Website gender perceptions: Effects and recommendations for gender inclusivity

by

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DEDICATION

I would like to dedicate this thesis to four wonderful groups of people. First, to Deidra and Andrew – you always made sure to listen when I lectured on "the plight". Your interest in my work is worth more to me than I could ever show. Second, to the driven and talented women in science, engineering, and the arts – you gave me the courage to flourish. Third, to my mother and father for having patience with me when they probably shouldn't have – thank you. Finally, to every reader who makes it to the end of this document, I commend you – it's a long one.

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ABSTRACT

This paper examines the interactions of design elements and perceptions of a website's gender as well as the effects of perceived gender on aspects of user experience. Designing for a particular gender is common in both product and web design, but in many situations is exclusionary. While imparting gender onto a product is often intentional, gender bias in websites largely is not. The unintentional gender bias in websites is created through a combination of internalized biases, biased tools, and culture. This work lays the foundation for understanding how websites become gendered as well as the effects of gendering on users' perceptions of websites through two studies.

The first study examines the masculinity and femininity of the web design elements Font, Color, Shape, Texture, Image, and Mixed Elements. Some element examples were found to be strongly feminine or masculine, while others were neutral. A strong positive correlation between masculinity and professionalism was also observed for three of the elements. The second study applied the results of the first study to a web design task through the creation of feminine, gender neutral, and masculine websites. The results showed that websites were perceived as having a gender and that the perceived gender of the websites effected the website's professionalism, workload, usability, likability and visual appeal. Neutral websites were preferred and found to be the most professional, usable, likable, and visually appealing. In contrast, feminine websites were the least usable, least professional, and the least visually appealing. There was a strong positive correlation between masculinity and professionalism but a strong negative correlation between femininity and professionalism. Similar correlations were observed for usability, likability, and visual

appeal. Together, these two studies inform considerations and recommendations for the design of gender inclusive websites.

CHAPTER 1: INTRODUCTION

The objective of this work is to study the interactions of perceived gender and web design. It aims to understand the implications that design choices have on perceptions of gender, professionalism, usability, and workload, and also provide recommendations for designing gender inclusive websites.

Focus Area

Gendered design is the process of deliberately choosing design elements to evoke a response from a particular gender (van Tilburg, Lieven, & Hermann, 2015). The association of a design element with a gender is largely learned through socialization and may vary with cultural identity (van Tilburg et al, 2015). In many contexts such as product design (Ehrnberger, Räsänen, Ilstedt, 2012), web design (Moss & Gunn, 2007), and computing (Friedman & Nissenbaum, 1996) gendered design is considered biased and exclusionary.

A walk through the aisles of a drugstore makes the prevalence of gendered design immediately apparent. This tactic is used because consumers' product preferences often fall along gender lines (van Tilburg et al., 2015; Xue & Yen, 2007; Fugate & Phillips, 2010, Ehrnberger et al., 2012). Products "acquire" gender through aesthetics and design choices; which results in guidelines for creating "strongly gendered products" (van Tilburg et al., 2015). However, while consumers responded favorably to strongly gendered products, it was strongly androgynous (employing strong masculine and strong feminine traits) products that consumers responded to most favorably (van Tilburg et al., 2015). While the use of gendered design may be preferred by marketers where a product is used in an outward expression of gender (van Tilburg et al., 2015; Xue & Yen, 2007), it is also inherently exclusionary

(Ehrnberger et al., 2012). For example, in 2012 when a popular pen company created a series of pens “for Her”, there was severe backlash from both men and women (Vinjamuri, 2012). The strong gendering of such a universal product was perceived as inappropriate.

The exclusionary nature of gendered design is especially apparent in the fields of interface and web design. Significant study has been given to the bias toward masculinity in these fields (Huff & Cooper, 1987; Moss, Gunn, & Heller, 2006; Horvath, Moss, Gunn & Vass, 2007; Moss & Gunn, 2007). For example, when groups of designers were asked to create computer programs for 7th grade boys, 7th grade girls, and a general class of 7th graders, the resulting “general” program was strikingly similar in design to the one for boys and shared few design elements with the program for girls (Huff & Cooper, 1987). These biases are explained by the notion that the “average” user will be male unless otherwise specified (Friedman & Nissenbaum, 1996). This bias should be familiar to those experienced in user centered design as a common design pitfall is assuming the user is very similar to the designer. The notion that designers unintentionally design for themselves is further explained in a study of 60 personal websites at Oxford University. The study illustrated that men and women design differently in areas of language, color, typography, and form. Websites designed by men were more appealing to men, and websites designed by women were more appealing to women (Moss et al., 2006). Website appeal may be maximized if the design “mirrors” the target population (Tuch, Bargas-Avila, & Opwis, 2010). The tendency to design with one’s own gender in mind combined with imbalance favoring men in the field (only 19-22% of IT professionals are women) compounds the problem of bias in web design (Horvath & Moss, 2007). This imbalance is perpetuated in part by the ways in which professionalism is perceived in the workplace. In a traditionally male field, women must

exhibit masculine traits in order to be hired or taken seriously – femininity is perceived as less professional (Forsythe, 1990).

The biases in web design also extend to the software used to create websites. In an analysis of 3,682 website templates across nine design packages, it was found that, using the default elements associated with each template, 84% were masculine in form (line and shape), 99.6% were masculine in color, and 99.8% were masculine in typography (Horvath et al., 2007). The exclusionary nature of gendered design is the driving force behind gaining a better understanding of website gender and developing gender inclusive design guidelines.

The challenge in creating gender neutral website designs is threefold: the majority of web designers are men, the software used to design websites points designers toward masculine design, and the user of the website is assumed to be a man. This vertical and horizontal male bias (software designed by and for an audience of men) creates a "masculine computer culture" which produces a "masculine discourse" within the field of web design (Robertson & Newell, 2004).

Given the bias that gendered design creates, there has begun to be more consideration for the use of gender neutral design strategies in computer systems (Friedman & Nissenbaum, 1996) and web design (Moss & Gunn, 2007; Fugate & Phillips, 2010). In fact, it has been suggested that "freedom from bias should be counted among the select set of criteria—including reliability, accuracy, and efficiency— according to which the quality of systems in use in society should be judged." (Friedman & Nissenbaum, 1996, pp.345-346). However, guidelines for gender neutral web design have yet to be set forth. Where 19-22% of website designers are women, but 51% of web browsers are women (Horvath et al., 2007), this is a gap in design knowledge.

Benefit

The goal of this work is to develop a better understanding of how websites become gendered, as well as how website gender effects users' perceptions of websites. The intersection of gender and professionalism in design is also examined which begins to shed light on potential biases due to users' perceptions of masculinity and femininity. The effects of website gender on workload and usability are examined to further inform designers on factors affecting the reception of their websites. Finally, recommendations for designing gender inclusive websites will be set forth.

Thesis Overview

This thesis contains two studies which focus on the interaction between gender and design with a goal of creating recommendations for gender neutral design strategies. The first study examined how examples of design elements are gendered while the second study put the elements into the context of a website. The first study (Gender and Professionalism of Web Design Elements), focuses on determining the gender associated with examples of web design elements as well as the professionalism of those element examples. For the purpose of this study, design elements considered are Color, Font, Shape, Texture, Image, and Mixed Elements (2 or more elements combined). Element examples are specific types of each element (such as the Font, Times New Roman). The questions that Study 1 will answer are: Are web design elements gendered? Are elements distinctly feminine, masculine, or gender neutral? How professional are element examples perceived? Finally, is there an interaction between gender and professionalism? In Study 1, participants rated the masculinity, femininity, and professionalism of a series of design element examples presented to them in an online survey. The results were analyzed to assign a score for femininity, masculinity, and

professionalism for each element example. Furthermore, the results were used to create guidelines for gender neutral web design.

The second study (Gender, Professionalism, Workload, and Usability of Websites), applies the results of Study 1 to a web design task and analyzes the gender, professionalism, usability, and workload associated with each website produced. The main objective of the study is to analyze the usability and workload of gendered websites as well as to determine the relationship between gender and professionalism in the context of a website. In study 2, city websites were designed in five gender categories: highly masculine, highly feminine, highly androgynous, undifferentiated, and "middle of the road" neutral. The ratings for the femininity and masculinity of the element examples in Study 1 were used to gender each site into one of the five categories. The topic of the website (a fictional city called "Oakdale") was chosen to be of general interest regardless of gender. In Study 2, participants completed a short task involving each website then rated the website's workload, masculinity, femininity, professionalism, and usability.

Thesis Structure

Two studies are described separately in this work. After Chapter 2 (Literature Review) provides background research for both studies, Chapter 3 will cover the Methods, Results, and Discussion for Study 1. Similarly, Chapter 4 will describe the Methods, Results, and Discussion for Study 2. Gender Inclusive Web Design Considerations and Recommendations will be presented in Chapter 5. Finally, Chapter 6 will conclude the work and offer areas of further study.

CHAPTER 2: LITERATURE REVIEW

To understand and work toward solutions to the problems outlined in the introduction, several related research areas are relevant. The first section of this chapter will focus on gender and product design. The body of work on gender and product design is considerably larger than that of gender and web design, so it provides necessary information about how non-human objects are gendered as well as the benefits and problems associated with gendered products. Next, gender and web design will be reviewed to gain a deeper understanding of the effects gender has on web design and how websites become gendered. Then, the interactions between gender and professionalism will be examined. Additionally, techniques for measuring gender will be reviewed followed by an overview of website design and design elements.

Gender and the Design of Products and Brands

Most studies which have examined gender and product design focus on the gender of the respondent as it relates to their perception of products (Gentry, Doering, & O'Brien, 1978; Golden, Allison, & Clee, 1979; McGrath, 1995). However, some recent studies have examined products as being gendered themselves (van Tilburg et al., 2015, Lieven et al., 2015). The perceived gender of the product has been found to be based on the backgrounds and cultural identities of the product's consumers (Allison, Golden, Mullet, & Coogan, 1980) as well as the ways in which the product is promoted and designed. For example, products which could ostensibly be used regardless of gender may acquire a gender through advertising campaigns (Debevec & Iyer, 1986; Golden et al., 1979 Iyer & Debevec, 1989**).** Outside of advertising, a product's physical features may contribute to determining its personality and in turn, its potential for becoming gendered.. Therefore, the gendering of a

product also depends on the respondent's association (based on background and culture) of a product's physical features with a gender (Govers, Hekkert, & Schoormans, 2002; van Tilburg et al., 2015). People tend to anthropomorphize (assign human characteristics to) products (Epley, Waytz, & Cacioppo, 2007) and evaluate them in the ways they evaluate humans (Govers & Schoormans, 2005). Furthermore, the mechanics of associating a product's appearance with a gender could be further explained by the ways in which people judge gender when meeting someone new. When meeting a new person, their gender is first judged by their physical appearance (Deaux & Lewis, 1984), which reinforces the notion that gender is determined by appearance, and for a product, by design.

In many societies, the association of products and design cues with gender begins in childhood. This is an example of the gender system that "organizes the relationship between the sexes on a symbolic, structural, and individual level" (Ehrnberger, Räsänen, Ilstedt, 2012, p. 87). It is further suggested that the system is built according to the principles of separation and hierarchy (Ehrnberger et al., 2012). Separation means that behaviors and tasks are divided into "male" and "female" categories while hierarchy implies that there is an order to gender with males ascribed higher value. Product language and retail stores separated into sections "for boys" and "for girls" reinforce the association (Ehrnberger et al., 2012). Dividing everyday items into gender categories from such a young age places expectations on boys to be smart, logical, and tough while girls should be beautiful, caring, and quiet (Lepkowska, 2008; Rommes, Bos, & Josine, 2011; Ehrnberger et al., 2012). With age, the type of gendered products people consume changes. Adults buying deodorant and razors are faced with the same gendered options as children choosing toys. The principle of hierarchy also applies to products where men are accepted as the norm while women are the exception

(Ehrnberger, et al., 2012). This same idea can be used to explain the fact that female products (for her) are often offshoots of the "regular" product (targeted at a "general audience" of people – presumed to be men) (Ehrnberger et al, 2002).

In research on brand design and gender, it has been shown that solid, bold, angular and sharp brand logos imply masculinity while light, delicate, and airy logos imply femininity (Lieven et al., 2015**).** Studies also suggest that these results are not limited to logos, but to the entire design element of shape (Schmitt & Simonson, 1997). Research on shape has demonstrated that "angular forms embody dynamism and masculinity whereas round forms create softness and femininity" (van Tilburg et al., 2015, pp. 424). Studies on product gender have also provided a basic outline for creating highly gendered products. Masculine products can be created through the use of bulky proportions, angular shapes, straight lines, dark colors, limited color, and dim reflectiveness (van Tilburg, 2015). Men also appreciate characteristics such as compactness, minimalism, and cleanliness (Xue & Yen, 2007). In contrast, feminine products may be created by using slim proportions, curvy lines, round shapes, light colors, an extensive color palette, and a shiny reflectiveness (van Tilburg et al., 2015). Women have been shown to be concerned with characteristics such as smoothness, uniqueness, and slimness (Xue & Yen, 2007). These associations suggest that men have more interest in the structure and shape of the product while women appreciate product details and organic forms (Xue & Yen, 2007).

Gendered design may be used to design a wide variety of products. Indeed most consumers will be able to assign a gender to a product regardless of designer intention due to the tendency to anthropomorphize items (Epley et al., 2007**).** However, it has been suggested that highly gendered products are best received and liked by consumers when they are used

in an outward expression of the self (van Tilburg et al., 2015). Such products include fragrance, personal care, and shoes. Gendered product design, however, can be inappropriate when used on a previously "ungendered" product. Bic "For Her" pens are a prime example of this problem where Bic created pens with a marketing campaign specifically for women (Vinjamuri, 2012). While consumers may undoubtedly be able to assign a gender to Bic pens (Epley, et al, 2007), the strong gendering of a product which had not been marketed with one gender in mind until that point created a wave of backlash (Vinjamuri, 2012). The well-known computer manufacturer, Dell, faced a similar problem when they introduced "Della" in 2009 (Casserly, 2009). Della was a marketing campaign to sell lightweight laptops (netbooks) to women. The campaign featured highly stylized (and pink) visuals along with significantly simplified technical specifications. Consumers felt that the campaign was offensive and condescending (Casserly, 2009). Both instances are prime examples of the faults associated with the "pink and shrink it" philosophy of product design (van Tilburg et al., 2015). That is, to market a product to a woman it need simply be made pink and small.

Studies on products and brands have shown that consumers prefer items with strong gender associations (van Tilburg et al., 2015; Lieven et al., 2015). However, the most preferred products (in terms of both preference and purchase intent) were those which were simultaneously very masculine and very feminine (highly androgynous) (van Tilburg et al., 2015). While consumers have responded favorably to highly androgynous products, the notion that products should embody a single gender persists.

Due to the attractiveness of marketing to one gender over another, there has been relatively little research into the area of gender neutral product design. In fact, some researchers have suggested that no product is completely gender neutral (Stilma, 2010). In

creating a gender neutral vacuum cleaner, the designer suggested using few stereotypical assumptions and focusing on functionality. Aesthetically, the design was kept simple using a white rounded cube shape (Stilma, 2010). More recently, designer Saana Hellsten created a package design concept for gender neutral personal care and household supplies (Hellsten, 2014). The product designs and packages focus on functionality rather than the gender of the consumer. Packages are subdued and combine matte textures with a limited color palette of mint green, teal, light blue, and black. Differences in packaging for a product were used to denote product attributes (such as shave cream for normal skin or dry skin) instead of gender (Hellsten, 2014).

Gender and the Design of Websites and Software

So far, the processes by which designers impart gender onto products and the ways in which consumers react to gendered products have been discussed. Next, gender and the design of websites and software will be reviewed. The key finding is that the ways in which websites (outside the realm of specific product websites like the Della) and software become gendered are very different from that of products. The gender biases in software and websites are often unintentional and a product of internalized biases, tools, and culture.

Website and software design teams tend to be predominantly male. Approximately 80% of web and software design professionals are men (Williams, 2014; Horvath et al., 2007), while men and women make up equal shares of users (Williams, 2014). As such, it has been suggested that it is unlikely that such design teams can effectively build a product free of gender bias (Williams, 2014). For those design teams which include women, it is still unlikely that any discussion of gender differences or bias will occur. Women are often reluctant to bring up such issues as doing so would draw attention to the fact that they are

women – a possibly detrimental career move (Williams, 2014). The discomfort women feel when voicing opinions when they are rooted in a female-perspective suggests that simply including a few women on a team is not enough to correct the biases (Williams, 2014). For example, a woman on a predominantly male design team would be unlikely to bring up issues of gender bias in order to avoid highlighting the fact that she was a minority in the group. A study of higher education websites (a type of website where the intended audience would be an equal number of men and women) showed that only 7% were designed by female or majority female teams and 19% by equal gender teams (Horvath et al., 2007, Moss and Gunn, 2005). Research by Robertson and Newell showed that the effects of male domination in the website and software design profession create a 'masculine computer culture' which deters women from entering or staying in the profession (Robertson & Newell, 2001).

The gender gap in website and software design is not created solely in adulthood, however. In school settings, more encouragement to use and engage with technology is given to boys than girls (Moss & Gunn, 2007). Educational software itself is often presented in a way that is appealing to boys, yet discouraging for girls (Lepper & Malone, 1985; Kafai, 1996; Al Mubireek, 2003). In web design specifically, it has been shown that each gender prefers the websites which have been produced by their own gender. In short, men prefer websites designed by men, and women prefer websites designed by women (Moss & Gunn, 2007). These preferences create conflict when information and communications technology instructors (most of whom are men) are tasked with selecting websites for the classroom and evaluating websites created by students (Moss & Gunn, 2007). Websites selected for presentation as examples in class may favor those with a more masculine design, which

could make the class and its content more appealing to male students (Moss & Gunn, 2007). Again, the gender of the instructor may also influence the assessment of student websites in favor of their own gender. However, it is not suggested that instructors (regardless of gender) consciously discriminate against students, but rather that the discrimination is indiscernible to the instructors (Moss & Gunn, 2007). Further, designers also tend to design with their own gender in mind where men design for men and women design for women. Moreover, participants can often determine the gender of the designer from looking at the website (Moss, 2003).

The masculinization of the web and software design field is not limited to education and employment. Multiple studies have shown a masculine bias in the tools for designing software and websites (Horvath et al., 2007, Huff & Cooper, 1987, Flanigan & Metzger, 2003) An analysis of 3,682 website templates across nine design packages revealed that the tools used to create websites are also biased toward masculinity (Horvath et al., 2007). It was found that 84% of the templates were masculine in terms of the lines used, 99.8% were masculine in layout, 99.6% were masculine in number of colors offered, and 99.8% were masculine in typography. One of the design programs offered no non-masculine features in any of its templates (Horvath et al., 2007).

The expectations that one person has for another person effect both the performance of the other and the way that performance is perceived (Fiske & Taylor, 1985). The consequences of these expectations have been explored in relation to race and interview practices (Darley & Fazio, 1980, Snyder & Swann, 1978), but were also examined in relation to educational software (Huff & Cooper, 1987). In relation to software design, the expectations of the designer and the effects of those expectations on users have been

described thusly: "…the expectations of the software designer are central in determining the design of the program. And it is often the program, and the program's approach to the user, that determines the success or failure of the user in his or her interaction with the computer." (Huff & Cooper, 1987, p.520) When formulating the hypothesis for their study on gender and educational software, the researchers drew on existing work which showed that when asked to describe a person, respondents overwhelmingly thought of a man (Broverman, Vogel, Broverman, Clarkson, & Rosenkrantz, 1972). The resulting hypothesis was that when groups of designers were asked to design software for boys, girls, and a general class of students, the "general" software would closely resemble the software for boys (Huff & Cooper, 1987). For the study, designers were tasked with creating a grammar teaching tool each for boys, girls, and a general class of 7th grade children. It was found that the programs for boys and girls were very different. However, the main finding was that the "general" program seemed to be written with only boys in mind – even though most of the designers were females who had expressed concern regarding sex bias in software (Huff & Cooper, 1987). The researchers suggested that the assumption that "male" is the default is present and deeply rooted in software design culture regardless of the designer's gender or intention.

Gender and Professionalism

In the workplace, the intersection of gender and perceived professionalism is complicated. Women who consistently exhibit masculine behaviors such as confidence, aggressiveness, and self-assuredness tend to be negatively evaluated in the workplace (Heilman, Block, Martell, & Simon, 1998) and passed over for promotions (Rudman & Glick, 2001; Brower, 2013; *Price Waterhouse v. Hopkins*, 1989). In one such instance, a woman whose professional and business development skills were widely recognized was

denied a promotion due to a perceived lack of interpersonal skills – which her employer viewed as being a result of her masculine presentation (Brower, 2013). The woman worked in a traditionally male field (accounting) where the presence of masculine behaviors such as assertiveness was required for success, however, her employer insisted upon her displaying traditionally feminine behaviors, dress, and mannerisms. Comments from her employer suggested that she attend "charm school", "dress more femininely", and "wear make-up" (*Price Waterhouse v. Hopkins, 1989*; Brower, 2013). As gender is read through appearance (Deaux & Lewis, 1984**)**, the remarks about her gender mostly focus on her appearance and dress (Brower, 2013). This case exemplified the double bind that women face wherein job requirements may call for masculine traits, but when displaying them, women are punished for gender atypical behavior.

In contrast to women who present as masculine, "ultra-feminine" women who did not exhibit any masculine behaviors in the workplace were perceived as less qualified, less confident, and also less likely to be promoted (O'Neill & O'Reilly, 2011). The problems facing both feminine and masculine women in the workplace create another double bind in which women have no "safe" route in terms of gender presentation, especially for women in traditionally male-held jobs (Brower, 2013; O'Neill & O'Reilly, 2011). To be hired or taken seriously in conventionally male workplaces, it has been suggested that women not dress in an overtly feminine manner, wear heels, or too much jewelry (Forsythe, 1990). However, these suggestions for success often clash with the gender expectations or even dress codes found in the workplace (Brower, 2013). The trend of feminine traits leading to fewer promotions also extends to men: men who exhibited traits of femininity were less likely to secure a promotion than their more masculine peers (O'Neill & O'Reilly, 2011; Brower,

2013). In general, overt displays of femininity or gender incongruent behaviors negatively impact overall perceptions of personal professionalism regardless of gender. However, it has been shown that in some cases the effects of gender atypical behavior can be mitigated. For instance, women who can self-monitor and "turn on" or "turn off" masculine behaviors in certain workplace situations were the most successful in securing promotions (O'Neill & O'Reilly, 2011).

While the effects of gendered actions on professionalism have been studied, less is known about the effect of gendered design on professionalism. In web design, designers often aim for their sites to be perceived as professional. However, it is unknown what effect the gendering of the site (intentional or unintentional) will have on user's perceptions of its professionalism. As such, the intersection of gender and professionalism in design is explored in the studies documented in this work.

Measuring Gender

To understand the gendering of products or websites, scales for measuring gender are necessary. One of the most widely used scales for measuring gender in individuals was introduced by Sandra Bem in 1974 for the measurement of psychological androgyny, called the Bem Sex-Role Inventory (BSRI). Unlike other scales of the time (namely the Masculinity-Femininity scale of the California Psychological Inventory (Gough, 1957)), the BSRI is not bipolar. That is, the BSRI includes both a masculinity and femininity scale. By developing a scale which allowed for separate measurements of masculinity and femininity, Bem allowed for individuals to be categorized as both masculine and feminine – or androgynous. The scale includes 60 traits categorized as Masculine, Feminine, or Neutral. Unlike other scales of the time, the BSRI categorized traits based on sex-typed social

desirability (whether the trait was socially acceptable for a man or a woman) (Bem, 1974). The scale asks participants to indicate how well the trait fits them on a 7 point scale where 1 is "Never or almost never true" and 7 is "Always or almost always true". From these ratings, the participant receives a masculinity, femininity, and neutral score. The scores are used to determine whether a person is Masculine, Feminine or Androgynous (possessing simultaneously high masculinity and femininity). Bem showed that in people, androgyny is related to better adaptability, greater flexibility within their environments, and better psychological health.

The use of scales which define masculinity and femininity as separate constructs (such as the BSRI) rather than on a bi-polar scale is supported by other researchers who found that perceptions of masculinity and femininity are independent of each other (Allison, Golden, Mullet, and Coogan, 1980; van Tilburg et al., 2015). A scale for measuring the masculinity and femininity of brands and brand logos as separate constructs was developed (Lieven et al., 2015). Product category masculinity and femininity perceptions were measured on 1-7 scales where 1 was "Not feminine (masculine) at all" and 7 was "Very feminine (masculine)". The scores for each scale were denoted as Feminine Perceived Gender (FPG) and Masculine Perceived Gender (MPG).

The FPG and MPG scale was again used extensively in a study on product gender (van Tilburg et al., 2015). However, for this study, the researchers defined the interactions of FPG and MPG as "zones" of gender. Values above the median for FPG and below the median for MPG denoted a feminine product. Similarly, values above the median for MPG and below the median for FPG denoted a masculine product. Products with simultaneously high (above the median) FPG and MPG were defined as being androgynous (drawn from the

definition of androgyny used in the BSRI (Bem, 1974)). Products with simultaneously low FPG and MPG (below the median) were defined as being undifferentiated (van Tilburg et al., 2015).

The two scales described so far used subjective measures to measure gender. However, the gender of website templates has also been measured objectively by creating a rating system for template features (Horvath et al., 2007). In this rating system, each template feature (such as typeface color options) was measured and scored according to its gender association. For example, featuring only one color was considered a masculine trait and scored with a 1 while having 7+ colors was considered a very feminine trait and scored a 4. Each template feature was weighted to derive an overall score for the template which ranged from 5-10 (5 being exclusively masculine and 10 being exclusively feminine) (Horvath et al., 2007).

Elements of Web Design and Website Development

The focus of much of the research on the design of user interfaces and websites has tended to be in the areas of usability and utility (Tuch et al., 2010). Considerable effort has been expended to identify and measure factors affecting usability. From an engineering perspective, Gehrke and Turban (1999) suggested page loading time, download time, successful search rate, error rates, and task completion time as usability measurement techniques. Design experts have also proposed many usability factors (Lee & Kozar, 2012). Spool, Scanlon & Schroeder, Snyder, and DeAngelo (1999) suggested ease of use, relevance, completeness, readability, and content quality while Nielsen specified areas of navigation, response time, credibility, and content (Nielsen, 2000). Nielsen also developed an extensive list of 113 “Design Guidelines for Homepage Usability” separated into 26 areas. These

guidelines were later distilled into “Top 10 Guidelines for Homepage Usability” separated into 4 areas: “Make the Site’s Purpose Clear”, “Help Users Find What They Need”, “Reveal Site Content”, and “Use Visual Design to Enhance, not Define, Interaction Design” (Nielsen, 2002). These guidelines are specific to the design of homepages and focus on bringing users to the website and creating a homepage that presents that presents key information in one place. The 10 guidelines are listed in Table 1.

Table 1. Jakob Nielsen's "Top 10 Guidelines for Homepage Usability" (2002)

Guideline	Area
1. Include a One-Sentence Tagline	Make the Site’s Purpose Clear
2. Write a window title with good visibility in search engines and bookmark lists	
3. Group all corporate information in one distinct area	
4. Emphasize the site’s high-priority tasks	Help Users Find What They Need
5. Include a search box	
6. Show examples of real site content	Reveal Site Content
7. Begin link names with the most important keyword	
8. Offer easy access to homepage features	
9. Don’t over-format critical content	Use Visual Design to Enhance, not Define, Interaction Design
10. Use meaningful graphics	

More broadly, Nielsen has also developed “10 Usability Heuristics for User Interface Design” (Nielsen, 1994). These heuristics have been widely used in interface and web design since their publication. The 10 Heuristics are listed in Table 2.

Table 2. Jakob Nielsen's 10 Usability Heuristics for User Interface Design (1994)

Heuristic	Definition
Visibility of System Status	The system should inform users of what is happening through appropriate and timely feedback
Match Between System and Real World	Information should be organized naturally based upon what users are accustomed to seeing in the real world
User Control and Freedom	Users should experience perceived control as they interact with the system
Consistency and Standards	Controls, images, and icons should be consistent throughout the system
Error Prevention	Eliminate error-prone conditions or offer confirmation messages to the user
Recognition Rather than Recall	Make objects, actions, and options visible – do not make the user remember instructions
Flexibility and Efficiency of Use	The system should be easy and efficient to use by novices and experts alike
Aesthetic and Minimalist Design	Avoid displaying excessive information and design elements
Help Users Recover from Errors	Present error messages that help users recover from errors
Help and Documentation	Help and Documentation should be easily accessible, easy to search, and easy to follow

In addition to being usable, it is accepted that interface or website appearance is crucial to making a positive overall impression on users (Tuch et al., 2010, Bargas-Avila & Opwis, 2010, Schenkman & Jonsson, 2000). Impressions of the aesthetics and overall design of a website are also formed very quickly (on the order of 500ms) (Tractinsky, Cokhavi, Kirschenbaum, & Sharfi, 2006) which highlights their importance further. As such, an understanding of the visual elements which make up a website is necessary.

