users found a site with a Triadic color scheme more usable and more aesthetically pleasing than a site with a non-standard color scheme. Their study was limited by its design in that it did not differentiate the users' perceptions of usability and attractiveness between the variables of color and balance, both of which make up *visual balance*. Papachristos et al. (2005) suggested that color combinations and schemes resonate with users in a particularly emotional manner. Their research shows that users tend to predictably attach specific emotional descriptors, such as fresh, modern, friendly, and aggressive, to specific color schemes and color combinations. Results of their research further suggested that the design attribute with the strongest effect on the website's perceived attractiveness is the *brightness* of the dominant color, followed by the *brightness* of the secondary color and its type (warm or cold), the *number of colors*, and the *contrast* between hues.

Based on the limited past empirical research, it is plausible to suggest that color, color schemes, and color combinations are variables dependant on other areas of design such as balance and contrast. It is also possible to suggest, based on the work by Papachristos et al. (2005) that the perceived "temperature" of a

color impacts a website's perceived usability and aesthetics. Thus, the following hypothesis is proposed for this study:

H1. There will be differences between designs in relation to users' perceptions of the website attractiveness for each color combination.

Gender Differences in Hedonic Effects

Effects of web design on affect have also been studied in the context of the users' gender. While most studies explored gender differences for credibility, trust, and satisfaction with websites, a few studies focused on the relationship between gender and perceived attractiveness of websites. In the realm of visual design, men had more favorable impressions of how product information was presented. Women were more attracted by the colors on the site, and men by animations and the interactive, 'flashy' aspects of the site (Cyr & Bonanni, 2005). Simon (2001) found that women preferred sites that were less cluttered, having few graphics, as well as sites that avoid multiple levels of sub-pages to drill through. Men liked sites that used extensive graphics and animation. Additionally, in a study of gender and Web usage among college students, significant gender differences emerged with respect to evaluative criteria and use patterns, with men liking some of the "bells and whistles" and women using academic Web sites more (Mitra et al, 2005).

It appears that there are gender differences regarding perceptions of attractiveness, usability, and the consequent affective state of satisfaction, in website design, but more research is needed to understand the nature of such differences. As with past studies on hedonic dimensions and usability/acceptance, gender differences were explored in terms of website designs as an aggregate of multiple design elements instead of a more controlled design regarding these aesthetic factors. Thus, the following hypothesis is proposed for this study:

H2. There will be differences between men and women in relation to their perceptions of website attractiveness for each color combination

METHODOLOGY

This study employs a 2 x 2 research design, where color is manipulated on two levels: warmth and scheme. Specifically, two sets of colors are selected from the color wheel, each being categorized as either "warm" or "cold." Color scheme indicates whether a warm color, for instance, is selected as the primary or secondary color choice for the particular website design. Implementation of this design resulted in the following four treatments or color combinations for the test website: i) Warm Primary – Warm Secondary (i.e. Red – Orange); ii) Warm Primary – Cold Secondary (i.e. Red – Light Blue); iii) Cold Primary – Warm Secondary (i.e. Blue – Orange); and iv) Cold Primary – Cold Secondary (i.e. Blue – Light Blue). All other design elements (e.g. text, images, background) were held constant across the four designs.

Tasks invoked participants to browse through the website in search of specific information. Participants were informed that the tasks were only meant to offer them an opportunity to explore the website and its design, instead of measuring their performance with it. Having evaluated the website design randomly assigned to them, participants were then asked to rank four different website designs in terms of perceived attractiveness.

A Structural Equations Modeling (SEM) technique, Partial Least Squares (PLS), is used in testing the validity of both the structural and measurement model. Data analysis will speak to the two aforementioned hypotheses, but also on any interaction effects between color and gender on the perceived attractiveness of websites.

A total of 130 subjects were recruited for this web-based voluntary study via email announcements on various databases and listserv. All participants used the same website, but each treatment involved the use of a discriminant color design described above. The minimum sample size for the selected method, PLS, is 10 times the number of the most complex construct. In this study endogenous constructs consist of five items, thus our sample size far exceeded the needed 50 cases. The sample exhibited an even split between males and females, an average age of 39, was entirely college-educated, 84% described themselves as Caucasian/White, and had an average experience of 18 years with computers and 11 years with the World Wide Web respectively. ANOVA tests found no significant differences for subjects in the various treatment groups in terms of these control variables, thereby ensuring the successful randomization of assignment across groups.

Two scales developed by Lavie and Tractinsky (2000) were used to measure the users' perceived attractiveness of websites through assessments of "classical aesthetics" and "expressive aesthetics." These 7-point Likert scales (anchored "Strongly Disagree/Agree") measured responses to the shared question "My perception of this website is that it is..." for each of the following items: Clean, Clear, Symmetric, Aesthetic, and Pleasant for "Classical Aesthetics", and Original, Creative, Fascinating, Sophisticated, and Uses Special Effects for "Expressive Aesthetics".

RESULTS

An item is significant if its factor loading is greater than 0.5 to ensure construct validity. Adherence to this criterion required the modification of the Classical Aesthetics scale by removing two items (i.e. Clear and Symmetrical). Each item was then re-validated by testing its item-to-total correlation measure, where all items had higher measures than the 0.35 threshold and finally reported in Table 1. It should be noted that the loading for Clean was 0.673 before the removal of the other items.