Font

Font refers to the design of characters unified by consistent visual properties (Carter, Day, and Meggs, 1993). The legibility of a font is determined by its contrast, proportion, and simplicity (Cui, 1998). A font may be categorized as serif, sans serif, or script where serif fonts include a finishing stroke and script fonts are based upon the fluid strokes of handwriting. In web design, highly stylized or script fonts are used sparingly (headings, titles) to ensure readability (Cui, 1998). Similarly, all uppercase text also decreases readability and is used with caution. It is suggested that font size be no less than 12 point for

web applications (Cui, 1998). Text should be adequately spaced to avoid overwhelming the user (White, 2011). Text should be in a contrasting color to the background it is displayed on to ensure it can be read (Nielsen, 2001).

Image

In website design, images may include logos, photos, illustrations, animations, and icons. The images included in a website should be relevant to the site's topic and interesting to the user (Nielsen, 2002). Images and graphics should be labeled if their meaning or purpose is not clear. Large photos should be appropriately edited (reduced in size or cropped) to show a reasonable level of detail (Nielsen, 2001).

Color

Colors are used in web design to create depth, structure information, and differentiate items (White, 2011). Designers should use caution when using highly saturated colors for text or large areas of the website as they can be uncomfortably bright on a screen. Color choices can also have psychological implications that should be considered when selecting a color palette for a website (Cui, 1998). The number of colors used on a site should be limited to avoid detracting from the message of the site (Nielsen, 2001).

Shape and Line

A shape is a self-contained area created with lines, textures, or colors (White, 2011). Shapes may be classified as one of four categories: rectilinear, curvilinear, organic, and geometric. Rectilinear shapes are composed of straight lines and have angular corners. Curvilinear shapes have edges dominated by curves. Geometric shapes are derived from or suggestive of Euclidean geometry. Finally, organic shapes feature curving edges suggestive of nature (White, 2011). In websites, shapes are often seen in buttons and boxes used to

differentiate areas of the site (such as menus or search boxes). The use of shapes also creates white space which helps to control the visual flow of the website (Garrett, 2010). A line connects two points and can be used to create divisions, shapes, connect information, convey movement, or create texture (White, 2011).

Texture

Texture refers to the way a surface may be experienced through touch (the feel of the surface). Texture can be the actual feel or perceived feel of a surface (as is the case with websites). Texture may be used to attract or deter attention from areas of a website. Like images, textures should be used with care but can be very effective for grabbing attention and highlighting elements (White, 2011). The use of texture should not be prioritized over legibility.

CHAPTER 3: GENDER AND PROFESSIONALISM OF WEB DESIGN ELEMENTS

Study 1 analyzed the gender and professionalism of web design element examples as well as the interaction between gender and professionalism. The study also served to inform the design of the websites in Study 2 (see Chapter 4).

Design elements are the basic "building blocks" of a visual piece (such as a painting, package design, or website). In web design, the basic elements of design are often defined as: line, shape, color palette, texture, typography, and form (White, 2011, Garrett, 2010). As gendering is accomplished through design choices (van Tilburg et al., 2015), it's important to know how the elements that make up a website's visual design are gendered. While in some cases creating a gendered website is useful, it's important to impart gender intentionally and not as a result of biases. As such, this study lays the foundation for understanding the gender of web design elements and creating recommendations for designing gender inclusive websites.

Methods

Research Objectives

The unintentional biases observed in web design give rise to several research questions: Are web design elements themselves gendered? Are some elements distinctly masculine and feminine? How professional are individual design elements perceived? Finally, is there an interaction between gender and professionalism of design elements? The answers to these questions are essential for designers to be intentional about the gender they impart onto their websites while still maintaining an appropriate level of professionalism.

Participants

The study included 1116 participants (681 female and 435 male) who were recruited from the faculty, staff, and student population at Iowa State University as well as through social media. Participants from Iowa State were recruited via a mass email to all university email addresses. Participants ranged in age from 18 to 76 years (mean = 29.1, SD = 13.7). 94.1 % of participants reported English as the language they are most comfortable speaking and 92% identified their native country as the United States. The participant group was skewed toward women from the United States under the age of 30. Participants were not offered compensation.

Variables

This experiment examined four of the design elements mentioned previously: Color, Typography (henceforth referred to as "Font"), Texture, and Shape. As images are integral to web design, Image was also included as an element in the study. Finally, Mixed Elements, which combine two or more elements, were examined as well. From this point on, Color, Font, Texture, Shape, Image, and Mixed Elements will all be referred to simply as "design elements". Furthermore, a specific instance of a design element (such as the color green) will be referred to as an "element example".

The examples in the study were selected to be appropriate for use in designing a "general use" website – meaning of appeal to a wide audience regardless of gender. Selecting examples in this manner was done to make the results particularly informative to the design of the websites in Study 2: Gender, Professionalism, Usability, and Workload of Websites. The number of examples in each element category is shown in Table 3.

Table 3. Number of unique examples in each design element category

Design Element	Number of Unique Examples
Font	18
Shape	14
Texture	12
Image	38
Color	21
Mixed Elements	21

Font

Fonts may be organized into three sub-categories: Serif, Sans Serif, and Script. The 18 fonts used in the study are listed in Table 4.

Table 4. The 18 fonts used in the study (separated into Serif, Sans Serif, and Script categories).

Serif	*Sans Serif*	*Script*
Garamond	ITC Bauhaus	Edwardian
Bookman	Brandon Grotesque	Sant'Elia
Times New Roman	Helvetica	Felt That
Stencil	Franklin Gothic	Bradley Hand
Applewood	Papercute	Glossdrop
Courier	Monospace	
	Impact	

Fonts were chosen based on their popularity in web applications over the last five years ("The 50 Most Popular Fonts on the Web", 2016) as well as their overall "safety" for web use ("CSS Web Safe Font Combinations", 2014). Examples of the fonts used in the study are shown in Figure 1.

Figure 1. Examples of the fonts used in the study.

Shape

The 14 shapes used in the study are listed in Table 5.The examples were chosen to be representations of basic shapes and embellishments which could be used in web design.

Table 5. The 14 shapes used in the study.

Shape	Diamond	Scroll
Arrows	Heart	Rectangle
Circle	Star	Square
Circles	Rectangles	Triangle
Circles and Squares	Rounded Rectangle	Triangle

Each shape example was presented simply on a white background (Figure 2).

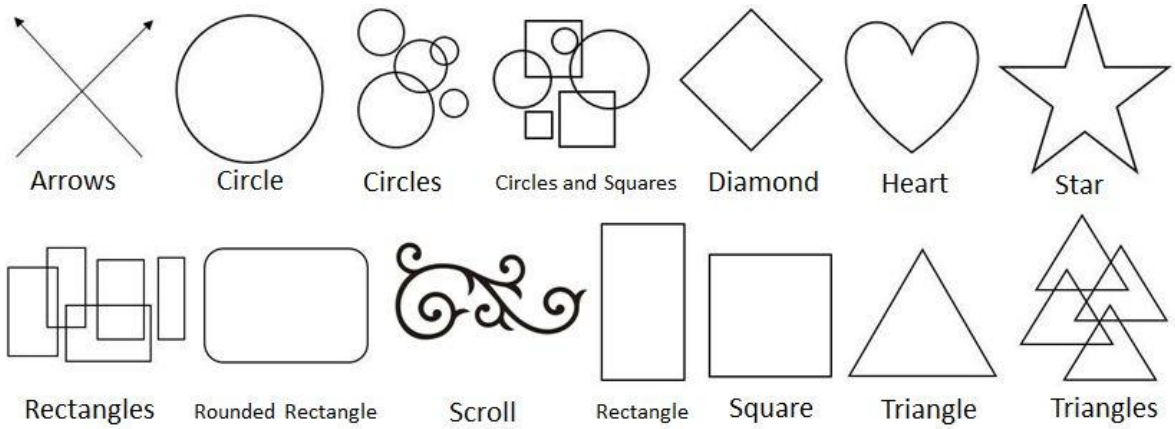

Figure 2. Examples of the shapes used in the study.

Textures

The 12 textures used in the study are listed in Table 6. Textures were obtained from open stock photography databases and selected for their appropriateness for use in websites (Savage & Hartmann, 2011).

Table 6. The 12 textures used in the study.

Texture		
Cardboard	Dark Denim	Red Stone
Linen	Handmade Paper	Stone Path
Scuffed Wood	Tree Limbs	Stone Wall
Floral Cloth	Light Paper	Rough Wood

Examples of textures used in the study are presented in Figure 3.

Figure 3. Examples of the textures used in the study.

Image

The 38 Images used in the study are listed in Table 7. Images were chosen from open stock photography databases and selected for their appropriateness for use in a general use website (a website that is of interest regardless of gender).

Table 7. The 38 images used in the study.

Images	Sunset	Living Room	Sheep
Woman with Baby	Horse	Library Interior	Mountains
Young Girl	Man with Baby	Man	City Highway
Woman	Young Boy and Young Girl	Dog	Man Working
Living Room Furniture	Man and Woman Working	Young Boy	Burger
Couple	Quinoa Salad	Arches	Wolf
Baby	Bread	Elephant	Cow
Blue House	Diverse Park	Gophers	High Rise Building
Woman Working	Corner Shop	Fields	Office
Cat	Lake with Trees	Desert Highway	

Examples of images used in the study are presented in Figure 4.

Figure 4. Examples of the images used in the study.

Color

The 21 colors used in the study are listed in Table 8. The hex codes for each color are given in brackets.

Table 8. The 21 colors used in the study with hex codes in brackets.

Color	Moss Green [#698b22]	Lime Green [#32cd32]	Light Blue [#87ceeb]
Pastel Pink [#ffc0cb]	Orange [#ee4000]	Red [#cd0000]	Aquamarine [#00f5ff]
Magenta [#ff3e96]	Grey [#838b8b]	Yellow [#ffff00]	Mint Green [#98fb98]
Brown [#a2693c]	Dark Blue [#00026a]	Sky Blue [#40cdeb]	Purple [#c00090]
Black [#000000]	Green [#00b159]	Teal [#00868b]	
Red-Brown [#8b0000]	Maroon [#a32220]	Light Orange [#ff8c69]	

The colors were chosen based on how common they are in web design (Liu, 2016). Examples of the colors used in the study are presented in Figure 5.

Figure 5. Examples of the colors used in the study.

Mixed Elements

Mixed Element examples were composed of two or more elements (such as color and shape) combined. Mixed Elements were included in the study as they begin to show the elements in context. The 21 Mixed Element examples are listed in Table 9.

Table 9. The 21 mixed elements used in the study.

Mixed Elements	Pink Thin Square	Green Thin Circle	Black Thick Circle
Pink Thick Circle	Pink Thin Circle	Blue Thick Bookman	Black Thick Bookman
Pink Thick Bookman	Pink Thin Square	Blue Thick Helvetica	Green Thick Square
Pink Thick Helvetica	Blue Thin Helvetica	Green Thick Circle	Black Thick Square
Pink Thin Bookman	Blue Thin Bookman	Green Thin Square	
Pink Thin Helvetica	Black Thin Helvetica	Black Thin Bookman	

Examples of the Mixed Elements are presented in Figure 6.

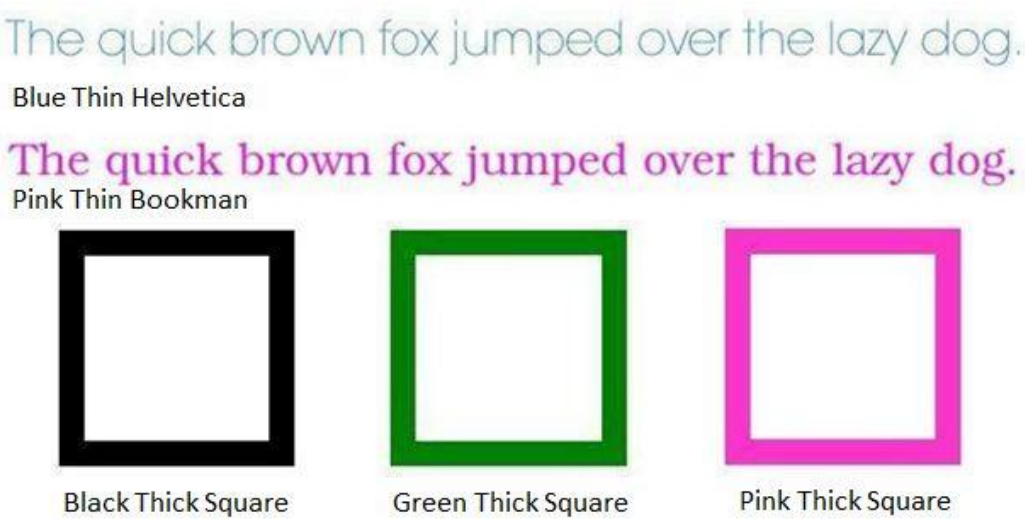

Figure 6. Examples of the mixed elements used in the study.

Dependent Variables

Each design element example was rated on three metrics as shown in Table 10.

Table 10. Metrics used in Study 1.

Variable	Metric	Measurement	Frequency	Data Type	
Gender	Feminine Perceived Gender (FPG)	Likert Scale 1-7	Once per element example	Subjective	Ordinal
	Masculine Perceived Gender (MPG)	Likert Scale 1-7	Once per element example	Subjective	Ordinal
Professionalism	Professionalism Rating	Likert Scale 1-7	Once per element example	Subjective	Ordinal

The metrics for gender, Feminine Perceived Gender (FPG) and Masculine Perceived Gender (MPG) are measured on a 1-7 scale where 1 is “Not Feminine (Masculine) at All” and 7 is “Very Feminine (Masculine)” (van Tilburg et al., 2015). Similarly, Professionalism is measured on a 1-7 scale where 1 is “Unprofessional” and 7 is “Professional”.

Experimental Design

Each participant randomly received half of the examples in each element category for a total of 62 examples per participant (for instance, each participant received 6 out of the 12 examples in the Texture category). Across participants, every element was presented roughly the same number of times using Qualtrics’ built-in randomization function. The order of element categories was also randomized.

Procedure

Participants accessed the study by clicking a link sent to them in an email. After accessing the study and providing consent, they were asked to fill out a short demographic survey which included their age (Appendix A). If a participant reported an age under 18, the study closed. Following demographics, a page showing instructions for completing the study as well as common definitions of femininity, masculinity, and professionalism was displayed (Table 11)

Table 11. Definitions of Femininity, Masculinity, and Professionalism used in Study 1

Term	Study Definition and Example
Femininity	**Femininity**: Femininity refers to qualities traditionally associated with women. For example, if you found a particular element to be very feminine, you might rate it a 7. If you found an element to not be feminine at all, you might rate it a 1.
Masculinity	**Masculinity:** Masculinity refers to qualities traditionally associated with men For example, if you found a particular element to be very masculine, you might rate it a 7. If you found an element to not be masculine at all, you might rate it a 1.
Professionalism	**Professionalism:** Professionalism refers to how appropriate for a business setting something is. For example, if you found a particular element very appropriate for a business setting, you might rate it a 7. If you found an element to not be appropriate for a business setting at all, you might rate it a 1.

To familiarize the participants with the scales used in the study, three example elements were presented as training: the script font Edwardian, the serif font Stencil, and the sans serif font Helvetica. After completing the training, participants advanced through the rest of the study where they assigned values for FPG, MPG, and Professionalism for each example (Figure 7). One example per page was displayed, and the participant clicked an on-screen button to advance through the examples at their own pace. When the last example element was completed, they were thanked for their participation and the study closed.

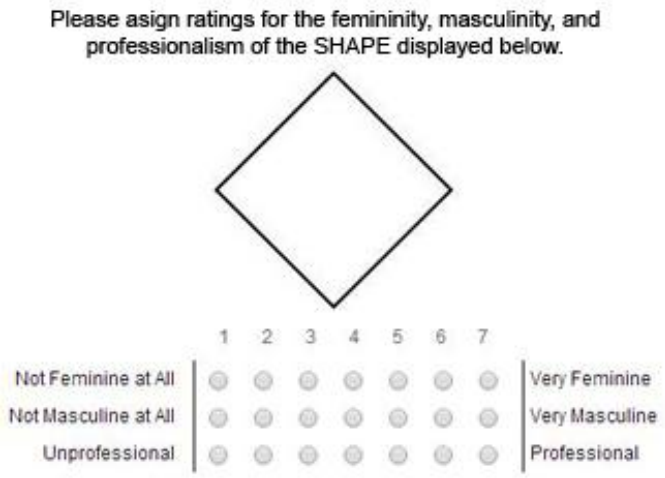

Figure 7. Element Example displayed with FPG, MPG, and Professionalism scales as seen by participants

The study was constructed and administered using Qualtrics. Participants accessed and completed the study using their personal electronic devices (desktop computer, laptop computer, tablet, smartphone) and internet connection.

Data Analysis

Summary statistics will be calculated for FPG, MPG, and professionalism ratings. T-tests will compare the FPG, MPG and Professionalism ratings for the three font categories (Serif, Sans Serif, and Script). For all results in Study 1, an alpha level of .05 is considered to be significant. ANOVA will be performed for the three font categories (Serif, Sans Serif, and Script). Tukey post-hoc tests will determine significance among the font categories. Cohen's d was used to evaluate effect size, where d>0.8 is a large effect, d>.05 is a medium effect, and d>.2 is a small effect. Finally, correlations between FPG and MPG, FPG and Professionalism, and MPG and Professionalism will be performed. A very strong correlation is defined as $80 \leq r \leq 1.0$, strong correlation is defined as $.60 \leq r \leq .79$, moderate correlation is defined as $40 \leq r \leq .59$, weak correlation is defined as $20 \leq r \leq .39$, and very weak correlation is defined as $0.0 < r \leq .19$.

Limitations and Assumptions

The study contained a limited number of examples of design elements (124). While the selection of examples was researched and intentionally broad, it cannot be considered comprehensive. As 92% of study participants reported being United States natives, the generalizability of the results to other cultures with differing gender-design associations is unknown. In terms of demographics, the participant group was not evenly spaced over the population but instead skewed toward women from the United States under the age of 30. Finally, the study included limited tests of design elements in context. The design elements were shown "floating" on a white background and not in the context which they would actually be used in web design. This limitation will be addressed in Study 2: Gender, Professionalism, Usability, and Workload of Websites.

Results

Design Elements

Feminine Perceived Gender and Masculine Perceived Gender

The mean FPG and MPG ratings for Font are presented in Figure 8 (ordered on FPG: low to high). Edwardian had the highest mean FPG at 5.48 (SD = 1.46) while Stencil had the lowest at 2.31 (SD = 1.11). Stencil had the highest mean MPG at 5.07 (SD = 1.26) while Edwardian had the lowest mean MPG at 2.30 (SD = 1.21).

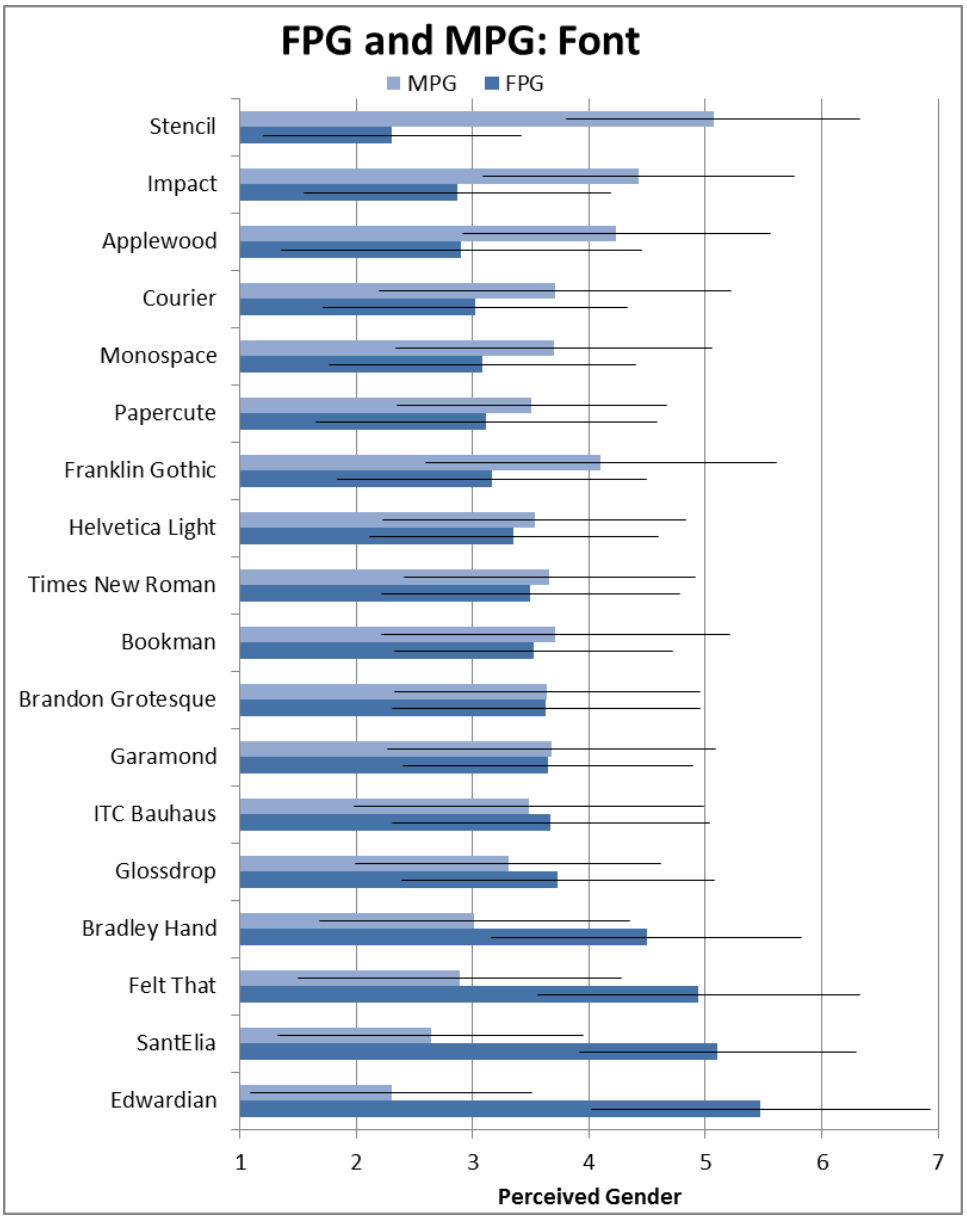

Figure 8. FPG and MPG for the Font category of element examples (n = 558). Bars represent standard deviation.

The examples in the Font element category may be assigned to three groups: Serif fonts, Sans Serif fonts, and Script fonts (Figure 9). Ratings for FPG in the Script group were significantly higher ($F(2, 3128) = 735$, $p<.0001$, $d = .81$) than ratings for the Serif and Sans Serif groups. There was no significant difference for FPG for the Serif and Sans Serif Groups. Ratings for MPG in the Script group were significantly lower ($F(2, 3128) = 300$, $p <$

.0001, d = .50) than ratings for the Serif and Sans Serif groups. There was no significant difference for MPG for the Serif and Sans Serif Groups.

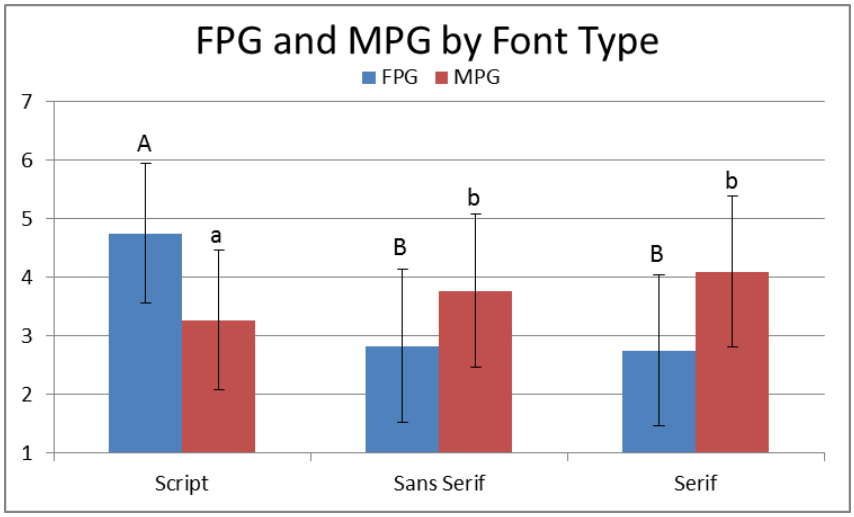

Figure 9. Results for FPG and MPG by font type (n = 2790). Bars represent standard deviation. Font types not connected by the same letter are significantly different.

The mean FPG and MPG ratings for Shape are presented in Figure 10 (ordered on FPG: low to high). Heart had the highest mean FPG at 5.54 (SD = 1.11) while Square had the lowest at 3.06 (SD = 1.48). Rectangle had the highest mean MPG at 3.94 (SD = 1.51) while Scroll had the lowest mean MPG at 2.48 (SD = 1.44).

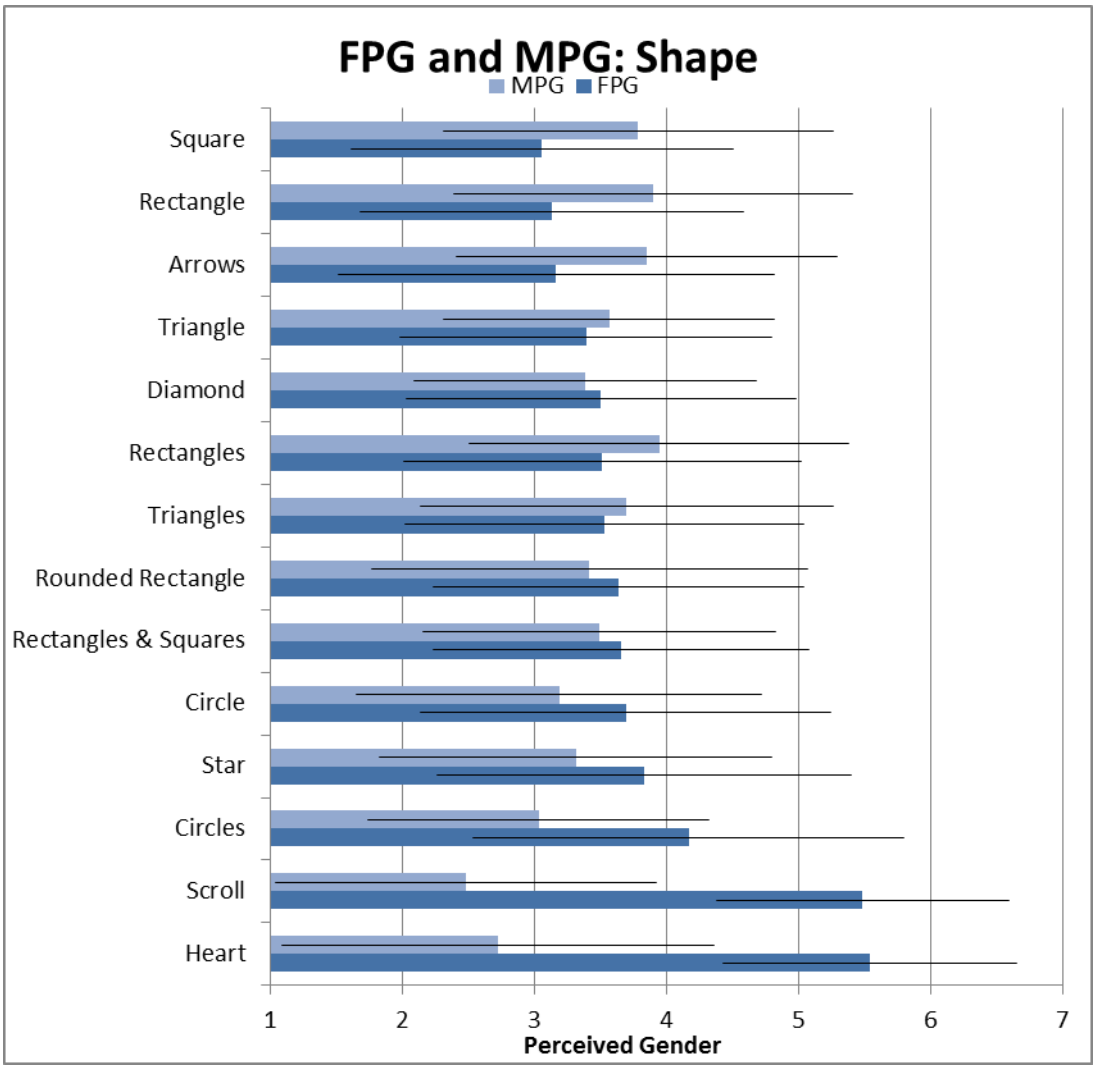

Figure 10. FPG and MPG for the Shape category of element examples (n = 558). Bars represent standard deviation.

The mean FPG and MPG ratings for Texture are presented in Figure 11 (ordered on FPG: low to high). Floral Cloth had the highest mean FPG at 5.71 (SD =1.25) while Cardboard had the lowest at 2.92 (SD = 1.12). Rough Wood had the highest mean MPG at 5.08 (SD = 1.52) while Floral Cloth had the lowest mean MPG at 2.05 (SD = 1.06).

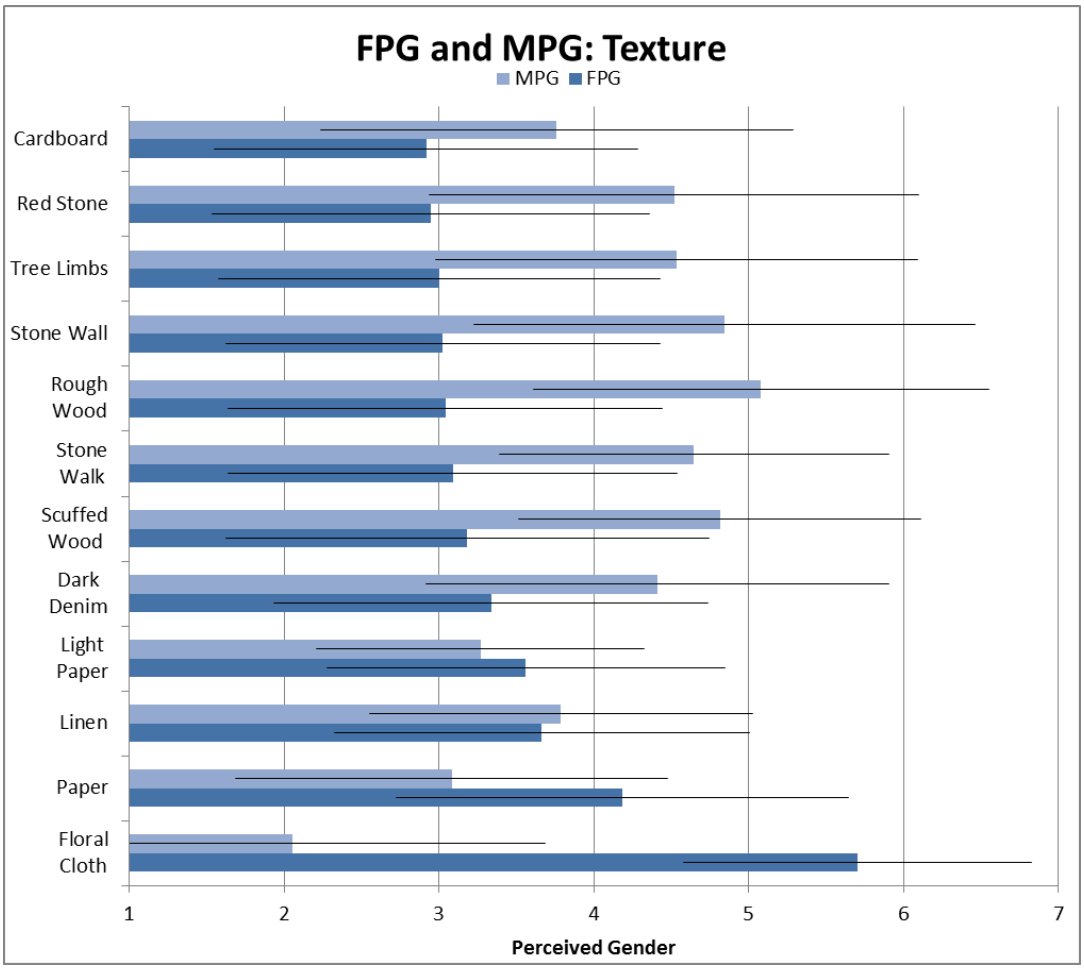

Figure 11. FPG and MPG for the Texture category of element examples (n = 558). Bars represent standard deviation.

The mean FPG and MPG ratings for Image are presented in Figures 12 and 13 (ordered on FPG: low to high). The figure for Image has been split for ease of viewing. Woman with Baby had the highest mean FPG at 5.88 (SD = 1.02) while Office had the lowest at 2.92 (SD = 1.15). Man with Baby had the highest mean MPG at 5.01 (SD = 1.41) while Young Girl had the lowest mean MPG at 2.32 (SD = 1.43).

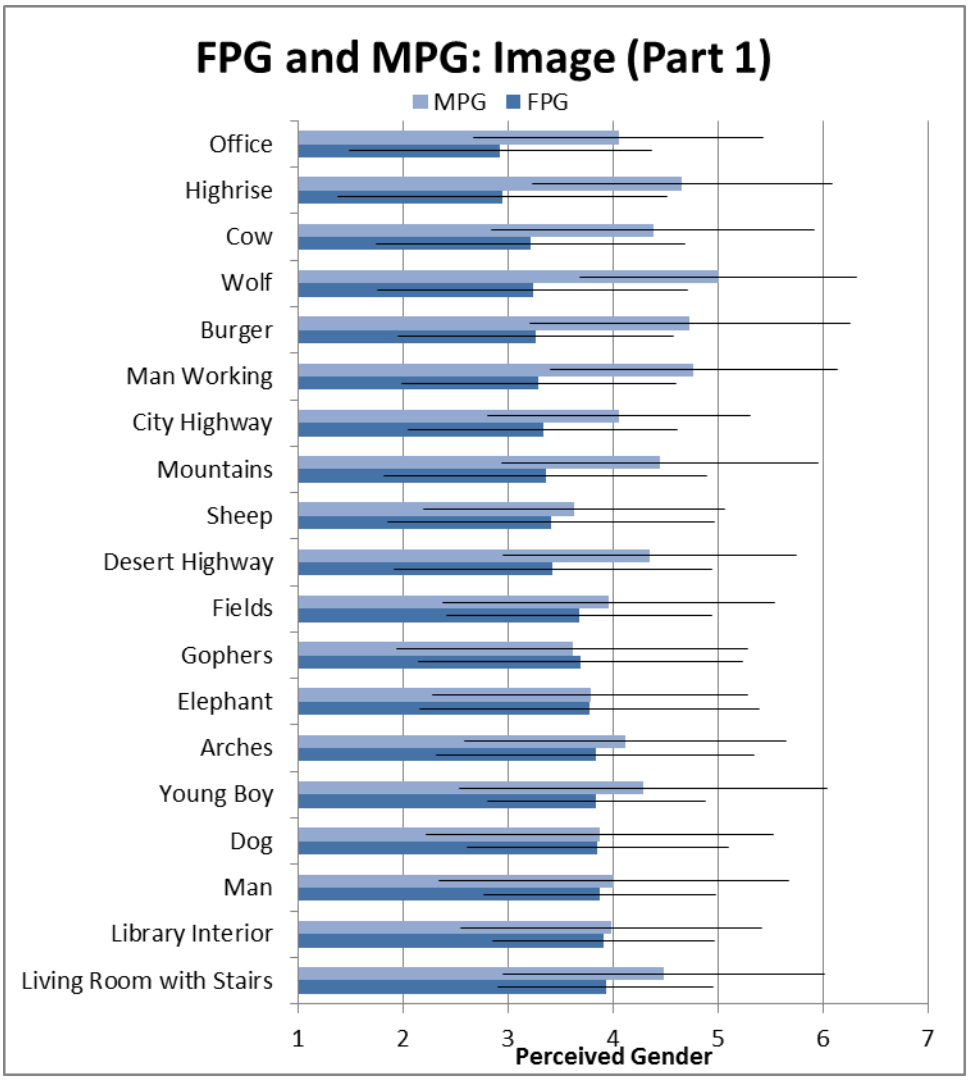

Figure 12. Part 1: FPG and MPG for the Image category of element examples (n = 558). Bars represent standard deviation.

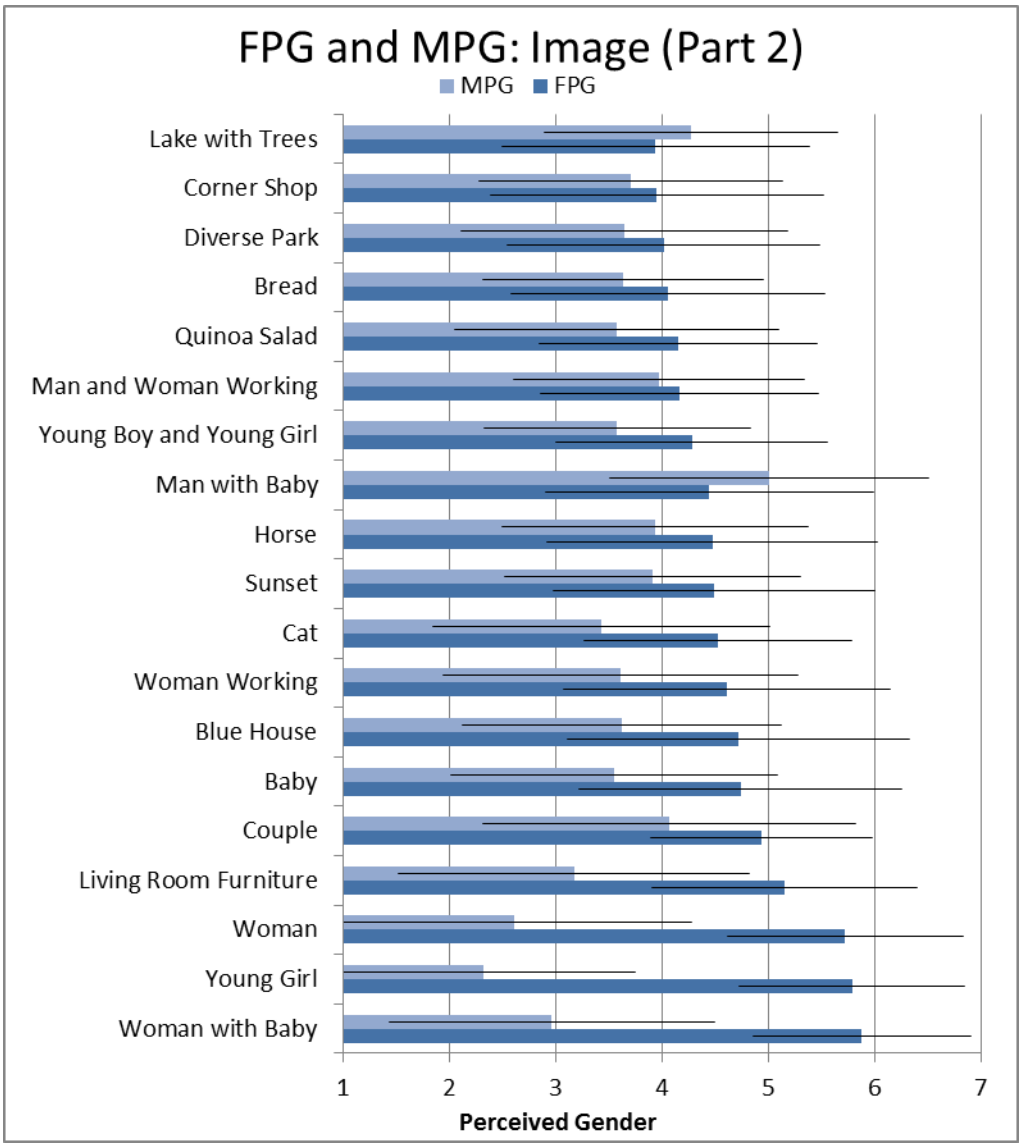

Figure 13. Part 2: FPG and MPG for the Image category of element examples (n = 558). Bars represent standard deviation.

The mean FPG and MPG ratings for Color are presented in Figure 14 (ordered on FPG: low to high). Pastel Pink had the highest mean FPG at 5.72 (SD = 1.04) while Brown had the lowest at 2.97 (SD = 1.59). Grey had the highest mean MPG at 4.90 (SD = 1.22) while Magenta had the lowest mean MPG at 2.26 (SD = 1.52).

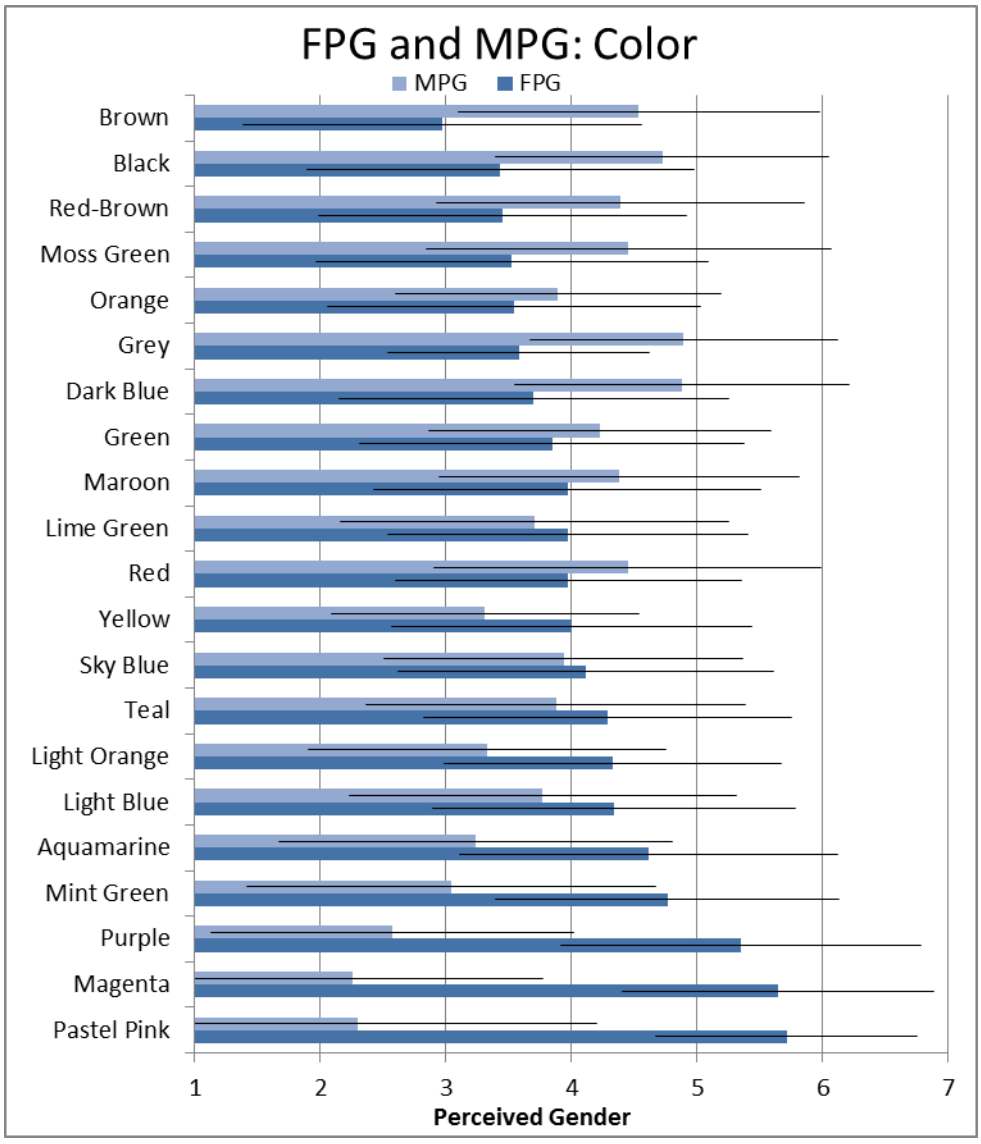

Figure 14. FPG and MPG for the Color category of element examples (n = 558). Bars represent standard deviation.

The mean FPG, MPG, and Professionalism ratings for Mixed Elements are presented in Figure 15 (ordered on FPG: low to high). Pink Thick Circle had the highest mean FPG at 5.47 (SD =1.40) while Black Thick Square had the lowest at 2.92 (SD = 1.48). Black Thick Square had the highest mean MPG at 4.60 (SD = 1.50) while Pink Thick Circle had the lowest mean MPG at 2.19 (SD = 1.54).

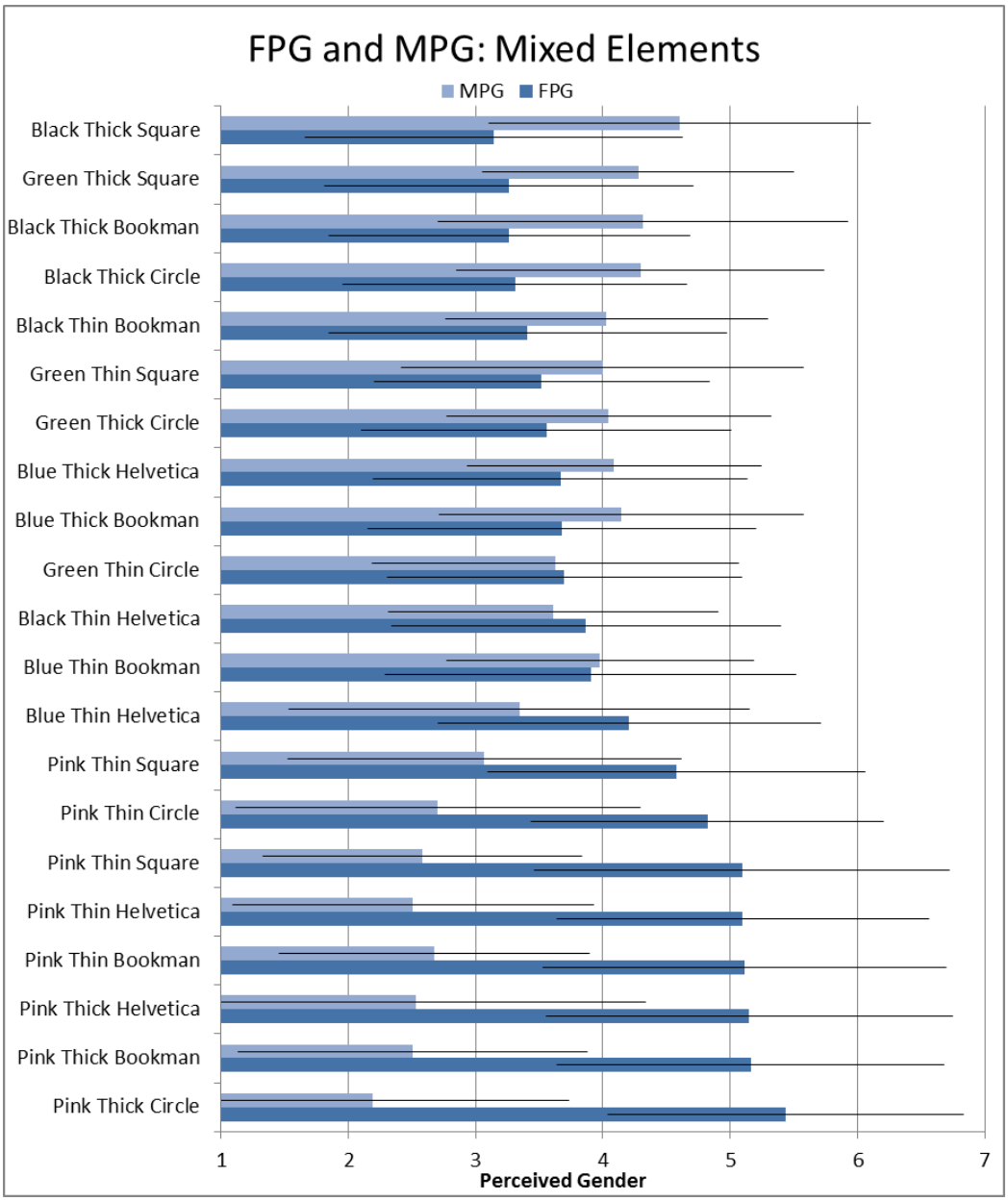

Figure 15. FPG and MPG for the Mixed Elements category of element examples (n = 558). Bars represent standard deviation.

Professionalism

The mean Professionalism ratings for Font are presented in Figure 16. Times New Roman had the highest mean professionalism at 6.16 (SD = .75) and Glossdrop had the lowest at 1.66 (SD = 1.48)

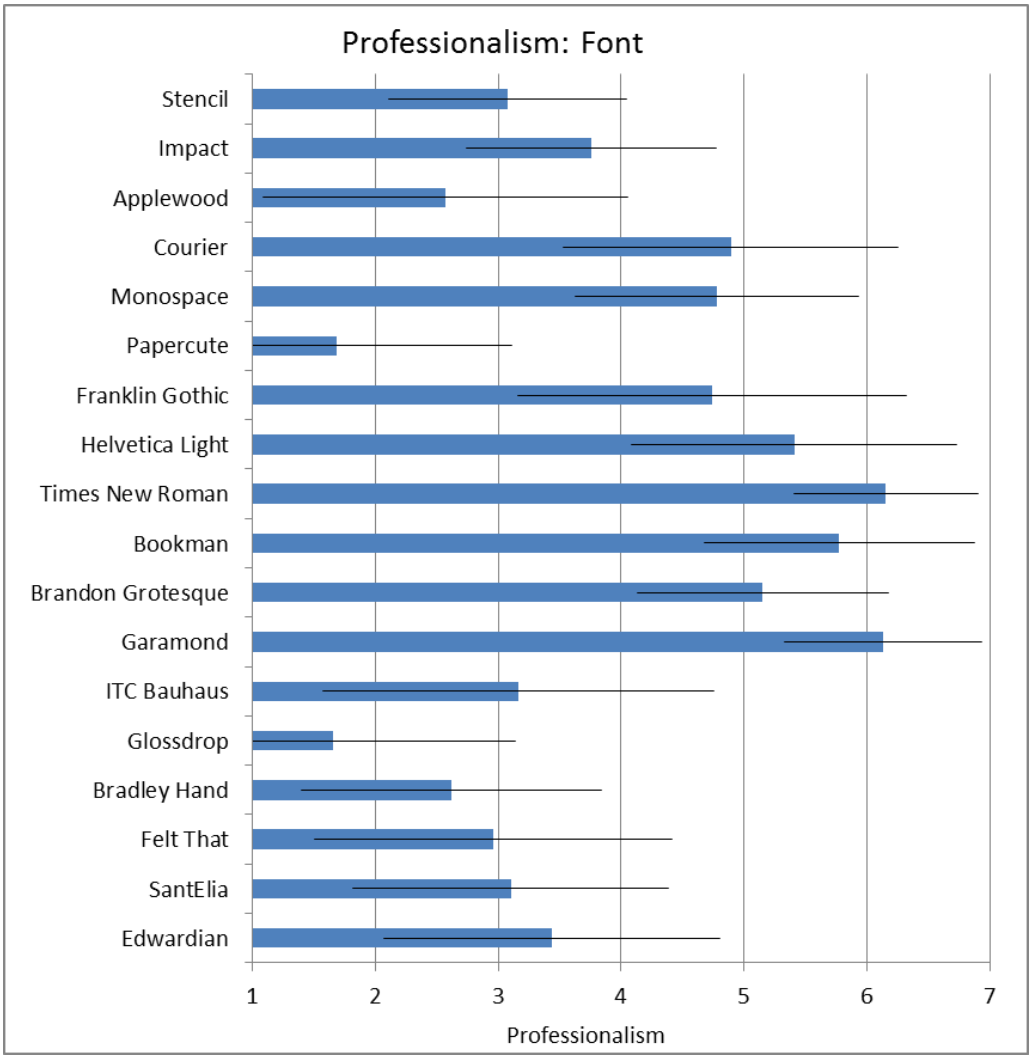

Figure 16. Professionalism ratings for the Font category of element examples (n = 558). Bars represent standard deviation.

Ratings for Professionalism in the Script group of fonts were significantly lower ($F(2, 3128) = 561$, $p < .001$, $d = .68$) than ratings for the Serif and Sans Serif groups. There was no significant difference for Professionalism for the Serif and Sans Serif Groups (Figure 17).

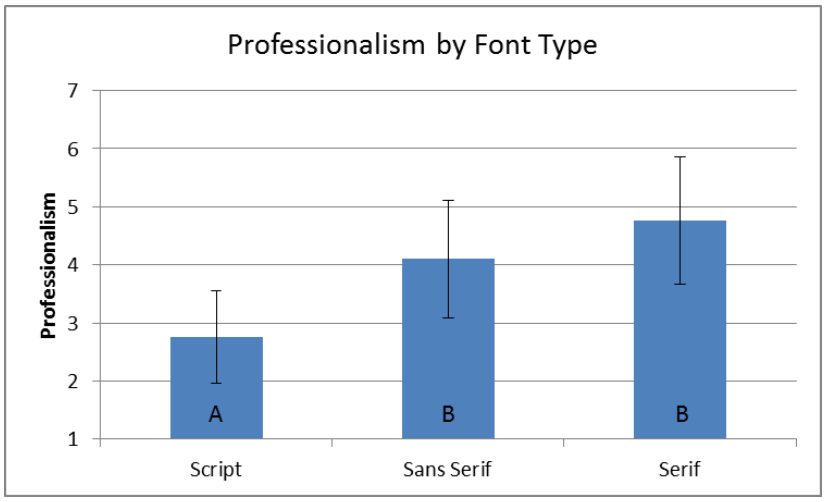

Figure 17. Mean Professionalism ratings by Font Type (n = 2790). Bars represent standard deviation. Font Types not connected by the same letter are significantly different.

The mean Professionalism ratings for Shape are presented in Figure 18. Square had the highest mean professionalism at 5.07 (SD = 1.52) and Heart had the lowest at 2.72 (SD = 1.57).

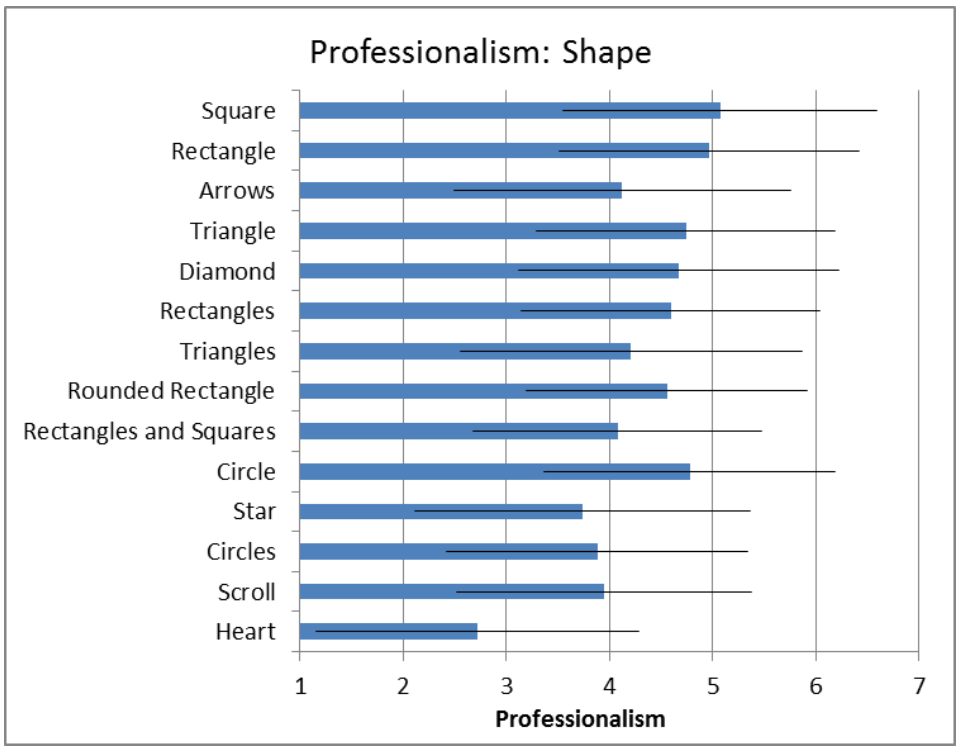

Figure 18. Mean Professionalism ratings for the Shape category of element examples (n = 558). Bars represent standard deviation.

The mean Professionalism ratings for Texture are presented in Figure 19. Dark Denim had the highest mean professionalism at 4.44 (SD = 1.60) and Tree Limbs had the lowest at 3.15 (SD = 1.52).