Results of tests for convergent, discriminant, and construct validity can be found in Table 2. Both constructs had adequate reliability and internal consistency well above the 0.7 threshold. Cronbach α -values were satisfactory for our two constructs and constructs' AVE exceeded the 0.5 benchmark for convergent validity. The square root of the variance shared between a construct and its items was greater than the correlations between the construct and any other construct in the model suggesting discriminant validity. Discriminant validity was confirmed by verifying that all items load highly on their corresponding factors and load lowly on other factors.

The structural model tested using PLS demonstrated mixed explanatory power for perceived attractiveness of websites. With an R-square of 0.43, 43% of the

variance in Expressive Aesthetics was explained by the color manipulation in this study. Only 3.2% of the variance for Classical Aesthetics was explained by this manipulation, suggesting that there are other dimensions not captured by the scale (in part explained after the removal of two items) and/or by the exogenous construct's effects.

From the two hypotheses, only the effects of color manipulation were supported. Both paths from Site Design to Classical Aesthetics and Expressive Aesthetics were significant to the 0.05 level ($t=2.149$ and $t=2.484$ respectively). Gender was not shown to have a significant effect on either Aesthetic construct.

The last measurement pertains to the ranking of the different website designs. Regardless of which website a participant was first exposed to, the ranking was not significantly affected. Rankings were significantly different (one-sample T-test) suggesting a preference for "blues" or the cold-cold color design (see Table 3).

DISCUSSION

The findings of the present study support and extend prior research regarding the effect of color combinations on aesthetics (Brady and Philips, 2003; Papachristos

Table 2. Validity test results

<i>ITEMS</i>	Classical Aesthetics	Expressive Aesthetics
Clean	0.590	-0.036
Aesthetic	0.887	0.025
Pleasant	0.914	-0.003
Original	-0.026	0.834
Sophisticated	0.094	0.829
Fascinating	0.010	0.875
Creative	-0.029	0.857
Uses special effects	-0.081	0.738
CORRELATIONS		
Classical Aesthetics	1	
Expressive Aesthetics	0.629	1
Internal Consistency	0.976	0.995
AVE - Convergent Validity	0.932	0.974
Discriminant Validity	0.966	0.987

Table 1. Item and construct statistics

	Mean	Std. Dev	Loading	Error	Item-Total Correlation	Alpha	Alpha if Item deleted
Classical Aesthetics	5.490	1.403				0.731	0.726
Clean	5.880	1.076	0.590	0.060	0.350		0.852
Aesthetic	5.200	1.308	0.887	0.043	0.625		0.555
Pleasant	5.380	1.157	0.914	0.041	0.729		
Expressive Aesthetics	3.082	2.003				0.885	0.885
Original	3.180	1.451	0.834	0.018	0.731		0.858
Sophisticated	3.830	1.490	0.829	0.020	0.698		0.866
Fascinating	2.850	1.393	0.875	0.017	0.789		0.844
Creative	3.200	1.422	0.857	0.018	0.771		0.848
Uses special effects	2.34	1.315	0.738	0.020	0.625		0.881

Table 3. Site rankings and one-sample comparison of means

Site Design Primary-Secondary	N	Mean	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Warm-Warm	130	3.35	1.041	0.091	36.74308	129	3.42268E-70
Warm-Cold	130	2.62	0.848	0.074	35.16415	129	5.93432E-68
Cold-Warm	130	2.41	0.912	0.08	30.08714	129	3.66714E-60
Cold-Cold	130	1.68	0.998	0.088	19.16219	129	1.49208E-39

et al., 2005). The triadic color schemes that utilized a cold primary color (blue) for the top or global part of the page and then used either another cold color (medium blue) or a warm color (orange) for the secondary page components provided the balance that users found most aesthetically pleasing. In contrast, the site that combined both a warm primary color (red) and a warm secondary color (orange) was the least preferred site, likely because the color pairing did not balance out the rest of the page. Additionally, research has shown that the cool blue color schemes are associated with higher perceived credibility and trust levels, which would be important for a travel booking website (Fogg et. al, 2001; Lee & See, 2004; Zhang & Li, 2005). The current results suggest that designers need to carefully consider color choice as the combinations will convey information about the quality of the site that may not be intended.

While other research has found gender effects in several computer-related contexts (Cyr & Bonanni, 2005; Simon, 2001), the current study did not indicate that gender impacted perceived website attractiveness. However, the small sample size may have been a factor, and the effect may be revealed as more responses are obtained. Similarly, women tend to employ more exhaustive information processing strategies than men do, which means that gender differences may have been masked by the lack of detailed content in the prototype website; the content was not as extensive as users expected from a travel website. We plan to expand and hone the website content to create a more realistic level of detail on each page, as well as having more content pages, which would enable users to better assess perceived usability within the context of the multiple color schemes. Additionally, future research efforts will seek to broaden the focus to assess the influence of culture on perceived website attractiveness and usability through a global multi-country study.

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