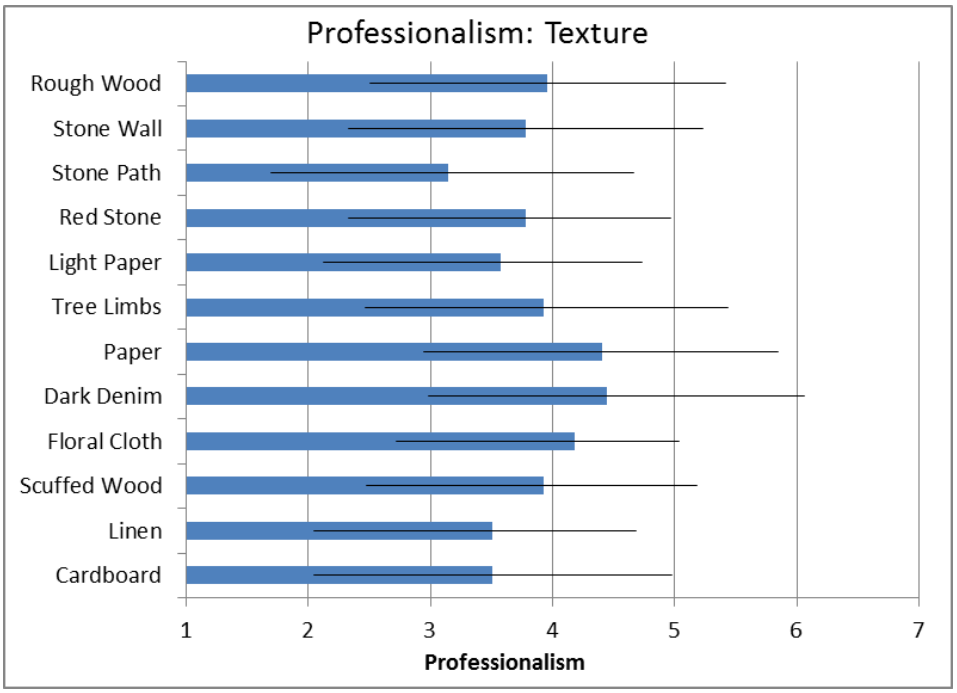

Figure 19. Mean Professionalism ratings for the Texture category of element examples (n = 558). Bars represent standard deviation.

The mean ratings for Professionalism for the Image category of element examples are presented in Figure 20. High Rise Building had the highest mean professionalism at 5.92 (SD = 1.00) and Man had the lowest at 3.17 (SD = 1.45).

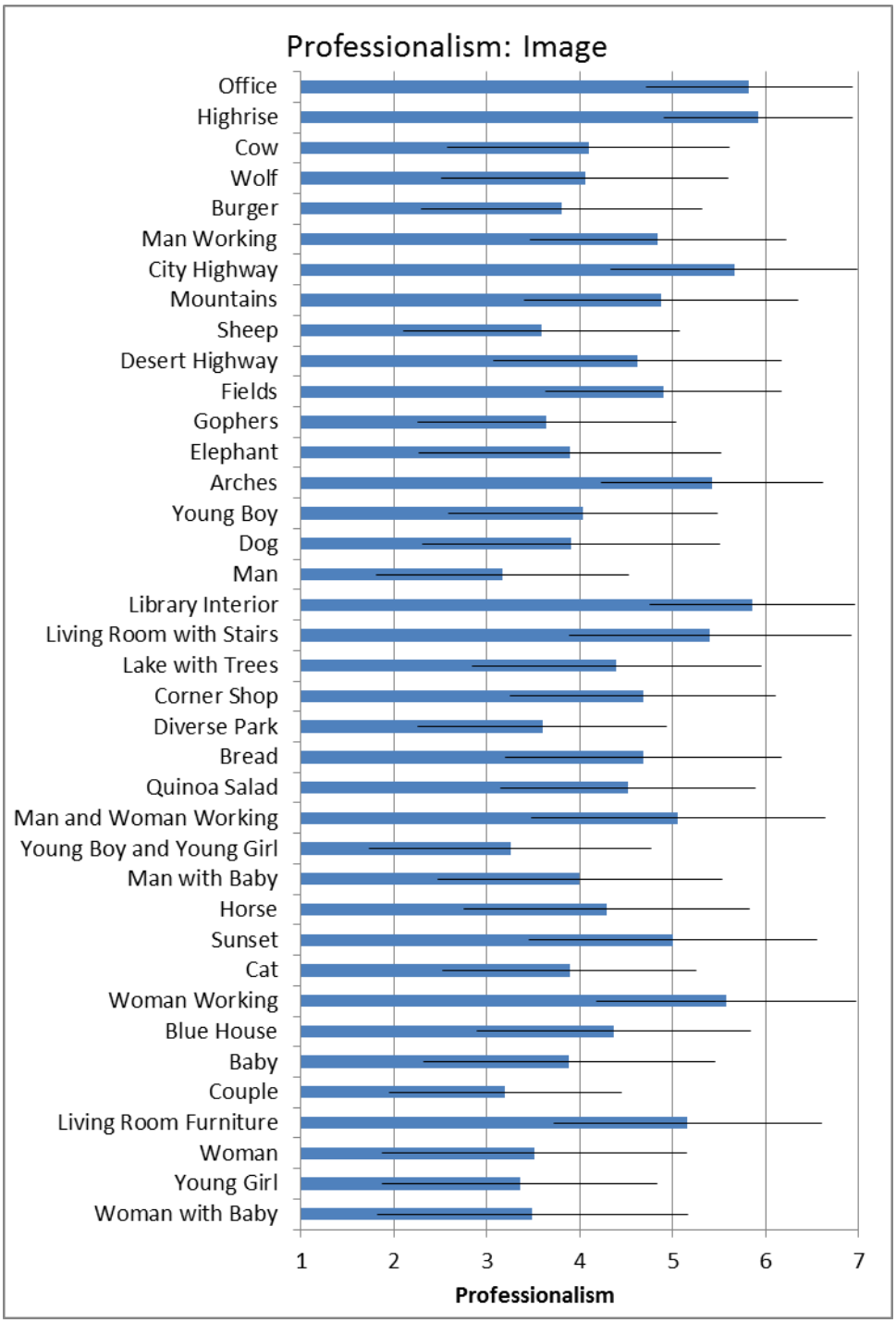

Figure 20. Mean Professionalism ratings for the Image category of element examples (n = 558). Bars represent standard deviation.

The mean ratings for Professionalism for the Color category of element examples are presented in Figure 21. Black had the highest mean professionalism at 5.92 (SD = 1.03) and Magenta had the lowest at 2.95 (SD = 1.37).

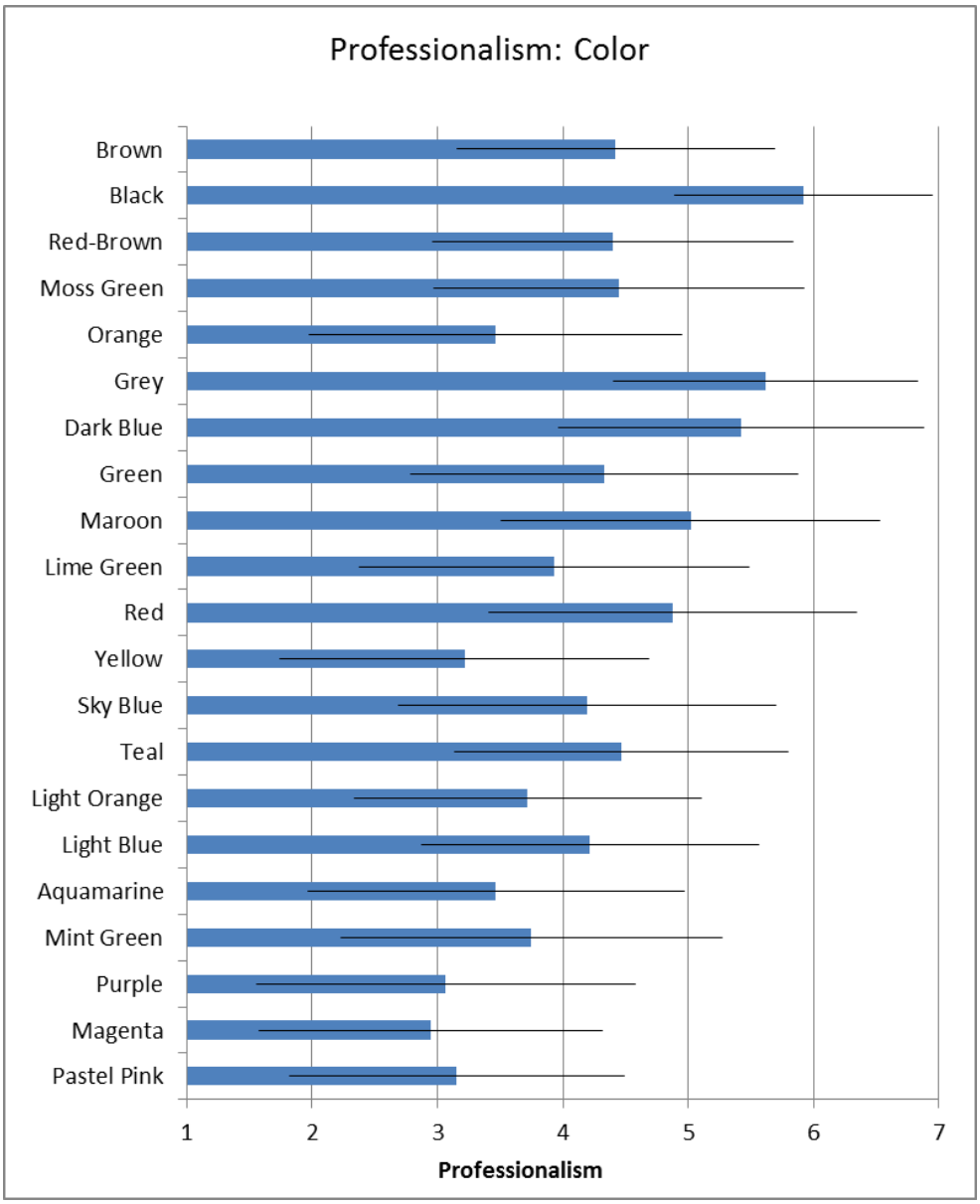

Figure 21. Mean Professionalism ratings for the Color category of element examples (n = 558). Bars represent standard deviation.

The mean ratings for Professionalism for the Mixed Elements category are presented in Figure 22. Black Thin Bookman had the highest mean professionalism at 5.73 (SD = 1.09) and Pink Thick Bookman had the lowest at 2.35 (SD = 1.58).

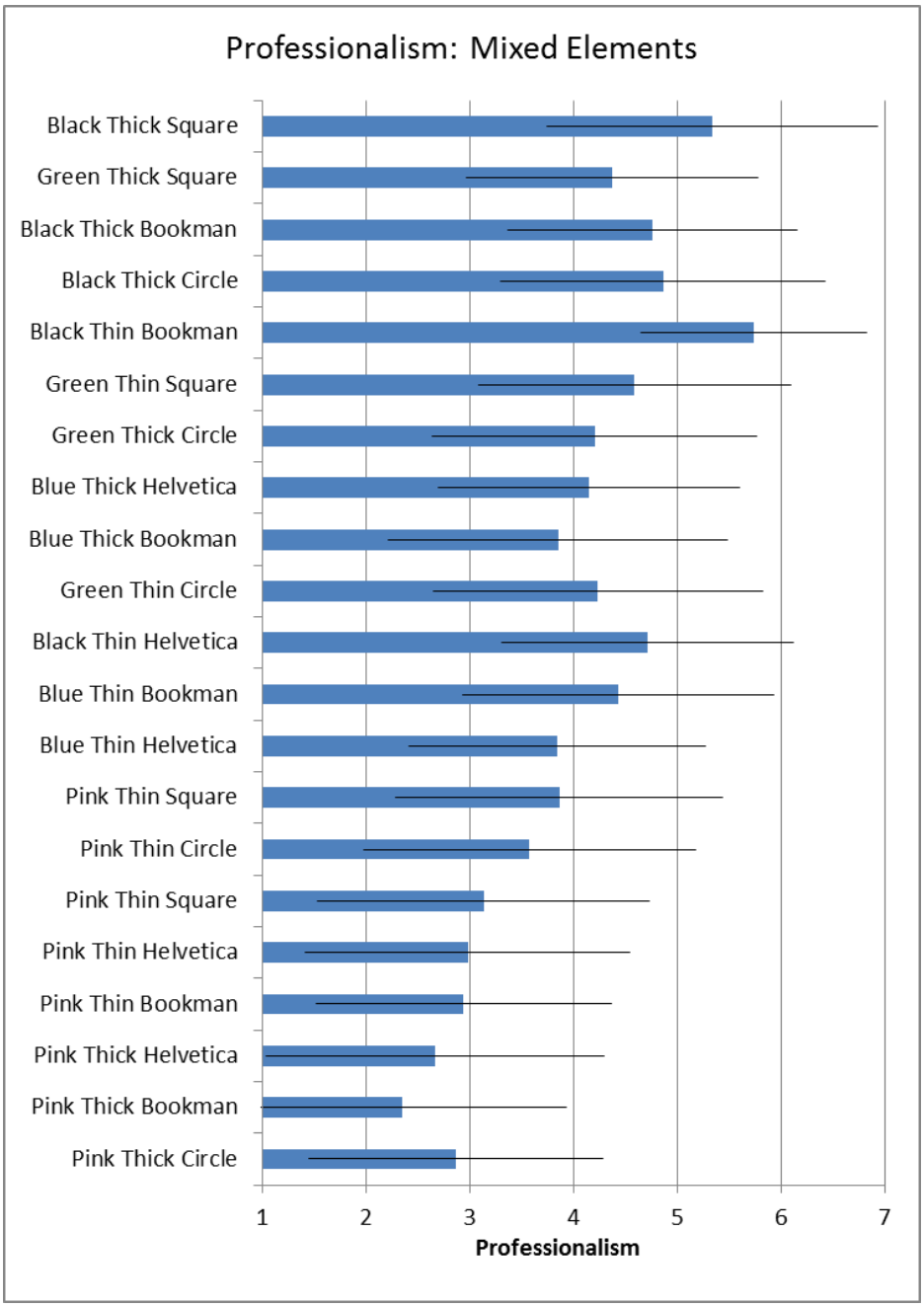

Figure 22. Mean Professionalism ratings for the Mixed Elements category of element examples (n = 558). Bars represent standard deviation.

Correlations

Feminine Perceived Gender and Masculine Perceived Gender

Font ($r(16) = .93$. $N = 18$, $p < .0001$) showed a very strong negative correlation between MPG and FPG (Figure 23).

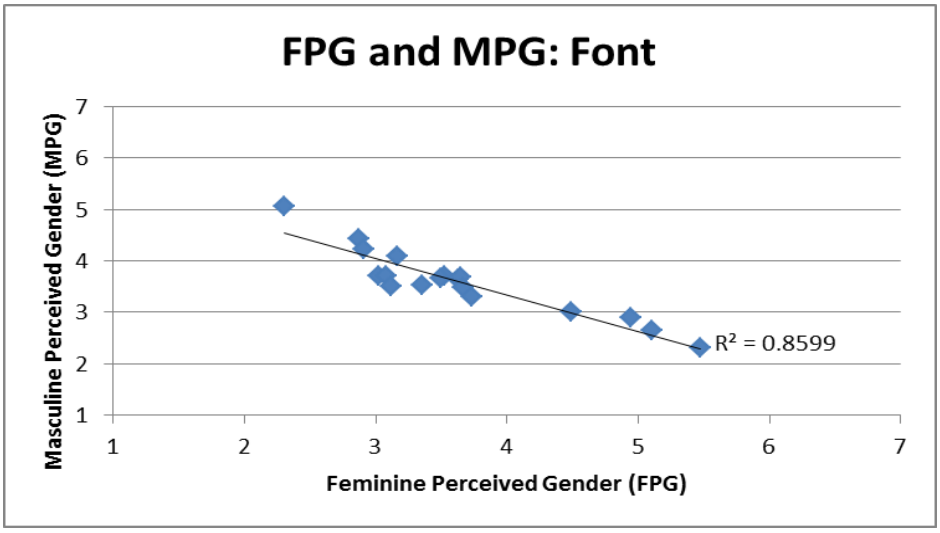

Figure 23. Correlation between MPG and FPG for the Font category of element examples.

Within Font, Script (r(3) = .95, N = 5, p <.0001) showed the strongest negative correlation between MPG and FPG followed by Serif (r(4) = .91, N = 6, p < .0001), and Sans Serif (r(5) = .67, N = 7, p = .0008) (Figure 24).

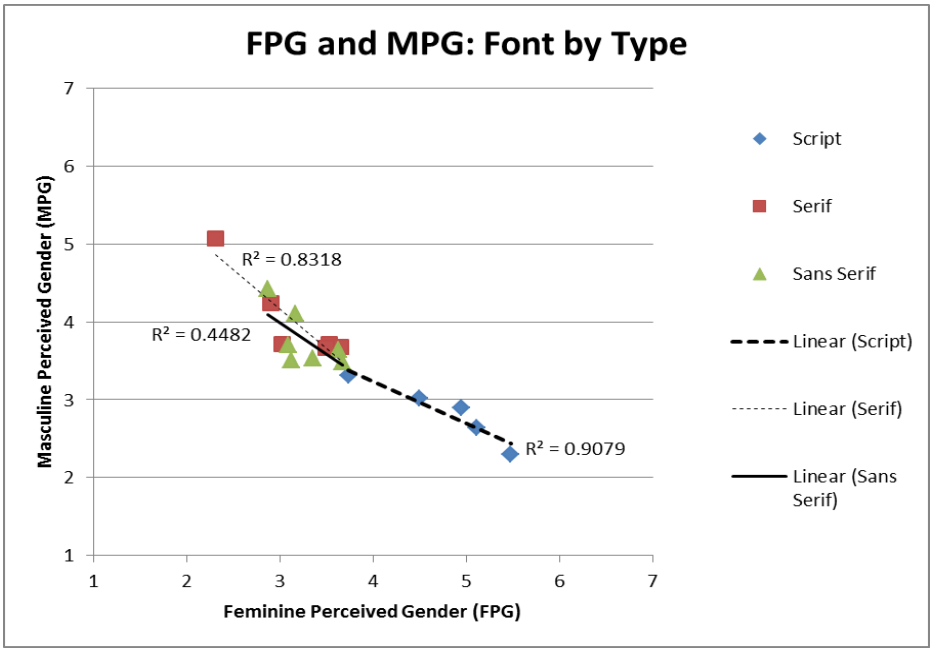

Figure 24. Correlation between MPG and FPG by Font Type (Script, Serif, and Sans Serif). "Linear" refers to the linear fit used to create the trend lines.

Shape (r(12) = .92, N = 14, p <.0001) exhibited a very strong negative correlation between MPG and FPG. The relationship between MPG and FPG for Shape is shown graphically in Figure 25.

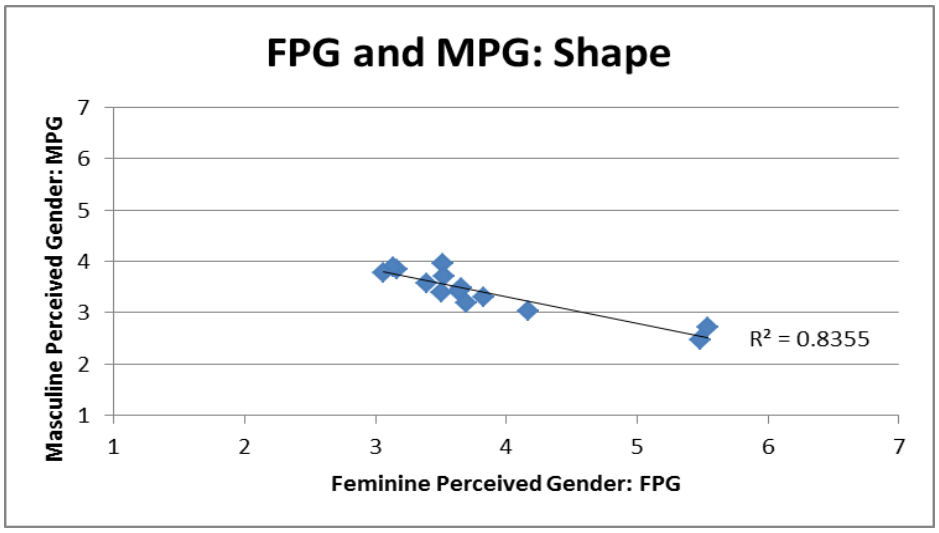

Figure 25. Correlation between MPG and FPG for the Shape category of element examples.

Texture (r(10) = .87, N = 12, p<.0002) showed a very strong negative correlation between MPG and FPG. The relationship between MPG and FPG is presented graphically in Figure 26.

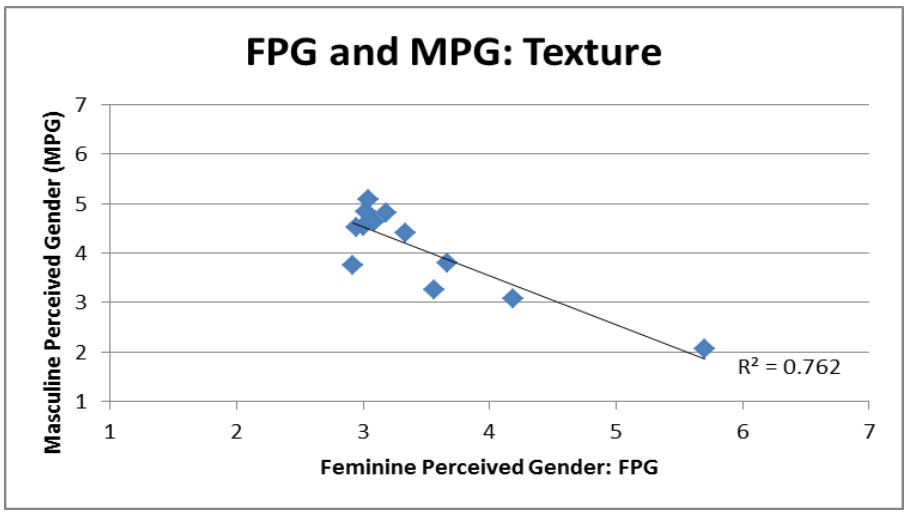

Figure 26. Correlation between MPG and FPG for the Texture category of element examples.

Image exhibited a strong negative correlation between MPG and FPG (r(36) = .75, N = 38, p <.0001). The relationship between MPG and FPG for Image is depicted visually in Figure 27.

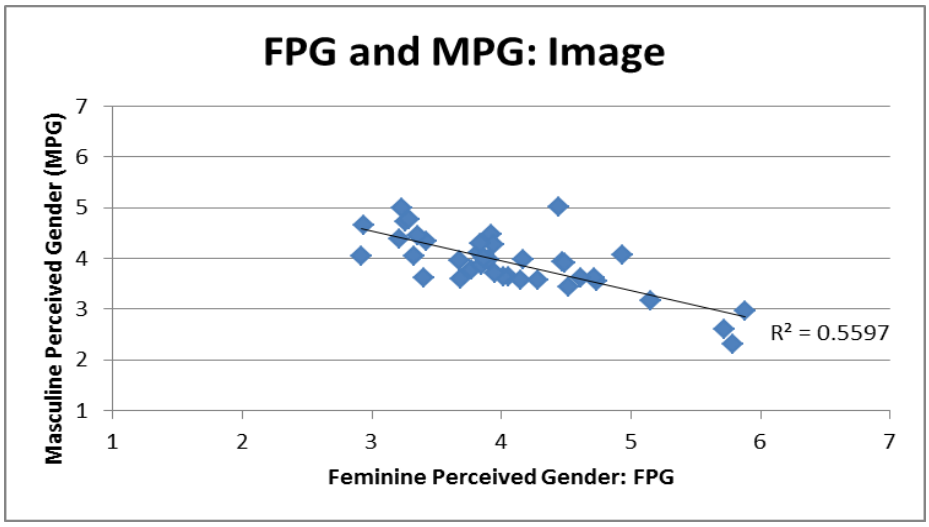

Figure 27. Correlation between MPG and FPG for the Image category of element examples.

Color showed a very strong negative correlation between MPG and FPG (r(19) = .91, N = 21, p <.0001). The relationship between MPG and FPG for Color is represented visually in Figure 28.

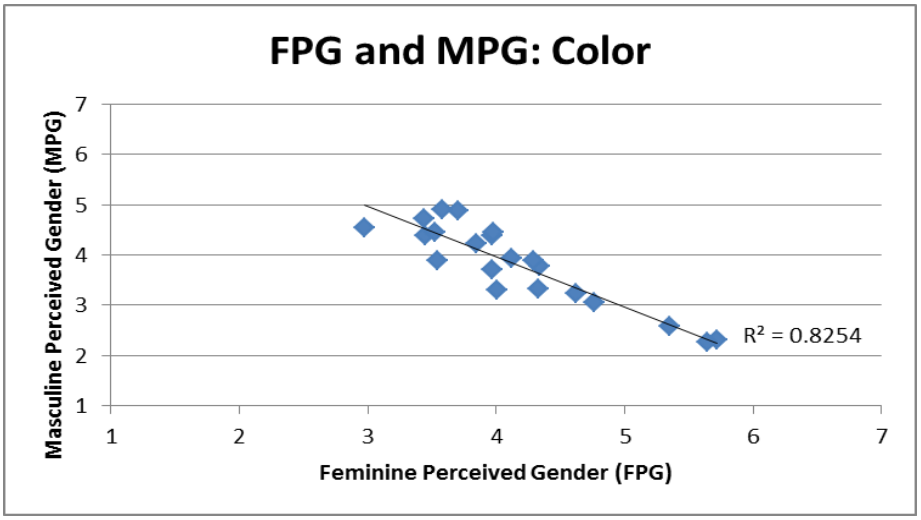

Figure 28. Correlation between MPG and FPG for the Color category of element examples.

Mixed Elements exhibited the strongest negative correlation (r(19) = .98, N = 21, p <.0001) between MPG and FPG. The relationship between MPG and FPG for Mixed Elements is shown in Figure 29.

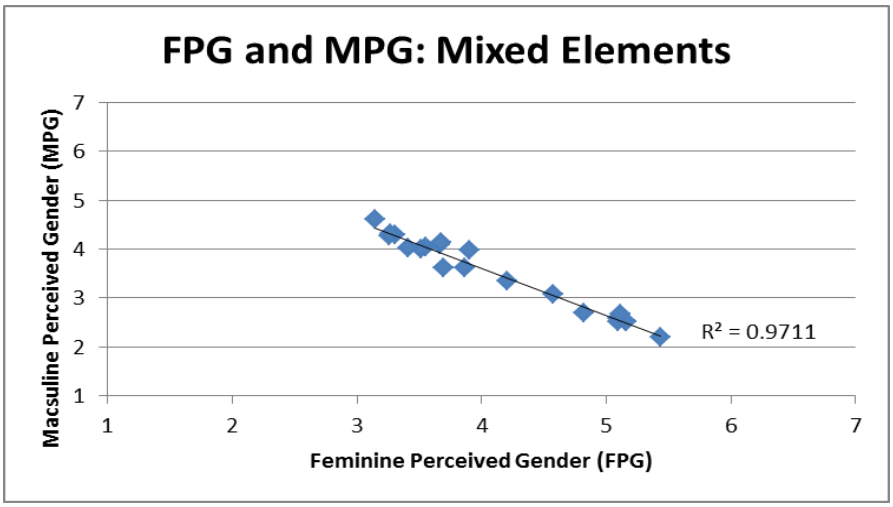

Figure 29. Correlation between MPG and FPG for the Mixed Elements category of element examples.

Perceived Gender and Professionalism

Font showed almost no positive correlation between Professionalism and MPG (r(16) = .17, N = 18, p = .51) (Figure 30). Similarly, there was almost no negative correlation between Professionalism and FPG (r(16) = .17, N = 18, p = .47) (Figure 30).

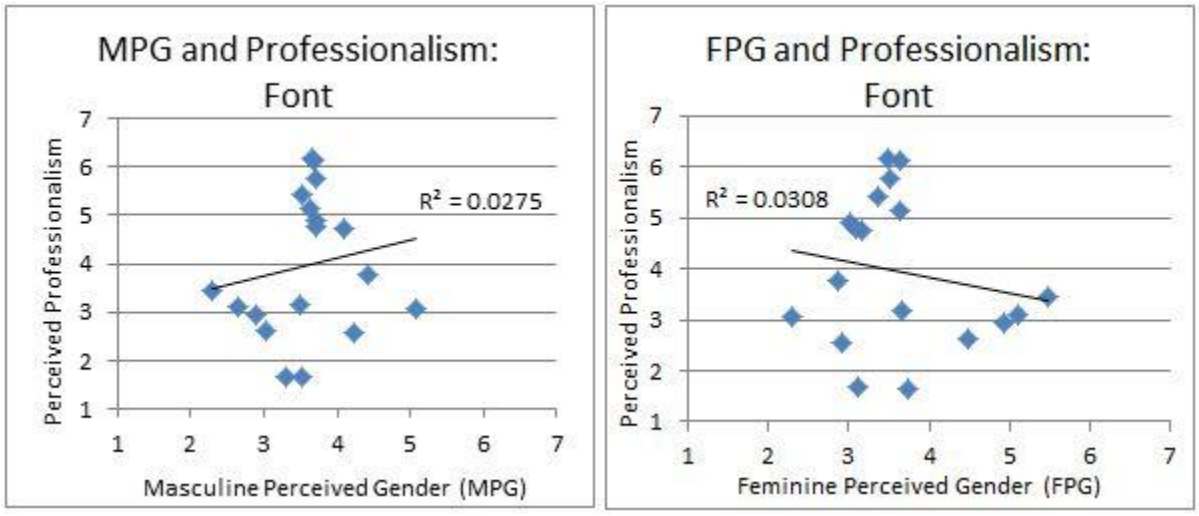

Figure 30. Correlations between Professionalism and MPG (left) and Professionalism and FPG (right) for Font.

Within the element of Font, Sans Serif fonts displayed little positive correlation between Professionalism and MPG ($r(5) = .14$, $N = 7$, $p = .54$) and a very weak correlation between Professionalism and FPG ($r(5) = .18$, $N = 7$, $p = .52$) (Figure 31). In contrast, Serif fonts exhibited a very strong negative correlation between Professionalism and MPG ($r(4) = .80$, $N = 6$, $p < .0002$) but a very strong positive correlation between Professionalism and FPG ($r(4) = .87$, $N = 6$, $p < .0002$) (Figure 31). Finally, Script fonts exhibited a very strong negative correlation between Professionalism and MPG ($r(4) = .93$, $N = 6$, $p < .0002$) but a very strong positive correlation between Professionalism and FPG ($r(4) = .99$, $N = 6$, $p < .0001$) (Figure 31).

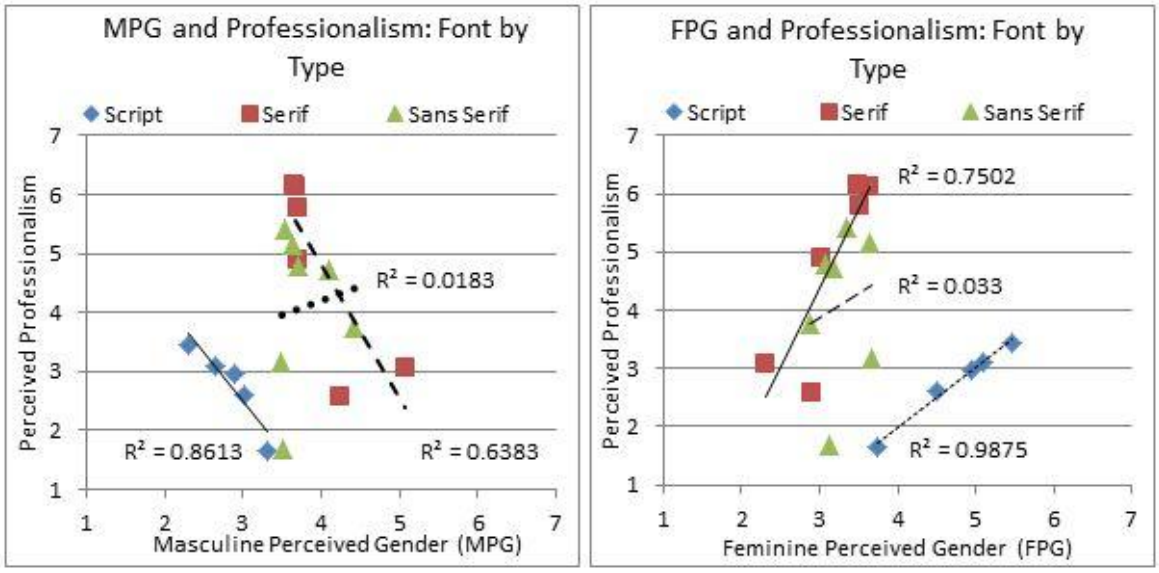

Figure 31. Correlations between Professionalism and MPG (left) and Professionalism and FPG (right) for Script, Serif, and Sans Serif fonts.

Shape showed a strong positive correlation between Professionalism and MPG ($r(12) = .63$, $N = 14$, $p = .015$) and a strong negative correlation between Professionalism and FPG ($r(12) = .77$, $N = 14$, $p = .0012$). The relationships between gender and professionalism for Shape are displayed in Figure 32.

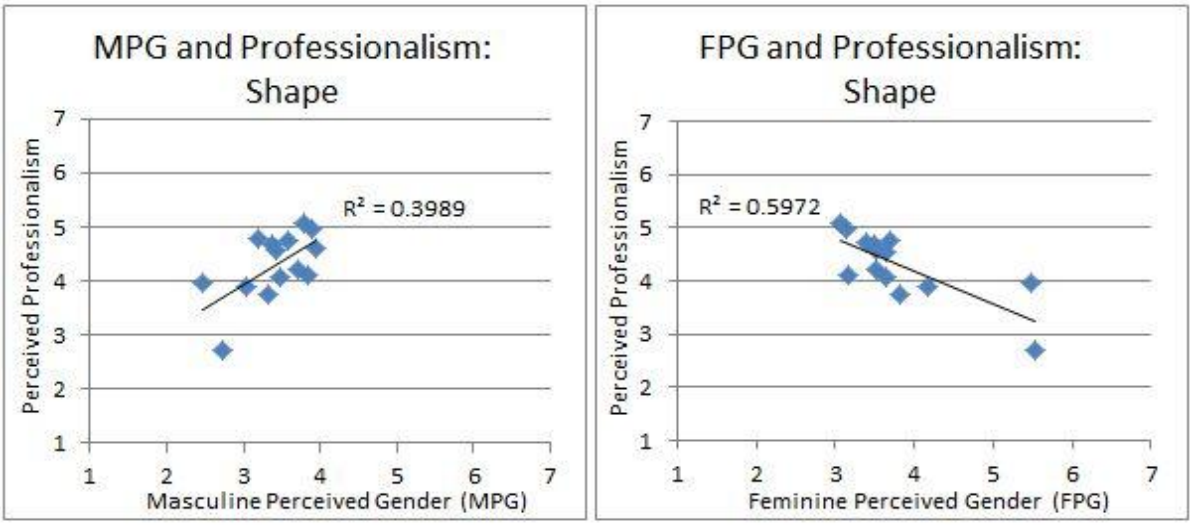

Figure 32. Correlations between Professionalism and MPG (left) and Professionalism and FPG (right) for Shape.

Texture exhibited very weak positive correlation between Professionalism and MPG ($r(10) = .17$, $N = 12$, $p = .57$) and a very weak negative correlation between Professionalism and FPG ($r(10) = .24$, $N = 12$, $p = .46$). The relationships between gender and professionalism for Texture are displayed graphically in Figure 33.

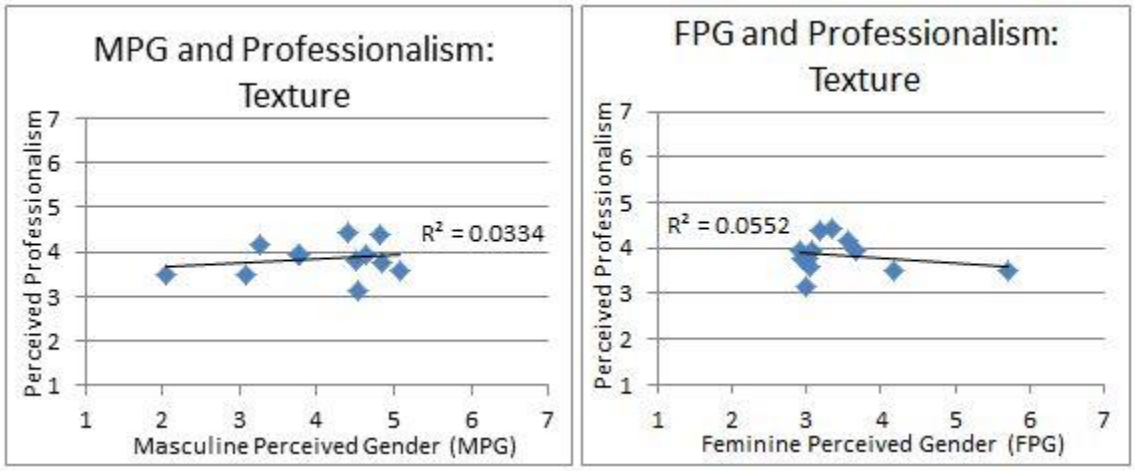

Figure 33. Correlations between Professionalism and MPG (left) and Professionalism and FPG (right) for Texture.

Image ($r(36) = .31$, $N = 38$, $p = .06$) exhibited a weak positive correlation between Professionalism and MPG and a weak negative correlation between Professionalism and FPG

(r(36) = .39, N = 38, p = .017). The relationships between gender and professionalism are shown graphically in Figure 34.

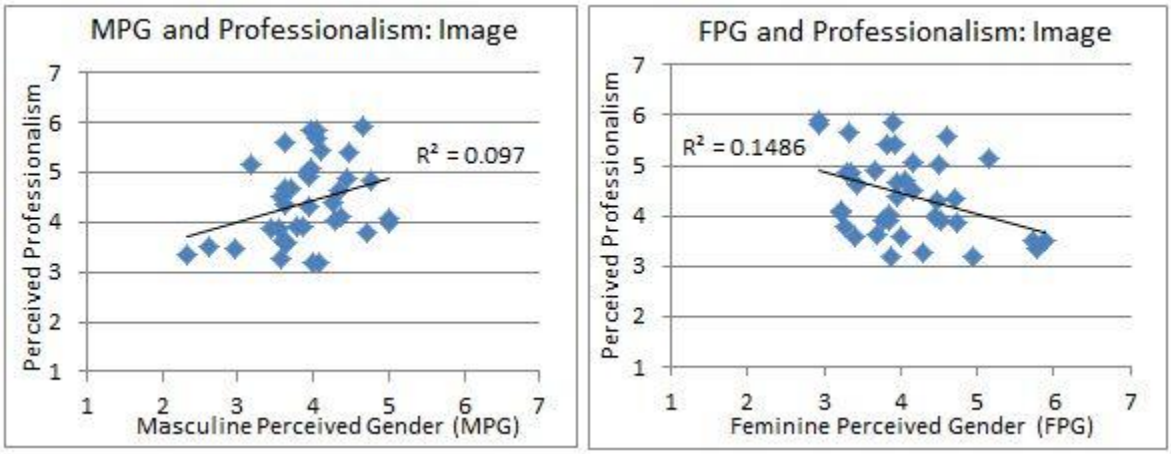

Figure 34. Correlations between Professionalism and MPG (left) and Professionalism and FPG (right) for Image.

Color showed a very strong positive correlation between Professionalism and MPG (r = .89, N = 21, p <.0001) and a strong negative correlation between Professionalism and FPG (r = .67, N = 21, p = .0008). The relationships between gender and professionalism for Color are presented graphically in Figure 35.

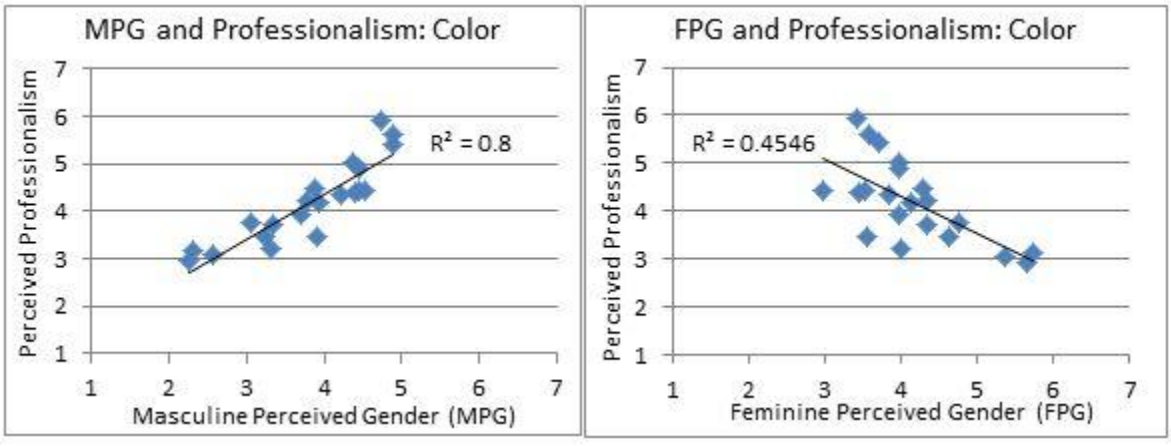

Figure 35. Correlations between Professionalism and MPG (left) and Professionalism and FPG (right) for Color.

Mixed Elements exhibited a very strong positive correlation between Professionalism and MPG (r = .87, N = 21, p <.0001) and a very strong negative correlation between

Professionalism and FPG (r = .91, N = 21, p < .0001). The relationships between gender and professionalism for Mixed Elements are shown graphically in Figure 36.

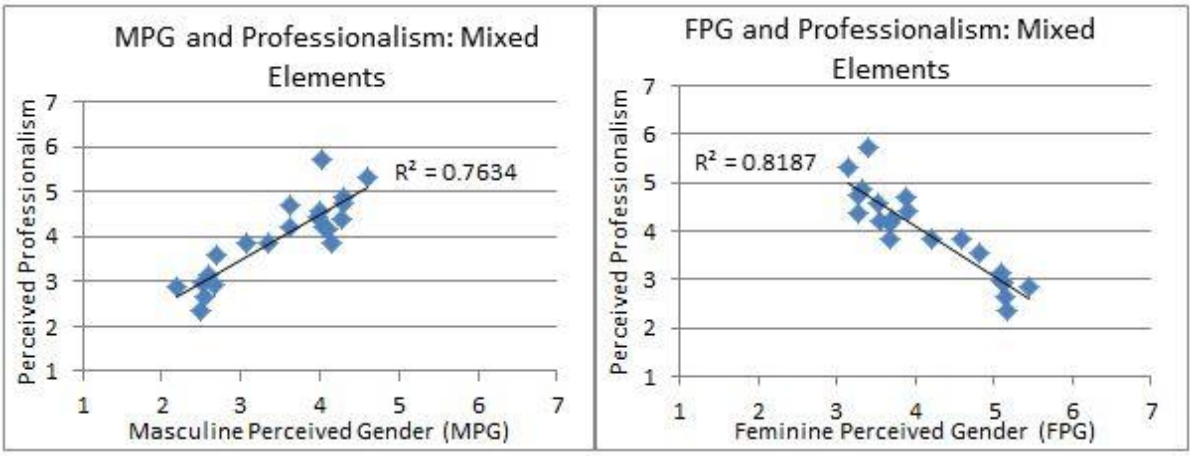

Figure 36. Correlations between Professionalism and MPG (left) and Professionalism and FPG (right for Mixed Elements.

Effects of Gender on FPG, MPG, and Professionalism

There were no significant differences by gender in the ratings of FPG, MPG, and Professionalism in Font, Texture, Color, Shape, or Mixed Elements. There was a significant difference (F(1, 74) = 5.53, p = .0214, d = .16) between men and women for MPG in the Image category with men assigning lower MPG values. There was no significant difference between men and women for FPG or Professionalism in the Image category.

Discussion

The results for FPG and MPG show that there are design elements which are distinctly masculine and feminine. The gendering of element examples tended to follow societal norms for what is considered masculine and feminine. Dark colors, angular shapes, rugged or business-like images, thick serif fonts, and wood or stone based textures were considered the most masculine (Figure 37).

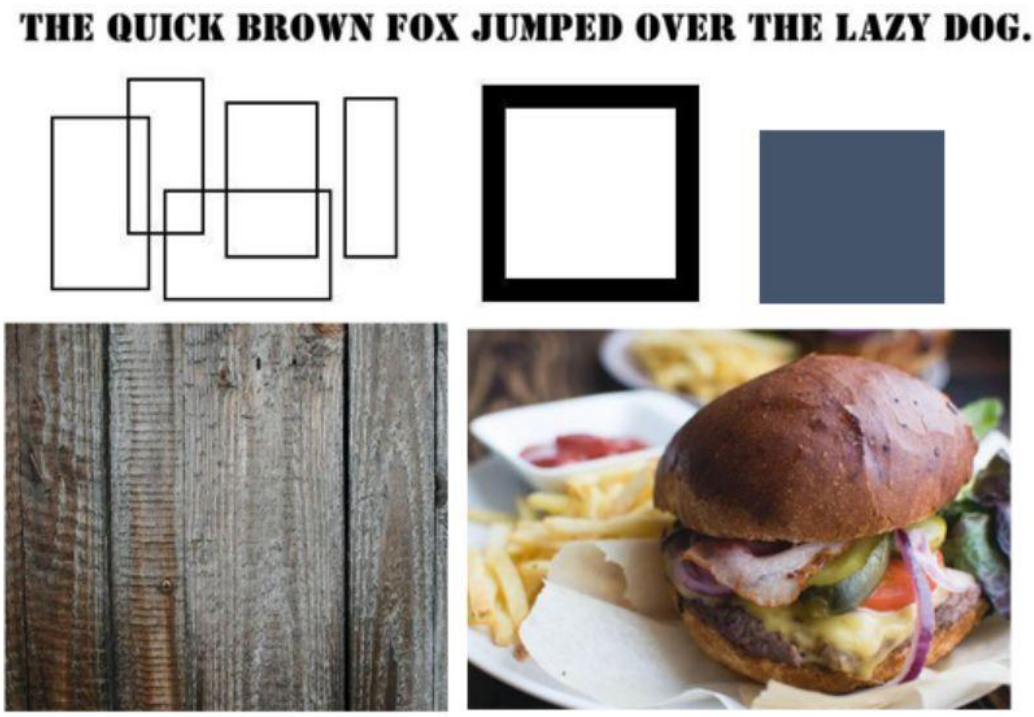

Figure 37. Font, Shape, Mixed Elements, Color, Texture, and Image that are considered highly masculine.

In contrast, light colors, curvy shapes, soft images, script fonts, and cloth based textures were considered the most feminine (Figure 38).

Figure 38. Mixed Elements, Font, Texture, Color, Shape, and Image that are considered highly feminine.

Design elements which are very much gender neutral also exist with FPG and MPG ratings in the middle of the scale. Overall, neutral elements tended toward sans serif fonts, simple textures, and animal or outdoor images. For the purpose of this study, gender neutrality is separated into three categories: low androgynous (undifferentiated), "Middle of the Road" androgynous and high androgynous (van Tilburg et al., 2015). Element examples which fall into the low androgynous category have simultaneously low FPG and MPG ratings and tended toward simplicity. Examples of low androgynous element examples include: the font Helvetica, images of animals such as elephants, sheep, and gophers, the texture of cardboard, and the color orange (Figure 39).

Figure 39. Font, Image, Texture, Color, Mixed Elements, and Shape which are considered low androgynous.

"Middle of the Road" androgynous elements have FPG and MPG scores within .15 of the mean. Examples in this category included: the font Times New Roman, textures such as light linen and paper, and images of general use buildings such as libraries. The "Middle of the Road" Neutral category of element examples was the smallest. This was likely due, in part, to its narrow definition.

Figure 40. Font, Image, Shape, and Color which are considered "Middle of the Road" Neutral.

Element examples in the high androgynous category have simultaneously high FPG and MPG and included: images including both men and women and colors such as sky blue and maroon (Figure 41). Like the “Middle of the Road” Neutral category, the Highly Androgynous category of element examples was quite small. Considering the very strong negative correlation between masculinity and femininity, it’s unsurprising that few elements are simultaneously very masculine and very feminine.

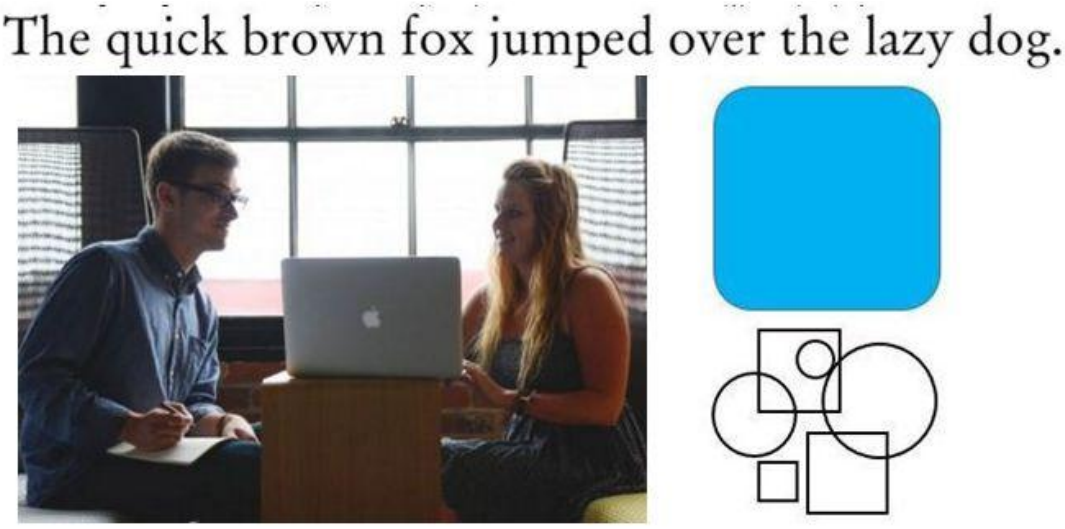

Figure 41. Font, Image, Color, and Shape which are considered Highly Androgynous.

In all of the six element categories, there was at least a moderate negative correlation between MPG and FPG. This result was largely expected due to the very strong negative correlation between masculinity and femininity observed by others using the same scales (Lieven et al., 2015; van Tilburg, at al., 2015). The highest negative correlation was observed in the Mixed Elements category. This could be due in part to the way the element examples were presented. In all categories except Mixed Elements, the examples were presented with no context or other elements. However, in the Mixed Elements category, examples from more than one category were presented together (such as a colored font). The mixing of two or more elements in the Mixed category provides more context in which to view the example and assign gender ratings. This result will be explored further in Study 2 where elements will be presented in the context of a full website.

In three of the six categories (Color, Mixed Elements, Shape), there was a strong to very strong positive correlation between Professionalism and MPG. That is, an element in those categories with a higher masculinity rating also had a higher professionalism rating. Similarly, the same three elements showed strong to very strong negative correlation between Professionalism and FPG – a higher femininity rating resulted in a lower professionalism rating. In these categories, the correlations between gender and professionalism are in line with the behavioral finding that femininity is considered less professional while masculinity is more professional (O'Neill & O'Reilly, 2011). Interestingly, the element which exhibited the least correlation between gender and Professionalism was Font – the fonts considered most professional were those which were rated most neutral in terms of FPG and MPG. This could have been an effect of the demographics of the participants: 87% of participants had received at least some college instruction where professional development advice (such as

fonts to use on professional documents) is common. Fonts often suggested for use in resumes and professional documents include: Helvetica, Garamond, and Times New Roman (Kitroeff, 2015) which were three of the four most professional fonts from the study. Further, while the Font category as a whole showed very weak positive correlation between Professionalism and MPG and very weak negative correlation between Professionalism and FPG, font types (Sans Serif, Serif, Script) within the category often showed the opposite correlation. The greatest of these contradictory correlations was between Professionalism and FPG for the Script font type. While as a whole the Font category exhibited very weak negative correlation between Professionalism and FPG, the Script fonts showed a nearly perfect *positive* correlation. Similarly, Script fonts exhibited a very strong negative correlation between Professionalism and MPG while as a whole Font exhibited a very weak positive correlation between Professionalism and MPG.

CHAPTER 4: GENDER, PROFESSIONALISM, WORKLOAD, AND USABILITY OF WEBSITES

This chapter is comprised of the methods, results, and discussion sections for Study 2: Gender, Professionalism, Workload, and Usability of Websites. Study 2 analyzed characteristics of websites (gender, professionalism, workload, usability, likability, and visual appeal) as well as interactions between characteristics (such as gender and professionalism and gender and usability). The results of Study 1 were used to inform the design of the eleven websites evaluated in Study 2.

Methods

Research Objectives

The objectives of the study were to:

- Determine if the perceived gender of the website matched the intended gender of the website
- Draw conclusions for the relationship between gender and professionalism (and compare those conclusions to those observed for elements in Study 1)
- Draw conclusions for the relationship between usability and gender, likability and gender, visual appeal and gender
- Determine which website gender participants like best (and least)
- Understand the effect of design elements in terms of how participants gender websites
- Understand what makes websites masculine, feminine, and gender neutral

Hypotheses

Study 2 had four hypotheses:

- H_1: Perceived website gender will match the designed gender of the website when that website is constructed using the categorized elements and themes from Study 1.
- H_2: There will be positive correlations between MPG and Professionalism, MPG and Usability, MPG and Likability, and MPG and Visual Appeal.
- H_3: There will be negative correlations between FPG and Professionalism, FPG and Usability, FPG and Likability, and FPG and Visual Appeal.
- H_4: Gender Neutral websites will be preferred over highly gendered sites with Highly Androgynous websites being the most preferred.

Participants

The study included 275 participants (200 female and 75 male) who were recruited from Iowa State University and social media. Participants from Iowa State were recruited via a mass email to all student, faculty, and staff university email addresses. Participants ranged in age from 18 to 75 years (mean = 33.1, SD = 15.4). 97.8 % of participants reported English as the language they are most comfortable speaking and 96.4% identified their native country as the United States. Participants were not offered compensation.

Task

Participants were shown a static image of a website screenshot (Figure 42) and asked to complete a short task using the information on the page. Each website was designed using the results of Study 1 with the intention of manipulating the combination of perceived masculinity and perceived femininity.

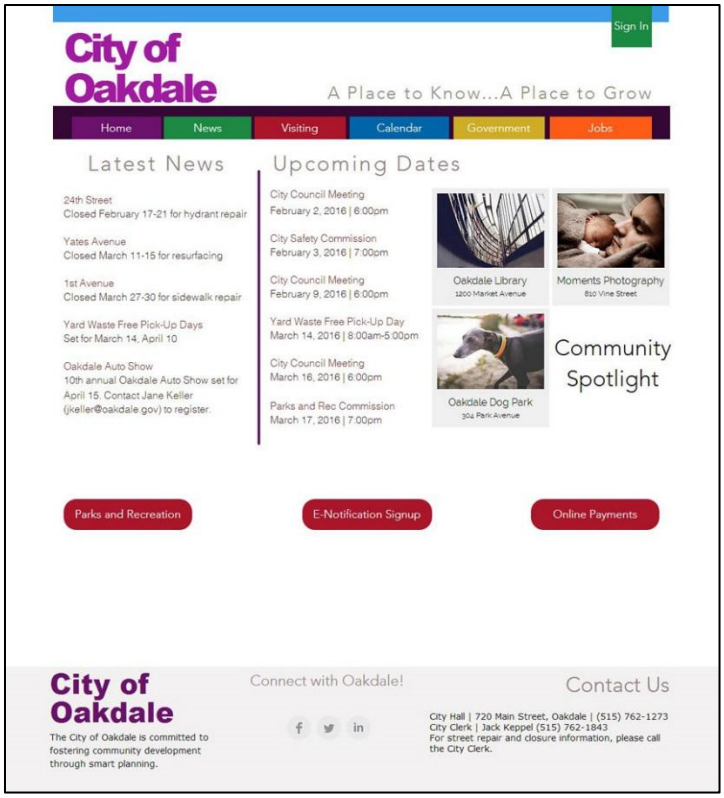

Figure 42. Screenshot of one of the 11 websites used in Study 2.

The tasks participants completed consisted of reading a question about the website, locating the information, and entering it into a text-box. The questions asked about each website are listed in Table 12.

Table 12. Tasks completed on each website.

Website	*Task*
Website 1	What upcoming event is happening on November 16, 2016?
Website 2	Who should you contact to register for the Children's Pet Show?
Website 3	What is located at 620 Highway 63?
Website 4	On what date is the Oakdale Auto Show?
Website 5	Which street is closed March 12-15 for curb repair?
Website 6	What is the address of sunshine daycare?
Website 7	On which day in March is the Yard Waste Free Pick-Up Day?
Website 8	Who should you contact to register for the Oakdale Auto Show?
Website 9	What is located at 901 9th Street?
Website 10	Which street is closed November 9-15 for resurfacing?
Website 11	Which street is closed March 11-15 for repairs?

Website Development

For the study, a series of 11 websites were designed. The topic of the websites was chosen to be a city webpage through pilot testing. Participants in the pilot study were presented with five website concepts: a website for a city, a website for a school, a website for a library, a product website for coffee mugs, and a product website for office supplies. Each of the concepts was rated on its masculinity and femininity with the most neutral concept being the city website.

Ten of the 11 websites were designed to fall into 5 gender categories: Feminine, Masculine, Low Androgynous (or Undifferentiated), Highly Androgynous, and "Middle of the Road" Neutral. Four of the 5 categories (Feminine, Masculine, Low Androgynous (Undifferentiated), and Highly Androgynous) are derived from the work of van Tilburg et al. (2015) which categorized product gender according to the medians of the gender variables

FPG and MPG. In that work, Feminine products had FPG values above the median for FPG and below the median for MPG. Similarly, Masculine products had FPG values below the median for FPG and MPG values above the median for MPG. Highly Androgynous products had FPG and MPG values above the median. Finally, Low androgynous or undifferentiated products had values below the median for both FPG and MPG (Bem, 1974; Bem, 1977; Spence, Helmreich & Stapp, 1974; Spence et al., 1975). In Study 1, design element examples were classified by their FPG and MPG into gender categories. The elements in each category as well as the themes among the elements were used to construct the websites for Study 2 into those same categories. The same definitions of the gender categories are used for the websites in Study 2. The 5th category, "Middle of the Road" Neutral, was added to account for elements whose FPG and MPG values were within .15 of the median. The categories are shown graphically in Figure 43.

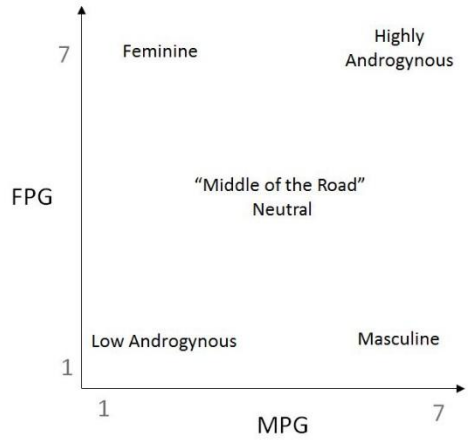

Figure 43. Categories of gender and their relative positions on the FPG and MPG scales.

Websites were designed intentionally with these categories in mind using the results of Study 1 as guidance. A summary of the element examples and themes used to construct each website type is presented in Table 13.

Table 13. Themes used to construct the 11 websites in Study 2.

Website Gender	*Colors*	*Fonts*	*Images*	*Textures*	*Shape and Line*
Feminine (2 Websites)	Pinks, purples, pastels, and light colors	Script, thin, embellished, delicate	Women, children, home and domestic items	Fabrics, florals, fine or smooth textures	Thin lines, scrolls, embellishments, curvilinear shapes
Masculine (2 Websites)	Grey, black, brown, and dark colors	Serif, thick, blocky, bold	Men, wild animals, rugged nature, business	Wood, stone, rough textures	Thick lines, angular shapes
Low Androgynous (2 Websites)	Very limited color palette, white, light grey, blue	Classic, simple fonts, Times New Roman, Arial	Parks, docile animals, simple images	No texture or subtle paper-like textures	Few embellishments, minimal extraneous lines, rounded corners
High Androgynous (2 Websites)	Bright, contrasting colors, colorful, teal, yellow, red/maroon	Sans Serif, bold, large	Men and women, families (including more than one gender)	No texture	Angular shapes, rounded corners
"Middle of the Road" Neutral (2 Websites)	Green, yellow, natural colors, limited color palette	Serif fonts, classic fonts such as Times New Roman	General use buildings, libraries, schools, nature	No texture or subtle paper/cloth textures	Mix of angular and curvilinear shapes, rounded edges
Gender Incongruent (1 Website)	Pinks, purples, white	Thick, blocky, bold fonts	Wild animals, rugged nature, business	Stone	Thick lines, angular shapes

The resulting websites may be seen in Figure 43. Large screenshots of each website may be found in Appendix B. The 11th website was designed specifically to be gender discordant, that is, exhibiting highly gendered design elements which do not seem to fit together. This approach differs from the highly androgynous websites in that highly androgynous websites do not make extensive use of highly gendered design elements. The 11th website was designed and included in the study for three purposes: to understand how participants react to gender discordance as opposed to high androgyny, to understand the differences between high androgyny and gender discordance, and to illustrate the importance of color when determining a website's gender.

1. "Middle of the Road" Neutral

2. Feminine

3. Highly Androgynous

4. Masculine

5. Low Androgynous

6. Feminine

7. Masculine

8. Highly Androgynous

9. Low Androgynous

10. "Middle of the Road" Neutral

11. Gender Discordant

Figure 44. Scaled-down screenshots of the 11 websites in Study 2.

Independent Variable

The study included one independent variable: *Website Gender*. Website Gender was comprised of five levels: Highly Masculine, Highly Feminine, Highly Androgynous, "Middle of the Road" Neutral, and Low Androgynous (Table 14). The Gender Discordant website (Website 11) was exploratory and not included in the main analysis.

Table 14. Femininity and Masculinity of website design elements by website gender.

Website Gender	*Femininity of Design Elements*	*Masculinity of Design Elements*
Highly Masculine	LOW	HIGH
Highly Feminine	HIGH	LOW
Highly Androgynous	HIGH	HIGH
"Middle of the Road" Neutral	MIDDLE	MIDDLE
Low Androgynous	LOW	LOW

Dependent Variables

There were seven dependent variables in Study 2: *Gender*, *Professionalism*, *Workload*, *Usability*, *Likability*, *Visual Appeal*, and *Preference*. The dependent variables were measured as shown in Table 15.

Table 15. Dependent variables and their metrics - Study 2.

Variables	**Metric**	**Measurement (Unit)**	**Frequency**	**Data Type**
Gender	Feminine Perceived Gender (FPG)	Likert Scale 1-7	Once per website	Subjective
	Masculine Perceived Gender (MPG)	Likert Scale 1-7	Once per website	Subjective
Professionalism	Professionalism Rating	Likert Scale 1-7	Once per website	Subjective
Workload	NASA TLX	TLX scale 0-60	Once per website	Subjective
Usability	Readability	Likert Scale 1-7	Once per website	Subjective
	Ease of completing task	Likert Scale 1-7	Once per website	Subjective
	Ease of finding information	Likert Scale 1-7	Once per website	Subjective
	Satisfaction with time to complete task	Likert Scale 1-7	Once per website	Subjective
Likability	Likability	Likert Scale 1-7	Once per website	Subjective
Visual Appeal	Visual Appeal	Likert Scale 1-7	Once per website	Subjective
Preference	Preference	Website Choice	Once after all trials	Subjective
	Qualitative Response	Theme Frequency	Once after all trials	Subjective

Gender. Gender is measured subjectively after each website and is composed of two metrics: Feminine Perceived Gender (FPG) and Masculine Perceived Gender (MPG). FPG is a measure of how feminine an element is perceived to be, and is measured on a 1-7 Likert scale where 1 is "Not Feminine at All" and 7 is "Very Feminine". MPG is a measure of how masculine an element is perceived to be, and is measured on a 1-7 Likert scale where 1 is "Not Masculine at All" and 7 is "Very Masculine".

Professionalism. This metric is measured subjectively after each website to determine participants' perceptions of a website's appropriateness for a business setting. It is measured on a 1-7 Likert scale where 1 is "Unprofessional" and 7 is "Professional".

Workload. Workload is measured subjectively after each website by using the six question NASA TLX survey. The TLX survey is used to measure Mental Demand, Physical Demand, Temporal Demand, Performance, Effort, and Frustration on a 10-point scale for a total workload on a 0-60 point scale (Hart & Staveland, 1988). The NASA TLX questionnaire may be found in Appendix C.

Usability. Usability is measured subjectively after each website to determine how usable participants found a website. It included four components rated on a 1-7 Likert scale where 1 is "Strongly Disagree" and 7 is "Strongly Agree". The four components were:

- I am satisfied with the ease of completing tasks on this website
- It was easy to find the information I needed
- Characters on the screen were readable
- I am satisfied with the amount of time it took to find what I needed

The full text of the Usability questions may be found in Appendix D.

Likability. This metric is measured subjectively after each website to determine how much participants liked a website. It included one question ("I liked this website") which was evaluated on a 1-7 Likert scale where 1 is "Strongly Disagree" and 7 is "Strongly Agree".

Visual Appeal. Visual Appeal is measured subjectively after each website to determine how beautiful participants found a website. It included one question ("Please rate the visual appeal of the website.") which was evaluated on a 1-7 Likert scale where 1 was "Ugly" and 7 was "Beautiful".

Preference. Preference is measured subjectively after all websites have been evaluated to determine which of the websites participants preferred most and least. It included four questions on the post-experiment questionnaire: "Which website did you like the most?", "Why did you like that website the most?", "Which website did you like the least?, and "Why did you like that website the least?" (Appendix E).

Post-experiment Questionnaire. The study also collected data on perceptions of gender and design as part of the post-experiment survey. After completing the questions for preference, participants were asked to describe what most affected their perceptions of femininity and masculinity when viewing the websites. They were also asked to provide three ways in which they thought a website could be made more feminine, masculine, and gender neutral. Finally, participants were asked to rank 5 design elements (Color, Font, Images, Texture, and Shape and Line) in order of their effect on how they determined a website's masculinity and femininity (Appendix E).

Experimental Design and Testing Environment

The experiment was a 1 x 5, within-subjects, repeated measures design. The experiment was in the form of a survey. Each participant received all 11 websites in random order using Qualtrics' built-in randomization function. The experiment took place on each participant's personal electronic device (desktop computer, laptop computer, tablet, smart phone) using their own internet connection.

Procedure

An outline of the experimental procedure may be found in Table 16.

Table 16. Experimental procedure for Study 2.

Experimental Procedure	
1. Informed Consent	
2. Pre-experiment Questionnaire	
3. *Experiment* (Items a-f are repeated 11 times – once for each website)	a. Presentation of Website
	b. Task
	c. TLX
	d. Gender
	e. Professionalism
	f. Usability, Likability, Visual Appeal
4. Post-experiment Questionnaire	

The experiment began when the participant clicked the link to the Qualtrics survey which was sent to them via email. Participants first read the informed consent document and provided consent electronically. After providing consent, they were asked to complete the pre-experiment questionnaire (Appendix G) which asked for their demographic information and web use habits. The first question of the pre-survey asked for the participant's age – if an age under 18 was reported, the survey closed immediately. Once the pre-experiment questionnaire was completed, a page with directions for completing the survey was shown. The page also included common definitions of femininity, masculinity, and professionalism. After the directions, the participant was shown the first website and asked to complete a task.

The task involved finding a piece of information on the site and entering it into a text box. Once the task was finished, the participant completed the NASA TLX questionnaire. Following the TLX, the participant rated the website's gender, professionalism, usability, likability, and visual appeal. The task, TLX, gender, professionalism, usability, likability, and visual appeal process was completed 11 times – once for each website. Once the participant had rated the final website, they were given the post-experiment questionnaire where they were asked to provide information about their favorite and least favorite websites as well as their perceptions about gender and design. After finishing the post-experiment questionnaire, the participant was thanked for their time and the survey closed.

Data Analysis

For all results in Study 2, an alpha level of .05 is considered to be significant. A very strong correlation is defined as $.80 \leq r \leq 1.0$, strong correlation is defined as $.60 \leq r \leq .79$, moderate correlation is defined as $.40 \leq r \leq .59$, weak correlation is defined as $.20 \leq r \leq .39$, and very weak or no correlation is defined as $0.0 < r \leq .19$.

Individual ratings will be averaged to determine the FPG, MPG, and Professionalism of each website and website category. ANOVA will be performed for all dependent variables. Tukey post-hoc tests will determine significance among the dependent variables for pairwise comparisons between website gender categories. Cohen's d was used to evaluate effect size, where d>0.8 is a large effect, d>.05 is a medium effect, and d>.2 is a small effect. Correlations between FPG and MPG, FPG and Professionalism, and MPG and Professionalism will be performed. Correlations between FPG (MPG) and Usability, FPG (MPG) and Likability, and FPG (MPG) and Visual Appeal will also be performed. Qualitative data will be analyzed to produce frequency counts and themes.

Limitations and Assumptions

One limitation of the study is the design of the websites. It has been shown that men and women design differently and with a bias toward their own gender (Moss et al., 2006), and for this experiment, all websites were designed by a woman. The gender of the designer could have imparted an unintended bias onto the websites in the study. Furthermore, the designer was not a web design professional and the limitations of her design skills may have influenced the participants' perceptions of the websites. However, this was mitigated through rounds of pilot testing and re-designing of the websites. The designs of the websites were also based on the results of Study 1. Finally, the websites were all derived from the same basic layout. This was a deliberate choice to mitigate the confounding effects of varying layouts. However, the gender effects of website layout were not examined or considered in the study.

A further limitation related to the design of the websites in the study is the limited application of design principles in their creation. The principles of graphic design are: alignment, balance, contrast, repetition, proximity, and space (Williams, 2008). Graphic design principles govern the relationships among design elements and provide organization and overall structure for the piece (Williams, 2008). The designs of the websites in the study did not consistently apply all of the principles. Proper application of design principles affects perception and usability (Watzman, 2007). Therefore, the inconsistent application of the principles could have affected measurements for usability, workload, and visual appeal.

The study was not conducted in a strictly controlled environment. Participants completed the study on their own time, using their own devices, and in the environment of their choice. The choice to conduct the experiment this way was made to ensure a large

number of participants from a variety of backgrounds. However, the lack of control over the testing environment could have affected the motivation of the participants.

Results

Gender: FPG and MPG

The websites in the study were designed to fall into five gender categories: Highly Feminine, Highly Masculine, Highly Androgynous, Low Androgynous, and "Middle of the Road" Neutral. Websites 2 and 6 (Highly Feminine), 4 and 7 (Highly Masculine), and 5 and 9 (Low Androgynous) were ranked by participants into the categories in which they were designed (Figure 45). Websites 3 and 8 were designed to be Highly Androgynous, but were perceived to be Low Androgynous. Similarly, websites 1 and 10 were designed to be "Middle of the Road" neutral, but were also perceived as Low Androgynous. As such, no websites were ranked as Highly Androgynous or "Middle of the Road" Neutral. The Gender Discordant website (Website 11) was rated as feminine, but much less feminine than the websites designed in the Feminine category.

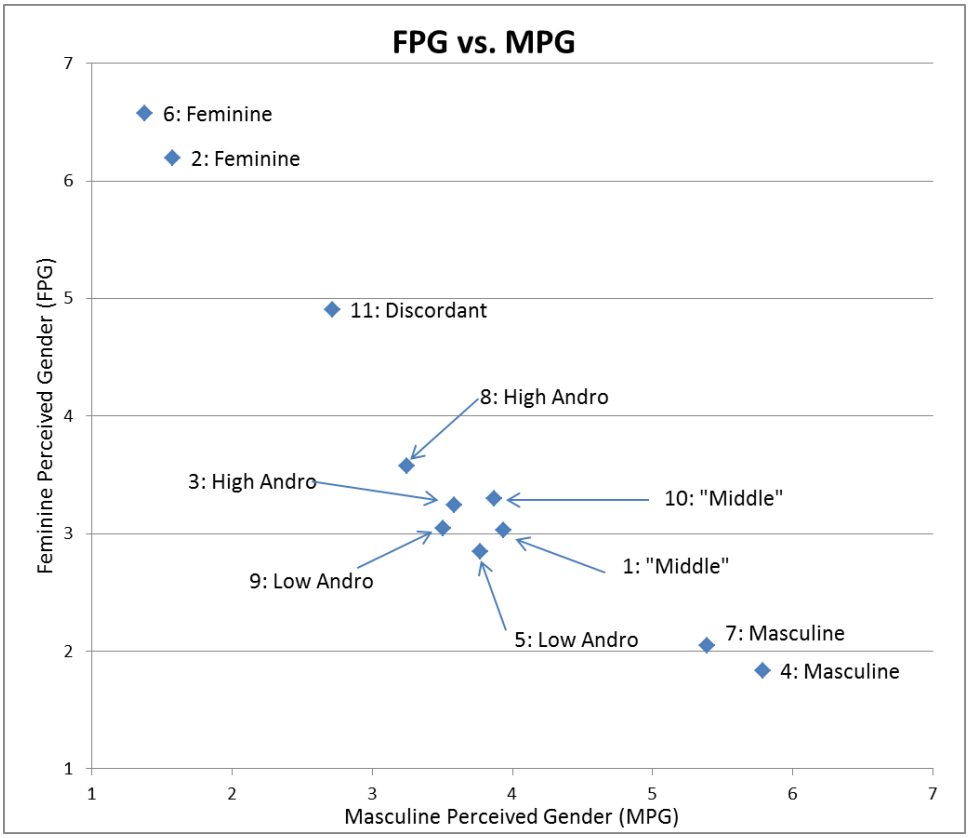

Figure 45. Placement of each website on the FPG and MPG scales.

The mean FPG and MPG ratings for each website gender category are presented graphically in Figure 46. For FPG, the difference between each category was significant ($F(5, 2975) = 852$, $p < .0001$, $d = 1.48$) with Feminine websites receiving the highest FPG ratings followed by Highly Androgynous websites. Similarly, the difference between each website category was significant ($F(5, 2977) = 616$, $p < .0001$, $d = 1.28$) for MPG with Masculine websites receiving the highest MPG ratings followed by "Middle of the Road" Neutral websites.

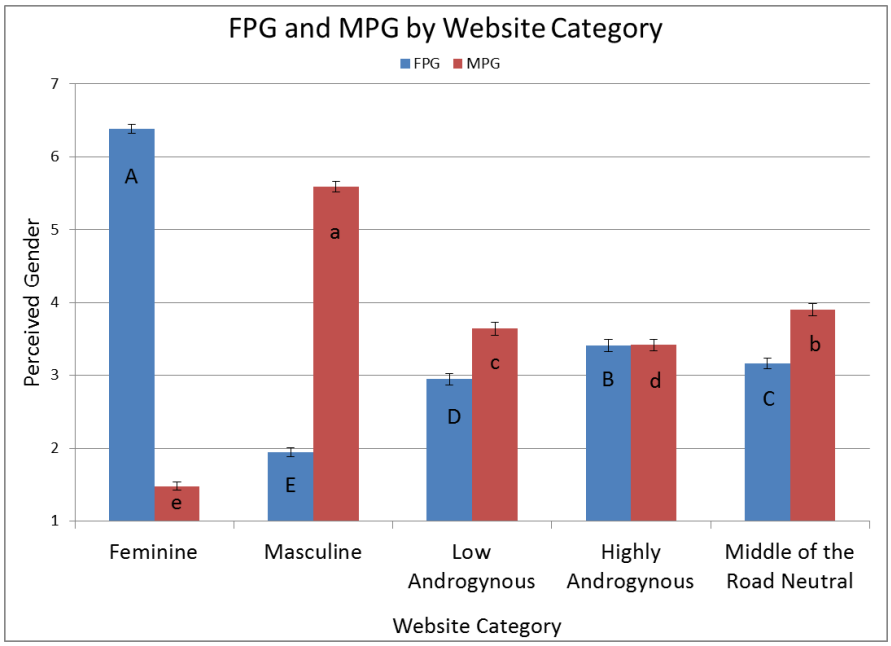

Figure 46. Mean FPG and MPG by Website Gender (n = 550). Website categories within the same series not connected by the same letter are significantly different. Bars represent standard error.

The mean FPG and MPG ratings for each website individually are presented graphically in Figure 47. Website 2 and Website 6 were perceived as the most feminine with mean FPG ratings of 6.20 (SD = 1.08) and 6.57 (SD = 1.38) respectively. Website 4 and Website 7 were perceived as the most masculine with MPG ratings of 5.79 (SD = 1.19) and 5.39 (SD = 1.36) respectively. Website 10 was perceived as the most neutral (closest to the midpoint of the scale) with a mean FPG of 3.30 (SD = 1.33) and a mean MPG of 3.89 (SD = 1.35).

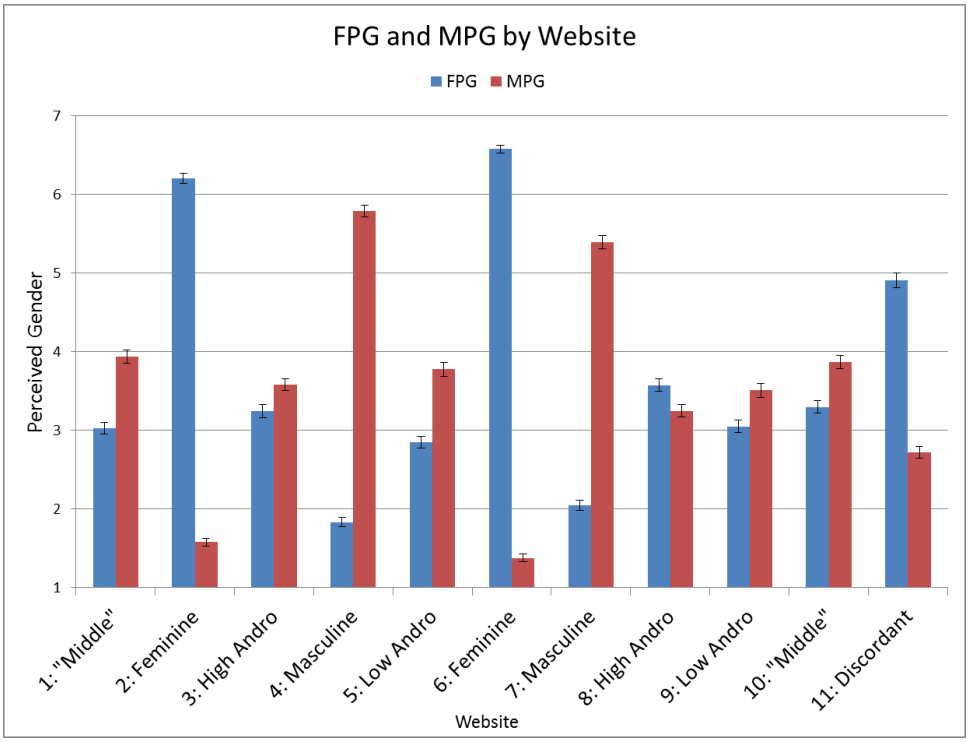

Figure 47. FPG and MPG scores for the 11 websites in the study (n = 275). Bars represent standard error.

There was a very strong negative correlation between FPG and MPG for the 11 websites in the study ($r(9) = .95$, $N = 11$, $p < .0001$). The correlation is represented graphically in Figure 48.

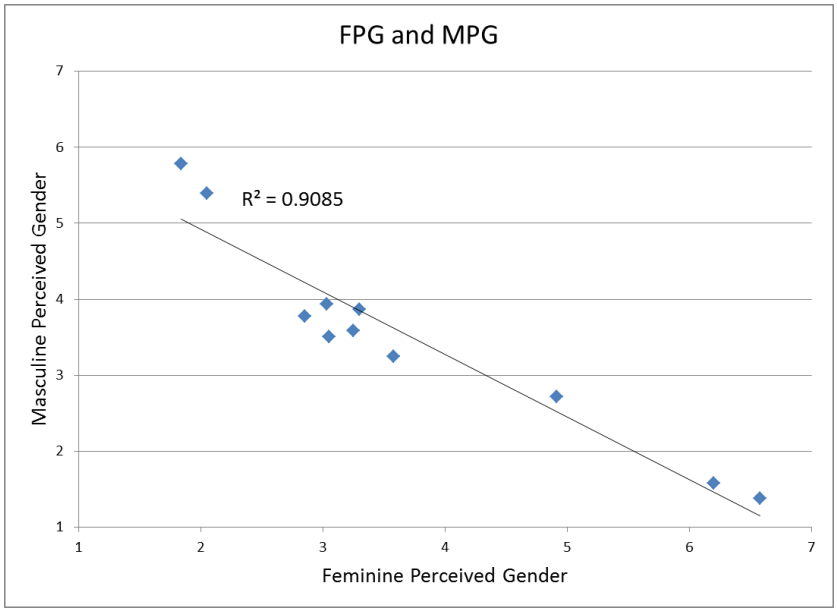

Figure 48. Correlation between FPG and MPG.

Professionalism

The mean Professionalism ratings for each website gender category are presented in Figure 49. Feminine websites were perceived as being the least professional while "Middle of the Road" Neutral websites were perceived as being the most professional. The differences between each website gender were significant ($F(5, 2976) = 159$, $p < .0001$, $d = .77$) except in the cases of Low Androgynous and Highly Androgynous and Low Androgynous and "Middle of the Road" Neutral

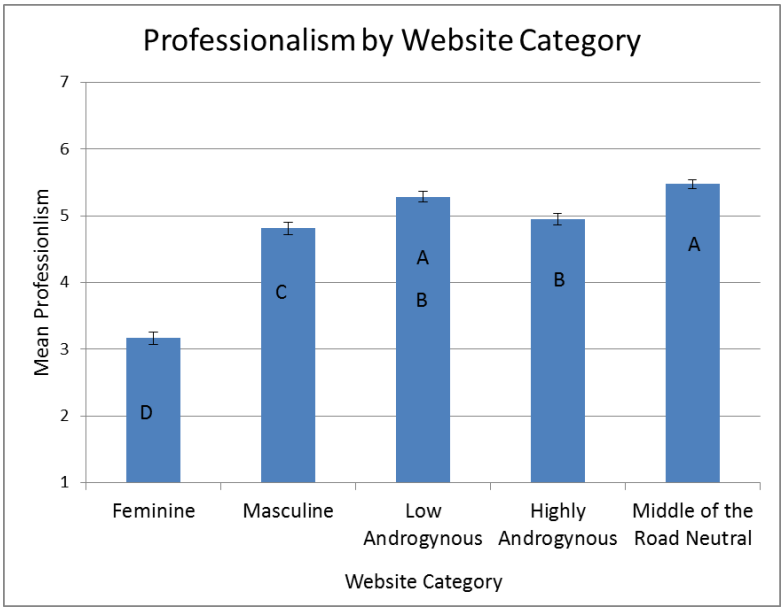

Figure 49. Mean Professionalism Rating by Website Category (n = 550). Website Categories not connected by the same letter are significantly different. Bars represent standard error.

The mean ratings for professionalism by website are presented in Figure 50. Website 1 ("Middle of the Road" Neutral) was considered the most professional with a mean Professionalism rating of 5.78 (SD = 1.14). Website 2 (Highly Feminine) was the least professional with a mean Professionalism rating of 3.07 (SD = 1.60).

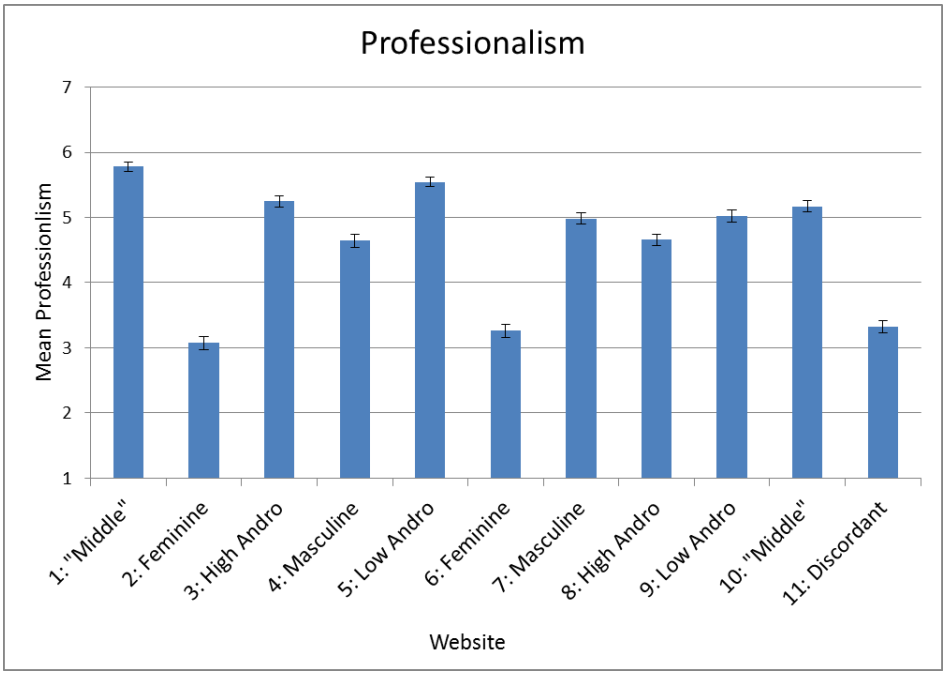

Figure 50. Mean professionalism ratings by website (n = 275). Bars represent standard error.

Gender and Professionalism

The websites exhibited a strong positive correlation between MPG and Professionalism ($r(9) = .67$, $N = 11$, $p < .0002$) (Figure 51). Conversely, the websites displayed a very strong negative correlation between FPG and Professionalism ($r(9) = .83$, $N = 11$, $p < .0002$) (Figure 51).

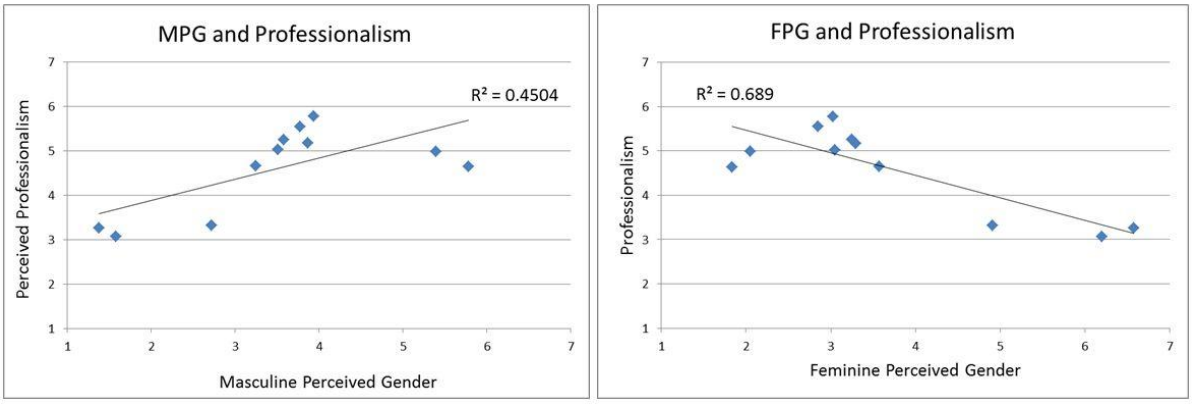

Figure 51. Correlations between MPG and Professionalism (left) and FPG and Professionalism (right).

Workload: NASA TLX

The results of workload from NASA TLX scores are presented in Figure 52. Feminine websites exhibited the highest overall workload while masculine websites exhibited the lowest. The workload associated with Feminine websites was significantly ($F(5, 29) = 7.14$, $p = .015$, $d = .69$) higher than the workload associated with any other website type.

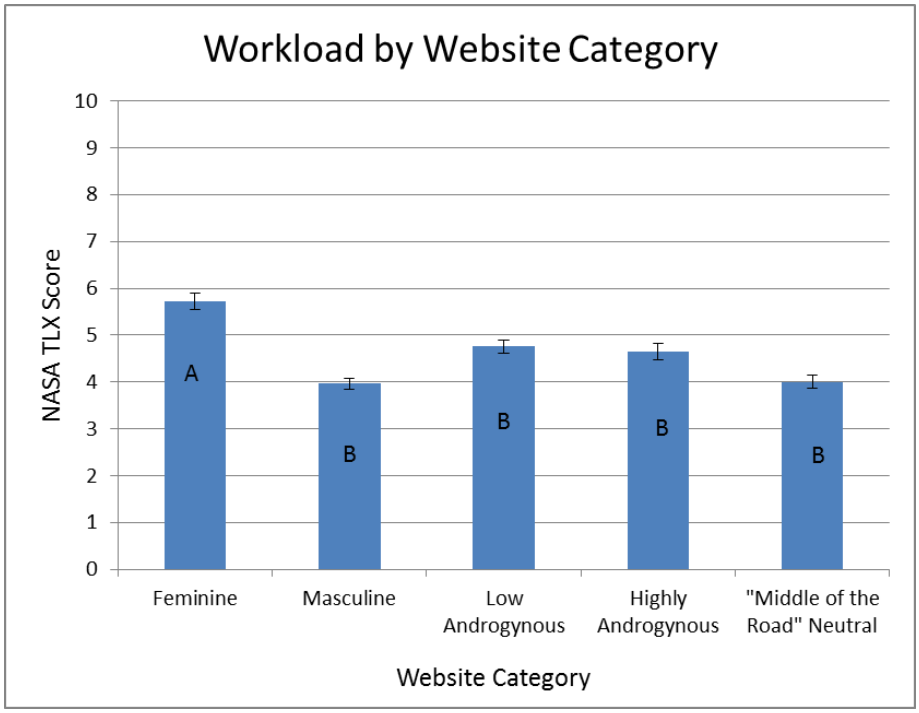

Figure 52. Mean workload by website category

Usability

The mean Usability scores for each website gender category are presented in Figure 53. Feminine websites had the lowest usability ratings while “Middle of the Road” Neutral websites had the highest. Feminine websites were rated significantly ($F(4, 572) = 10.42$, $p = .0079$, $d = .45$) less usable than “Middle of the Road” Neutral websites. There were no significant differences among any other website gender categories.

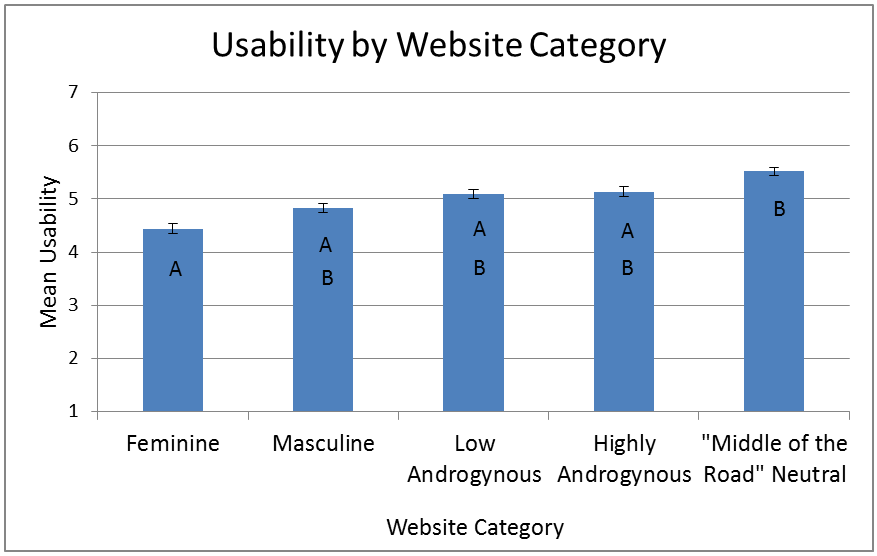

Figure 53. Mean Usability by website category (n = 550). Bars represent standard error. Website categories not connected by the same letter are significantly different.

The correlations between gender and Usability were also examined. Masculine Perceived Gender (MPG) and Usability exhibited a strong positive correlation (r(9) = .74, N = 11, p = .0011) (Figure 54). Conversely, there was a strong negative correlation between Feminine Perceived Gender (FPG) and Usability (r(9) = .77, N = 11, p = .0008) (Figure 54).

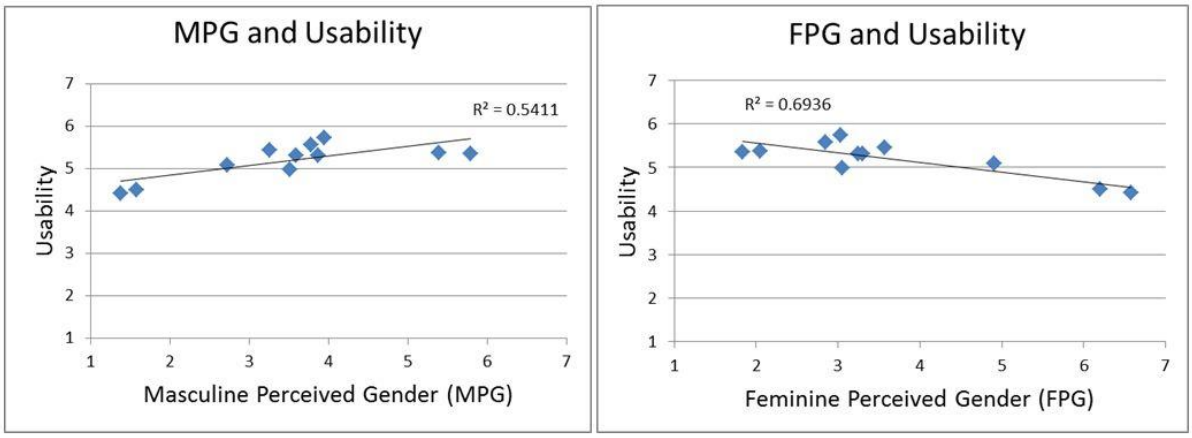

Figure 54. Correlations between MPG and Usability (left) and FPG and Usability (right).

Likability

The mean Likability scores for each website gender category are shown in Figure 55. Again, Feminine websites scored the lowest and “Middle of the Road” Neutral websites

scored the highest. Feminine websites were rated significantly (F(4, 576) = 14.2, p = <.0001, d = .56) less likable than all other website categories.

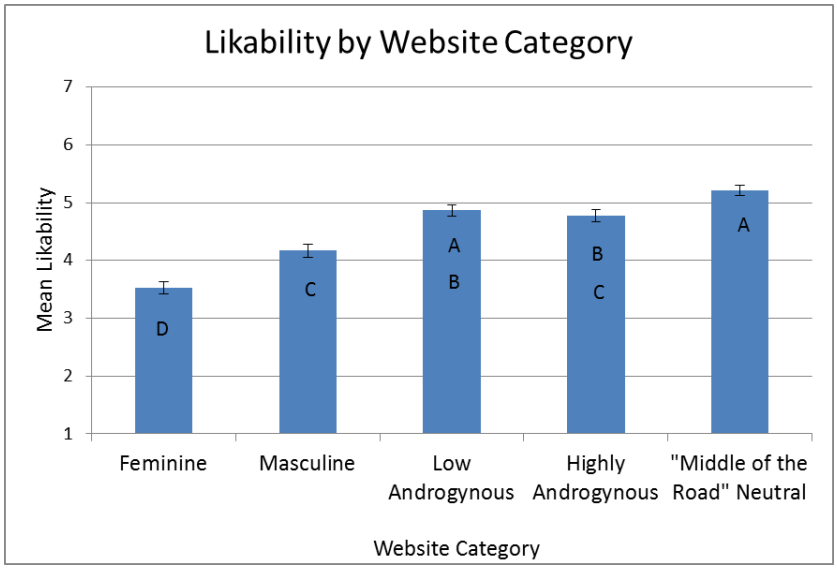

Figure 55. Mean Likability by website category (n = 550). Bars represent standard error. Website categories not connected by the same letter are significantly different.

There was a moderate positive correlation between MPG and Likability (r(9) = .53, N = 11, p = .0019) (Figure 56). Conversely, there was a strong negative correlation between FPG and Likability (r(9) = .72, N = 11, p = .0011) (Figure 56).

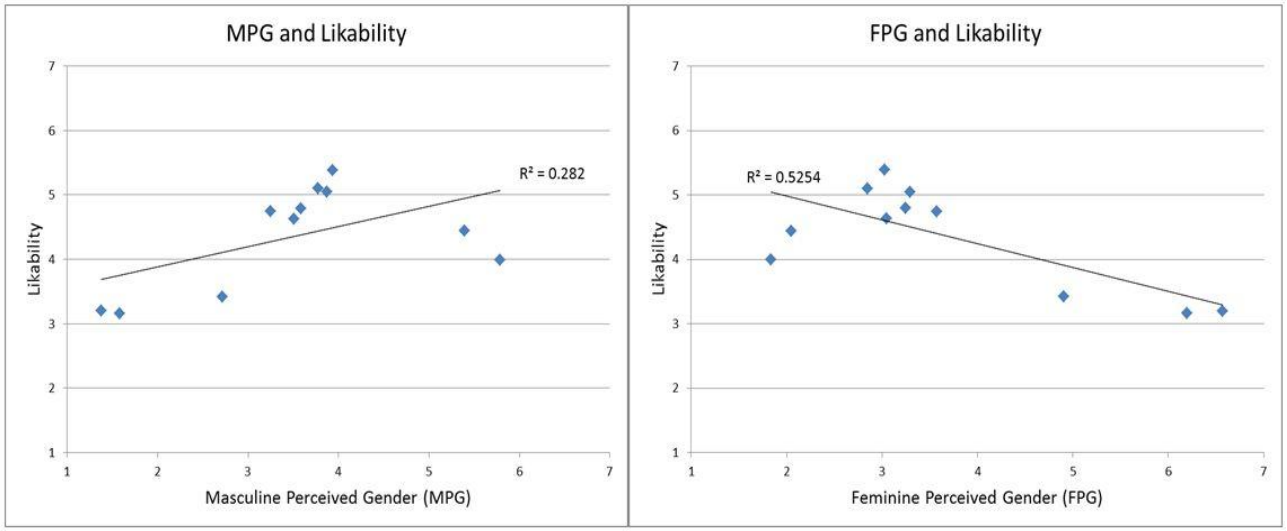

Figure 56. Correlations between MPG and Likability (left) and FPG and Likability (right).

Visual Appeal

The mean Visual Appeal ratings for each website gender category are shown in Figure 57. Feminine websites scored the lowest and "Middle of the Road" Neutral websites scored the highest. Feminine websites were rated significantly lower than "Middle of the Road" Neutral websites and Low Androgynous websites, but were not significantly different from Masculine or Highly Androgynous websites ($F(4, 576) = 14.97$, $p < .0001$, $d = .51$). Masculine websites were rated significantly lower than Highly Androgynous websites, but were not significantly different from any other website type ($F = 12.66$, $p = .0079$, $d = .49$). Low Androgynous websites were rated significantly higher than Feminine websites, but were not significantly different from any other website genders ($F = 12.66$, $p = .0079$, $d = .49$). "Middle of the Road" were ranked the most visually appealing and significantly higher than both Feminine and Masculine websites ($F = 12.66$, $p = .0079$, $d = .49$).

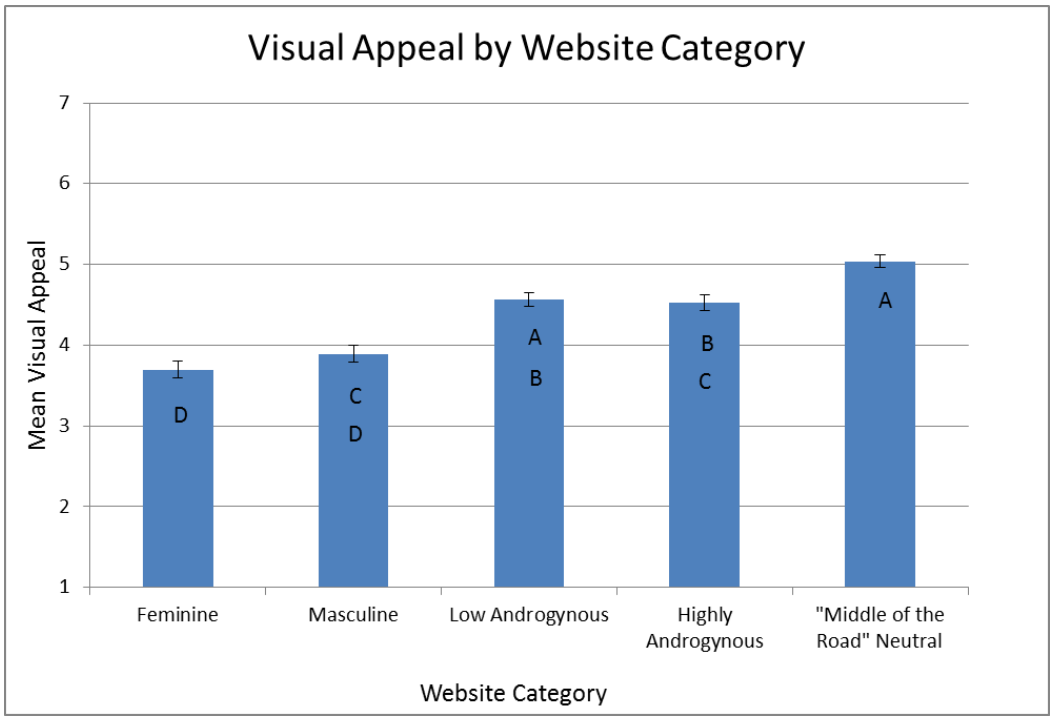

Figure 57. Mean Visual Appeal by website category (n = 550). Bars represent standard error. Website categories not connected by the same letter are significantly different.

There was a moderate positive correlation between MPG and Visual Appeal (r(9) = .50, N = 11, p = .0019) (Figure 58). Conversely, there was a strong negative correlation between FPG and Visual Appeal (r(9) = .68, N = 11, p = .0017) (Figure 58).

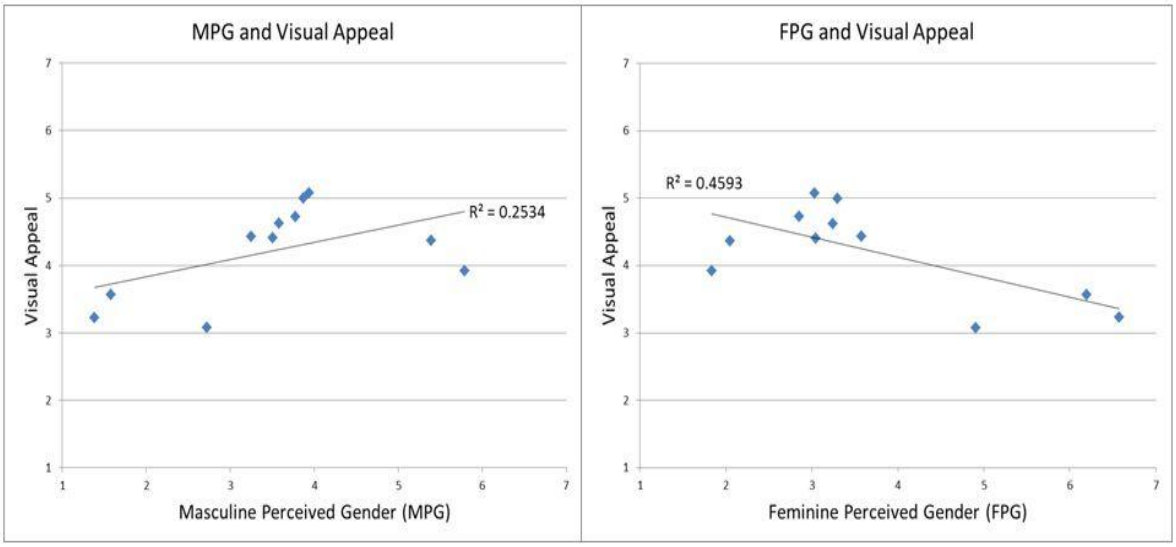

Figure 58. Correlations between MPG and Visual Appeal (left) and FPG and Visual Appeal (right).

Preference

The most preferred website was Website 1 ("Middle of the Road" Neutral) with 63 out of 275 responses (Table 17). The second most preferred website (Website 10) was also from the "Middle of the Road" Neutral category with 57 out of 275 responses.

Table 17. Most preferred websites by frequency.

Most Preferred	*Website Category*	*Count*	*Women*	*Men*
Website 1	"Middle of the Road"	63	47	16
Website 10	"Middle of the Road"	57	43	14
Website 9	Low Androgynous	39	33	6
Website 5	Low Androgynous	34	19	15
Website 3	Highly Androgynous	24	18	6
Website 8	Highly Androgynous	21	19	2
Website 7	Masculine	19	8	11
Website 4	Masculine	8	3	5
Website 11	Gender Discordant	5	5	0
Website 6	Feminine	4	3	1
Website 2	Feminine	1	1	0

The least preferred website was Website 11 (Gender Discordant) with 95 out of 275 responses (Table 18). The second least preferred website was Website 6 (Feminine) with 79 out of 275 responses.

Table 18. Least preferred websites by frequency.

Least Preferred	*Website Category*	*Count*	*Women*	*Men*
Website 11	Gender Discordant	95	68	27
Website 6	Feminine	79	56	23
Website 4	Masculine	24	19	5
Website 2	Feminine	22	16	6
Website 9	Low Androgynous	20	13	7
Website 10	"Middle of the Road"	17	9	8
Website 8	Highly Androgynous	7	7	0
Website 3	Highly Androgynous	6	6	0
Website 5	Low Androgynous	3	2	1
Website 7	Masculine	2	2	0
Website 1	"Middle of the Road"	0	0	0

The most and least preferred websites are represented visually in Figure 59. "Middle of the Road" websites were the most preferred overall while the Gender Discordant and Feminine websites were the least preferred.

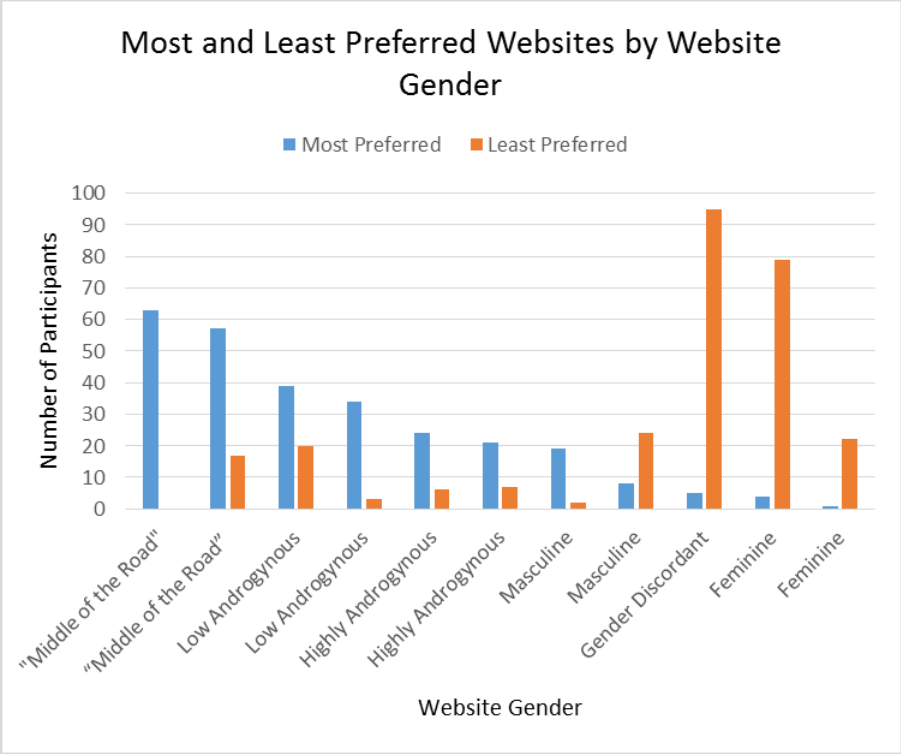

Figure 59. Most and least preferred websites by website gender

The most common reasons why participants preferred Website 1 were:

- Simple/Easy to Follow (12 responses)
- Clean (11 responses)
- Easy to Read (10 responses)
- Visually Appealing (8 responses)
- Gender Neutral (7 responses)
- Neutral Colors (6 responses)
- Professional (6 responses)
- Simple Fonts (4 responses)
- Well-Balanced (4 responses)

Website 11 was the least preferred for the following reasons:

- Clashing Colors (24 responses)
- Harsh (18 responses)
- Odd/Strange (14 responses)
- Too Cluttered (11 responses)
- Ugly (11 responses)
- Hard to Read (8 responses)
- Overwhelming (6 responses)
- Unprofessional (6 responses)

Perceptions of Gender

Participants cited color (193 mentions) and font (124 mentions) as the elements most affecting their perception of femininity. Similarly, participants cited color (180 mentions – 34 mentions modified color with "dark"), font (71 mentions), and background/texture (31 mentions) as most affecting their perception of masculinity. When asked to rank design elements in order of their effect on determining a website's femininity and masculinity, the most common ranking was: Color, Font, Image, Texture, Shape and Line (Table 19).

Table 19. Ranking of design elements in order of their effect on gender perceptions.

Element	*Color*	*Font*	*Image*	*Texture*	*Shape and Line*
Mean Rank	1.66	2.20	3.63	3.64	3.88
Standard Deviation	1.01	1.03	1.20	1.11	1.12

When asked to list three ways in which a website could be made more masculine, participants suggested dark colors (125 mentions), blocky, bold, or large fonts (65 mentions), strong and bold lines (42 mentions), wood, metal, or stone textures (28 mentions), and images of men, the outdoors, animals, or sports (25 mentions). To make websites more feminine, participants suggested: light colors such as pink, purple, and pastels (200 mentions), thin, curvy, or script fonts (102 mentions), images of women, small animals, children, and "cute things" (61 mentions), and round or curvy shapes (45 mentions). Ways in which a website could be made more gender neutral included: limited or neutral colors (165 mentions), clean, simple lines and shapes (76 mentions), clean, simple, un-stylized, or classic fonts (53 mentions), minimal or natural images (25 mentions).

Discussion

Hypothesis #1

There was partial support for *Hypothesis 1: Perceived website gender will match the designed gender of the website when that website is constructed using the categorized elements from Study 1*.

Six of the 10 websites which were designed into a specific gender category matched the category into which they were designed. However, no websites were rated as being Highly Androgynous or "Middle of the Road" Neutral. Instead, the websites which were designed into these categories were actually rated as Low Androgynous. (However, for the purpose of discussion, all websites will be referenced by their designed gender category.) This result is not completely surprising for a variety of reasons. In Study 1 there were very few elements in the "Middle of the Road" Neutral and Highly Androgynous categories. The Highly Androgynous element category was the smallest followed by the "Middle of the Road" Neutral category. The very strong correlation between FPG and MPG contributed to the lack of elements which could be perceived as masculine and feminine simultaneously and the narrow definition of "Middle of the Road" Neutral limited that category as well. These limitations made it difficult to successfully apply those elements to a design task. The tendency for FPG and MPG to be very strongly correlated even when presented on separate scales has been observed by van Tilburg et al. (2015) and Lieven et al. (2015) in similar studies. This tendency could have also contributed to the lack of Highly Androgynous websites. In previous work on product design (van Tilburg et al., 2015) High Androgyny correlated to better liked products and greater purchase intent. It would have been of interest to see if those trends were applicable to websites. Instead, the websites which were designed

to be Highly Androgynous were not in the top four most liked websites. It has been shown that designers impart bias into their designs (Moss et al., 2006) and the feminine gender bias of the designer could have influenced the design of the highly androgynous sites to not be gendered as intended. Similarly, the masculine sites were not as strongly gendered as the feminine sites which could be explained by the gender of their designer.

While the Highly Androgynous sites did not end up categorized that way, they did succeed in having nearly identical FPG and MPG values where no other website gender did. Instead, "Middle of the Road" Neutral and Low Androgynous sites were considered more masculine than feminine.

Hypothesis #2 and Hypothesis #3

Hypothesis 2 *(There will be a negative correlation between FPG and Professionalism, FPG and Usability, FPG and Likability, and FPG and Visual Appeal)* and Hypothesis 3 *(There will be a positive correlation between MPG and Professionalism, MPG and Usability, MPG and Likability, and MPG and Visual Appeal)* are fully supported. The results for Professionalism followed the trends shown by Color, Mixed Elements, and Shape in Study 1 where there was a negative correlation between FPG and Professionalism and a positive correlation between MPG and Professionalism. Combining the elements into a website amplified the effect into a much stronger negative correlation between FPG and Professionalism and a much stronger positive correlation between MPG and Professionalism. In short, higher masculinity resulted in higher Professionalism. However, it's important to note that the most professional websites were not the highly masculine sites. Instead, the most professional sites were those which were designed to be "Middle of the Road" neutral. The negative correlation between FPG and Professionalism was stronger than the positive

correlation between MPG and professionalism suggesting that the presence of femininity is more detrimental to a website's professionalism than the absence of masculinity.

Similar results were observed for Usability, Likability, and Visual Appeal. Feminine websites were rated as the least usable, least likable, and least visually appealing. There was once again a strong negative correlation between FPG and Usability, Likability, and Visual Appeal but a strong positive correlation between MPG and Usability, Likability, and Visual Appeal. "Middle of the Road" Neutral sites were the most usable, most likable, and most visually appealing. However, the overall low ratings of Masculine sites in terms of Usability, Likability, and Visual Appeal demonstrate that masculinity may be preferred only until it becomes overt.

Hypothesis #4

Hypothesis #4: *Gender Neutral websites will be preferred over highly gendered websites with Highly Androgynous websites being the most preferred* was partially supported by the results. Websites in the three gender neutral categories (Low Androgynous, "Middle of the Road" Neutral, and Highly Androgynous) were the most preferred. The two most preferred websites were from the "Middle of the Road" Neutral category. Therefore, the second part of Hypothesis 4 (*Highly Androgynous websites being the most preferred*) is not supported.

Gender Discordance

The Gender Discordant website reinforced the effect of color on perceptions of gender. While the content, fonts, images, shapes, and textures used in the site were the same as Masculine Website 7, the color palette was changed to be composed of pinks and purples. The resulting website was perceived as feminine. However, the website was not well liked.

Participants liked the Gender Discordant website the least and gave it low marks for usability, likability, and visual appeal. It was described with phrases such as “clashing”, “awkward”, and “it doesn’t make any sense”. The Gender Discordant site also helped to illustrate the differences between High Androgyny and Gender Discordance. While the Highly Androgynous websites were not the participants’ favorites, they were considerably better liked than the Gender Discordant site. The website also helps to demonstrate that gender neutrality is not best achieved through simply blending highly gendered design elements as design elements do not carry the same weight in terms of determining a website’s gender – the results show that color is the most influential design element.

Color and Website Gender

Color being the greatest indicator of website gender is supported by participants’ rankings of the element in terms of its effect on their perceptions of website gender. Color was also by far the most mentioned element when they were asked directly about what they thought made a site masculine or feminine. The effect of color persisted when participants were asked to provide ways in which to make a site more masculine, feminine, or gender neutral – the majority of the responses focused on which colors should or shouldn’t be used in each case.

CHAPTER 5: DESIGN CONSIDERATIONS AND RECOMMENDATIONS

By synthesizing knowledge from the literature with the results of the two studies described previously, considerations and recommendations for creating gender inclusive websites may be set forth. While this chapter will focus on gender inclusivity, it's important to note that a gendered website may preferred in some instances. The goal, however, is for designers to be intentional about the gender imparted onto their websites and avoid unintended bias. An emphasis will be put on understanding how websites become gender biased and ways in which these biases may be counteracted. The considerations and recommendations will be divided into three sections: Pre-Design, Design, and Post-Design. Pre-Design will focus on what needs to be considered in terms of gender before beginning the design process. The Design section will emphasize basic design elements and how their use contributes to gender and gender inclusivity. Finally, Post-Design will concentrate on examining an existing design for gender bias.

Pre-Design

Know the Audience

Know the users, but recognize biases. While this idea sounds incredibly simple, in practice, recognizing unintended biases can be difficult. Most designers are familiar with the idea of "know your users" or "know your audience". However, the idea of a "general audience" is tricky. As has been discussed previously (Chapter 2), in website design "general" is often conflated with "men" (Broverman et al., 1972, Huff & Cooper, 1987), leading designs that are intended to be neutral to actually be more masculine. When thinking of users for a "general" site, consider users of all genders. Consider the topic of the website and whether it has gender implications. People tend to anthropomorphize and gender

products (Epley et al., 2007). Therefore, if a product website is being designed, think about how the product itself may be gendered and its implications on users' perceptions of its website – a gendered product would imply a gendered website.

Determine Whether Gendering the Website is Useful

When considering building a highly gendered website, determine whether gendering is the best route and why. From the results of Study 2, neutral sites are shown to be more preferred than highly gendered sites. If there is no clear reason to impart a gender onto the site, it may be best to consider neutrality.

Impart Gender Wisely and With Caution

If the website has a clearly gender biased audience, gendering may be appropriate as website appeal is maximized when it "mirrors" their target audience (Tuch et al., 2009). The key, however, is to make the gendering of the site deliberate and not a product of unintended bias. If gendering a site is chosen as the best option, it is important not to alienate the users or gender the site in a way that is perceived as offensive (such as the "Della" and "Bic for Her" examples). Designers should be careful to avoid stereotypes or reductions to meaningful content when gendering a website (Casserly, 2009; Vinjamuri, 2012).

Design

This section will give design recommendations and points to consider when designing gender inclusive websites. The tables of Feminine, Gender Neutral, and Masculine design elements originally presented as charts in Chapter III will be reintroduced to accompany their corresponding recommendations. The tables for feminine elements are arranged in order of femininity (most feminine to least feminine) where femininity is defined as the absolute value of FPG minus MPG. Similarly, the tables for masculinity are arranged in order of

masculinity (most masculine to least masculine) where masculinity is defined as the absolute value of MPG minus FPG.

Consider Language

When creating written content for a website, the gender implications of the language used should be considered. The use of jargon and "expert language" is associated with masculinity while emotional language (words which convey feelings, exclamation points) and abbreviations are associated with femininity (Moss et al., 2006). Language should also be examined for bias in terms of pronouns (he/she, him/her).

Keep It Simple

From the results of Study 2, viewers greatly appreciate simplicity as it makes websites easier to read and use. Furthermore, simplicity also contributes to keeping a site from becoming biased. For a gender inclusive site, avoid over-embellishing and focus on content and usefulness. A clean and simple background (such as white or another light, solid color) is recommended (as can be seen in the results of Study 2).

Color

As seen in the results of Study 2, color has a very large impact on how viewers gender a website. A darker, limited palette will imply masculinity (Table 20) while a colorful website with brighter colors (especially the use of pinks and purples) (Table 20) will imply femininity (van Tilburg et al., 2015; Xue & Yen, 2007). Choosing a main neutral color and accenting with one or two brighter colors to add visual interest can help a site stay away from bias. The use of a white (or a similar light color) background allows for high text contrast which improves readability (Cui, 1998), but also brightens a site to keep it from becoming overtly masculine.

Table 20. Feminine, Neutral, and Masculine colors.

	Color	*FPG*	*MPG*	*Neutral Category*
Feminine (high to low)	Pastel Pink	5.7	2.3	
	Magenta	5.7	2.3	
	Purple	5.4	2.6	
	Mint Green	4.8	3.1	
	Aquamarine	4.6	3.2	
	Light Orange	4.3	3.3	
	Yellow	4.0	3.3	
	Light Blue	4.3	3.8	
Neutral	Sky Blue	4.1	4.0	Highly Androgynous
	Teal	4.3	3.9	Highly Androgynous
	Maroon	4.0	4.4	Highly Androgynous
	Lime Green	4.0	3.7	"Middle of the Road" Neutral
	Orange	3.5	3.9	Low Androgynous
Masculine (high to low)	Brown	2.0	4.5	
	Grey	3.6	4.9	
	Black	3.4	4.7	
	Dark Blue	3.7	4.9	
	Red Brown	3.5	4.4	
	Moss Green	3.5	4.5	
	Red	4.0	4.5	
	Green	3.9	4.2	

Font

The greatest functional concern when selecting fonts to use in a website is readability (Cui, 1998). Delicate, embellished, and script fonts are considered to be feminine (Table 21) while blocky and thick fonts are perceived as masculine (Table 21). Many “classic” fonts, such as Times New Roman, Helvetica, and Garamond (Table 21), are considered to be gender neutral but also very readable and universally safe for web use (“CSS Web Safe Font Combinations”, 2014).

Table 21. Feminine, Neutral, and Masculine fonts.

	Font	*Font Type*	*FPG*	*MPG*	*Neutral Category*
Feminine (high to low)	Edwardian	Script	5.5	2.3	
	Sant'Elia	Script	5.1	2.6	
	Felt That	Script	4.9	2.9	
	Bradley Hand	Script	4.5	3.0	
	Glossdrop	Script	3.7	3.3	
Neutral	Garamond	Serif	3.7	3.7	Highly Androgynous
	Times New Roman	Serif	3.5	3.7	"Middle of the Road" Neutral
	Brandon Grotesque	Sans Serif	3.6	3.6	"Middle of the Road" Neutral
	Bookman	Serif	3.5	3.7	"Middle of the Road" Neutral
	ITC Bauhaus	Sans Serif	3.7	3.5	"Middle of the Road" Neutral
	Helvetica	Sans Serif	3.3	3.5	Low Androgynous
	Papercute	Sans Serif	3.1	3.5	Low Androgynous
Masculine (high to low)	Stencil	Serif	2.3	5.1	
	Impact	Sans Serif	2.9	4.4	
	Applewood	Serif	2.9	4.2	
	Franklin Gothic	Sans Serif	3.2	4.1	
	Courier	Serif	3.0	3.7	
	Monospace	Sans Serif	3.1	3.7	

Texture

Texture can be a very highly gendered element (as seen in the results of Study 1) and exhibited the largest range of FPG and MPG values in the study. Only one texture was considered to be gender neutral – cardboard. As such, avoiding strongly gendered textures (such as wood, stone, and embellished fabric (Table 22) is recommended.

Table 22. Feminine, Neutral, and Masculine textures.

	Texture	*FPG*	*MPG*	*Neutral Category*
Feminine (high to low)	Floral Cloth	5.7	2.1	
	Paper	4.2	3.1	
	Light Paper	3.6	3.3	
	Linen	3.7	3.8	
Neutral	Cardboard	2.9	3.8	Low Androgynous
Masculine (high to low)	Rough Wood	3.0	5.1	
	Stone Wall	3.0	4.8	
	Scuffed Wood	3.2	4.8	
	Red Stone	3.0	4.5	
	Stone Path	3.1	4.7	
	Tree Limbs	3.0	4.5	
	Dark Denim	3.3	4.4	

Shape

Men tend to prefer symmetry, geometric shapes, and rectilinear shapes while women prefer curvilinear and organic shapes (Xue & Yen, 2007). Consider minimizing the use of specific shapes and instead allow areas to be defined by surrounding white space (Garrett 2010; White, 2011). Alternatively, combining curvilinear shapes and rectilinear shapes (such as a rounded corner rectangle (Table 23)) may also contribute to gender neutrality.

Table 23. Feminine, Neutral, and Masculine shapes.

	Shape	*FPG*	*MPG*	*Neutral Category*
Feminine (high to low)	Scroll	5.5	2.5	
	Heart	5.5	2.7	
	Circles	4.2	3.0	
	Star	3.8	3.3	
	Circle	3.7	3.2	
Neutral	Rectangles and Circles	3.7	3.5	High Androgynous
	Rectangle with Rounded Corners	3.6	3.4	"Middle of the Road" Neutral
	Diamond	3.5	3.4	Low Androgynous
Masculine (high to low)	Rectangle	3.1	3.9	
	Square	3.1	3.8	
	Arrows	3.2	3.9	
	Rectangles	3.5	4.0	
	Triangle	3.4	3.6	
	Triangles	3.5	3.7	

Images

There is a tendency for designers to use images which depict people of their own gender (Moss et al., 2006). Including images of more than one gender is recommended to avoid bias. It is also important to consider the elements that make up any image that may become part of the website. Angularity, dark colors, and ruggedness imply masculinity (Table 24) while softness, light colors, and small children (Table 24) are perceived as feminine. Images of nature, general use buildings, and diverse groups of people are gender neutral options (Table 24).

Table 24. Feminine, Neutral, and Masculine images.

	Image	*FPG*	*MPG*	*Neutral Category*
Feminine (high to low)	Girl	5.8	2.3	
	Woman	5.7	2.6	
	Woman with a Baby	5.9	3.0	
	Living Room Furniture	5.2	3.2	
	Baby	4.7	3.6	
	Blue House	4.7	3.6	
	Cat	4.5	3.4	
	Woman Working	4.6	3.6	
	Sunset	4.5	3.9	
	Quinoa Salad	4.2	3.6	
	Bread	4.1	3.6	
Neutral	Man and Woman Working	4.2	4.0	Highly Androgynous
	Lake with Trees	3.9	4.3	Highly Androgynous
	Horse	4.5	3.9	Highly Androgynous
	Living Room with Staircase	3.9	4.5	Highly Androgynous
	Couple	4.9	4.1	Highly Androgynous
	Man	3.9	4.0	"Middle of the Road" Neutral
	Curved Library	3.9	4.0	"Middle of the Road" Neutral
	Elephant	3.8	3.8	Low Androgynous
	Dog	3.8	3.9	Low Androgynous
	Gophers	3.7	3.6	Low Androgynous
	Sheep	3.4	3.6	Low Androgynous
	Corner Shop	4.0	3.7	Low Androgynous
	Fields	3.7	4.0	Low Androgynous
	Diverse Park	4.0	3.6	Low Androgynous
Masculine (high to low)	Wolf	3.2	5.0	
	High Rise Building	2.9	4.7	
	Man Working	3.3	4.8	
	Burger	3.3	4.7	
	Cow	3.2	4.4	
	Office Interior	2.9	4.1	
	Mountains	3.4	4.4	
	Desert Highway	3.4	4.4	
	City Highway	3.3	4.1	
	Boy	3.8	4.3	
	Arches	3.8	4.1	

Consider the Strength of Each Element

The results of Study 2 showed that the element of color had the greatest impact on determining a site's gender. A change in color palette can make a masculine site into a gender discordant and feminine site (as seen with the Gender Discordant website in Study 2). As such, the colors used in a website should be given great consideration. As such, when examining a website to determine its gender, consider the strength of each element. The inclusion of a few feminine shapes or lines will likely have a much weaker effect on the website's gender than a feminine color palette.

Post-Design

Include Evaluation of the Design's Gender

Examine the design for unintended biases and collect data on perceived gender. Make notes about masculine and feminine elements used in the site and determine whether they are appropriate for the intended gender of the website. Consider including website gender with user evaluations early in the design process. Understanding the perceived gender of a website early on will prevent surprises later in the design process and ensure that the site's gender is intentional. As shown in Studies 1 and 2, collecting data on perceived gender is not only easy, but inexpensive and simple to add to existing evaluations. Gender may be evaluated through the use of two items on a seven point Likert scale where 1 is "Not Feminine (Masculine) at All" and 7 is "Very Feminine (Masculine)" (van Tilburg et al., 2015; Lieven et al., 2015).

Check for Discordance

Gender neutrality is not created through the combination of highly gendered elements (such as the Gender Discordant website seen in Study 2). Significant use of multiple highly

gendered elements (like a feminine color palette with masculine textures and fonts) may strike viewers as clashing and unpleasant. Check for elements which are gender discordant and consider replacing them with elements that are neutral.

CHAPTER 6: CONCLUSION

Summary of Findings

This research was broken down into two studies. Study 1 evaluated the gender and professionalism of six web design elements: Font, Texture, Image, Shape, Color, and Mixed Elements. The results showed that most of the design elements in the study were gendered-meaning that participants consistently rated them either masculine or feminine. Masculine elements included: blocky, serif fonts, wood or stone textures, rectilinear and geometric shapes, dark colors, and images depicting ruggedness or work environments. Feminine elements included script fonts, paper and fabric textures, curvilinear and organic shapes, light colors, and images depicting children and the home. Some elements were found to be gender neutral in that they were not perceived to be highly masculine or highly feminine. Neutral elements included classic fonts such as Times New Roman, images depicting both men and women, images depicting docile animals, and colors such as teal, green, and orange. However, the study also found that some elements were simultaneously masculine and feminine – or highly androgynous.

Study 1 found that there was at a strong positive correlation between masculinity and professionalism for three elements: color, mixed elements, and shape. For the same three elements, there was a very strong negative correlation between femininity and professionalism. In short, elements which were perceived as more masculine were perceived as being more professional and elements which were feminine were less professional.

Study 2 applied the results of Study 1 to a web design task through the creation of feminine, gender neutral, and masculine websites. The results showed that websites were perceived as having a gender. Further, the perceived gender of the websites effected

perceptions of their professionalism, workload, usability, likability and visual appeal. Neutral websites were preferred by participants and found to be the most professional, usable, likable, and visually appealing. Feminine websites incurred the highest workload, were the least usable, least professional, and the least visually appealing.

The correlations between gender and professionalism seen in Study 1 were again observed in Study 2: there was a strong positive correlation between masculinity and professionalism but a strong negative correlation between femininity and professionalism. Similar correlations were observed for usability, likability, and visual appeal. However, in each case, the correlation between masculinity and professionalism was weaker than that between femininity and professionalism. This implies that it is not the presence of masculinity that makes a website professional but instead the absence of femininity. Further, while masculinity was correlated to higher ratings in terms of professionalism, usability, likability, and visual appeal, highly masculine websites received low scores overall in these areas. This result implies that masculinity is preferred until it becomes overt.

Study 2 also examined the strength of the effects which design elements have on determining a website's gender. It was found that color was most influential in determining a site's gender followed by font. However, there was little difference among the effects of shape and line, texture, and image.

Implications

The results of the two studies provide insights into the relationship between web design and perceived gender. Similar to products, websites become gendered through their design. However, unlike products, websites often become gendered unintentionally through biases in culture, software, and designers themselves. Because of the effect gender has on

perceptions of professionalism, visual appeal, and likability as well as usability and workload, it is important to consider how a website will be gendered during the design process.

Participants preferred websites which were gender neutral. Gender neutral websites also reduced participants' workload and were the most usable. Therefore, in general, gender neutral websites are recommended and may be created through the careful combination of design elements. A shift toward web neutrality is also a step toward addressing the overall masculine bias of the web. However, the combination of highly masculine and highly feminine elements can create gender discordance – which was regarded by participants as not only visually displeasing but also difficult to use.

The strong correlation between masculinity and professionalism implies that the gender biases observed in workplaces extend into the field of web design. While femininity and gender incongruence are seen as unprofessional in the workplace, they are also perceived to be less professional when applied to websites.

Future Work

The two studies demonstrate that web sites and web design elements are gendered and, as with people, that their gender has an impact on how they are perceived. However, more research is needed in the area of gender and website design to fully understand their interactions.

The scope of Study 1 could be expanded to include more examples of design elements. Evaluating the gender and professionalism of more element examples would produce a better picture of the nuances of how design elements are gendered. A larger number of element examples with values for femininity and masculinity could also be of use

to designers looking to create both gender neutral and gendered websites. A main limitation of Study 1 is the demographic of its participants – 92% of which were United States natives. As the association of design elements with a gender differs with cultural identity, repeating the experiment with a different demographic would explore those differences. Such a repetition would also serve to generalize the results of the study.

The design of the websites in Study 2 was a key limitation of the experiment. As the websites were not designed by a web design professional, recreating the experiment with sites designed by professionals would serve to validate the results. Women and men tend to design differently and with a bias toward their own gender. As the designer of the websites evaluated in Study 2 was a woman, future work is needed to determine if the gender-bias of a designer carries over into websites which have been intentionally gendered. Furthermore, studies which show that designers impart their own gender bias onto the sites they design have used a random sampling of websites. Future work could be completed to determine if the biases are present when male and female designers each create their own versions of the same website. Finally, the recommendations set forth in Chapter 5 could be verified by applying them to a web design task and comparing the perceived gender of the resulting websites to websites designed without recommendations.

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APPENDIX A: STUDY 1 DEMOGRAPHIC QUESTIONNAIRE

What is your age?

What is your gender?

How would you classify yourself?

a. American Indian/Native American
b. Asian
c. Black/African American
d. Hispanic/Latino
e. White/Caucasian
f. Pacific Islander
g. Other

What is the highest level of education you have completed?

h. Less than high school
i. High school/GED
j. Some college
k. 2-Year college degree
l. 4-year college degree
m. Masters Degree
n. Doctoral Degree
o. Professional Degree

What is your native country?

What language are you most comfortable speaking?

APPENDIX B: ENLARGED WEBSITE SCREENSHOTS

Figure 60. Enlarged screenshot of Website 1: "Middle of the Road" Neutral.

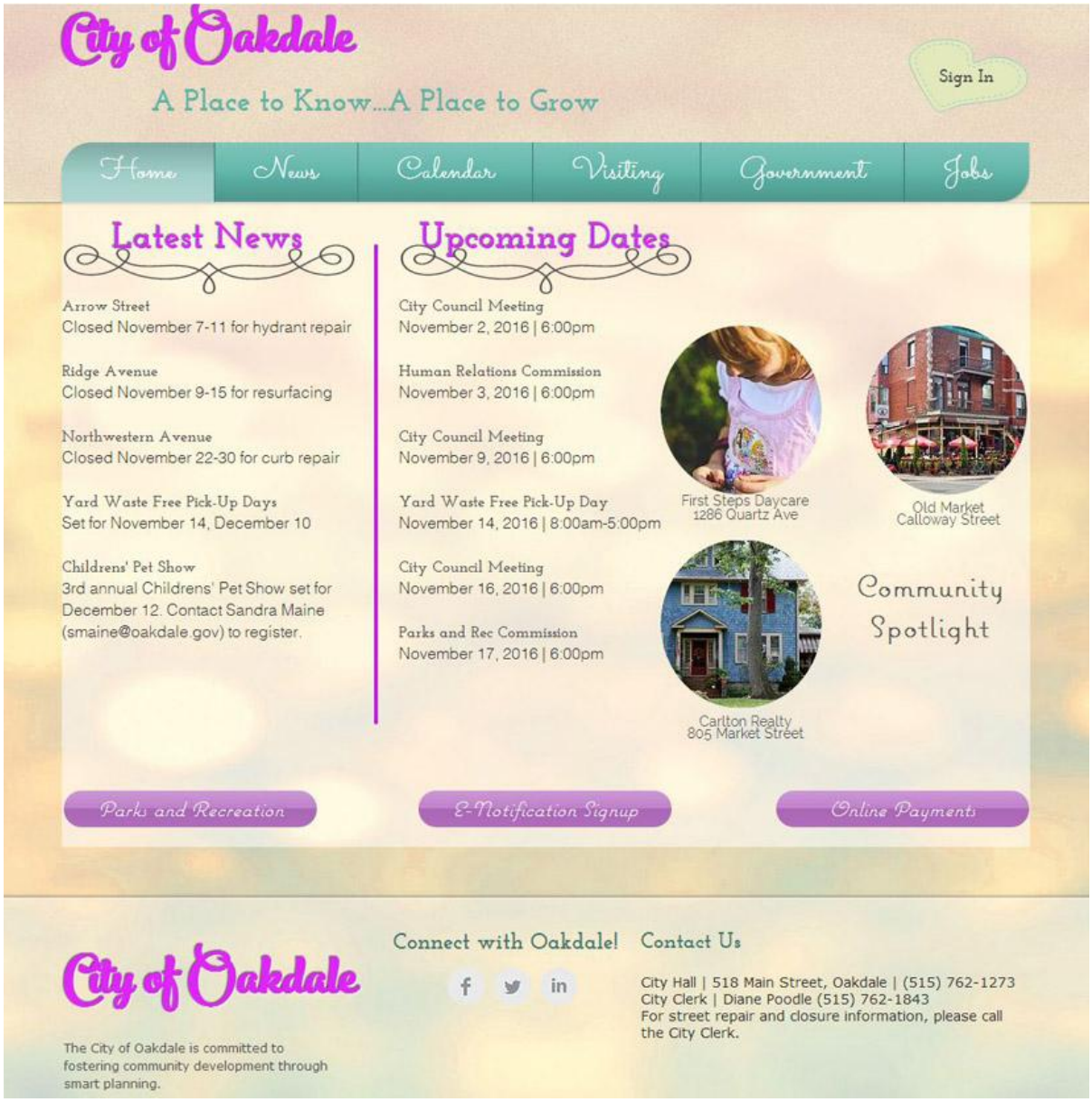


Figure 61. Enlarged screenshot of Website 2: Feminine.

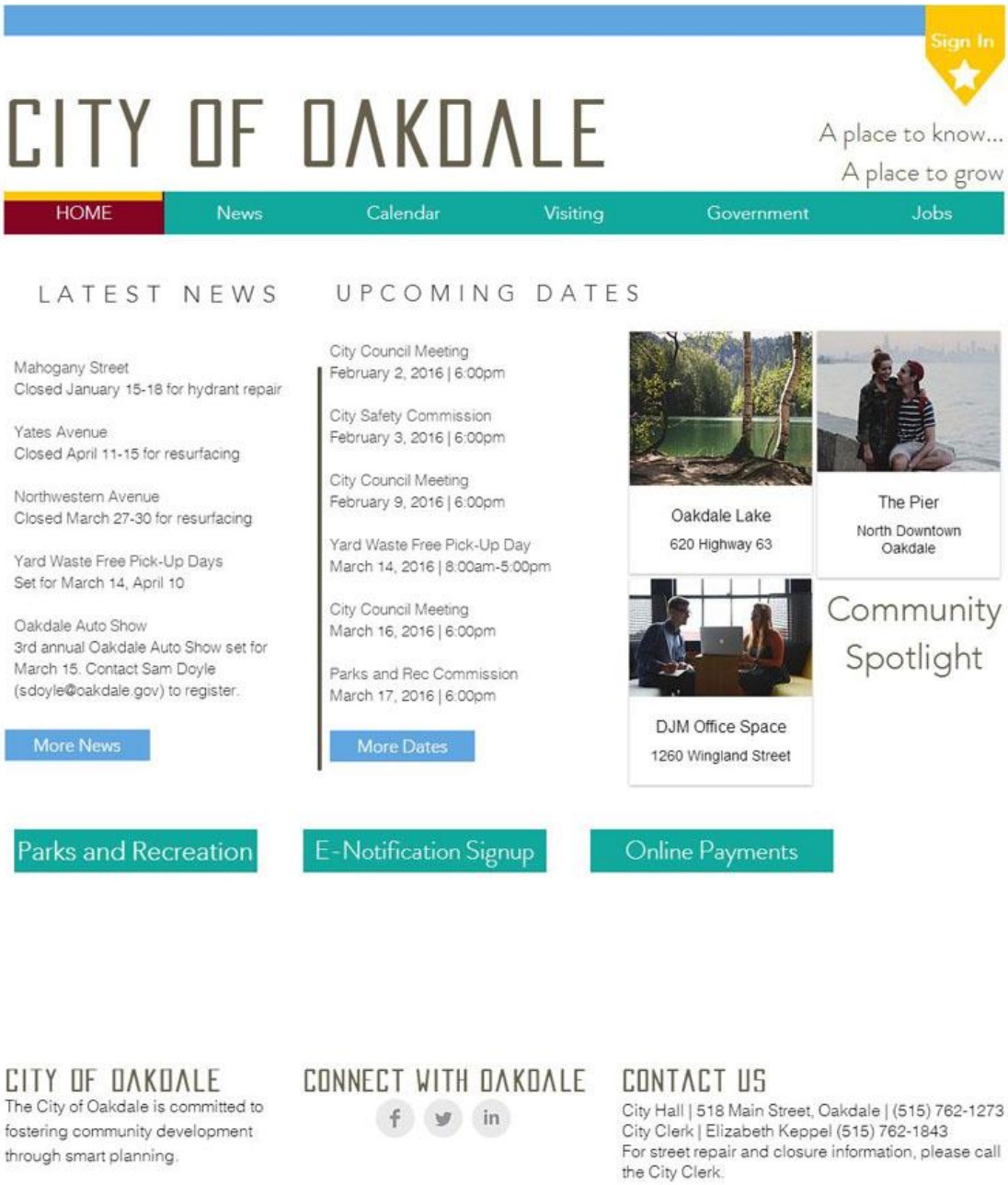


Figure 62. Enlarged screenshot of Website 3: High Androgynous.

Figure 63. Englarged screenshot of Website 4: Masculine.

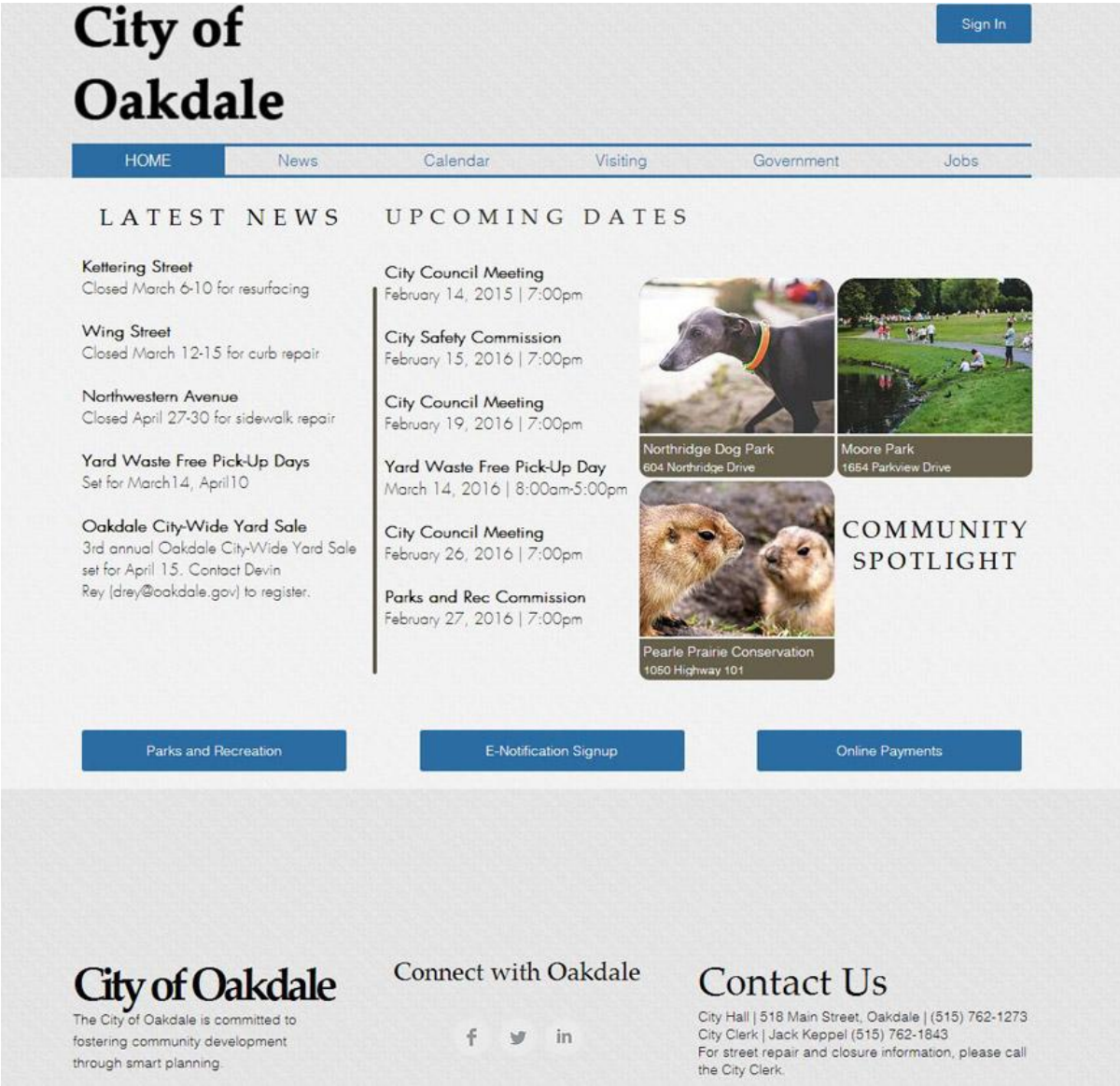


Figure 64. Enlarged screenshot of Website 5: Low Androgynous.

Figure 65. Enlarged screenshot of Website 6: Feminine.

Figure 66. Enlarged screenshot of Website 7: Masculine.

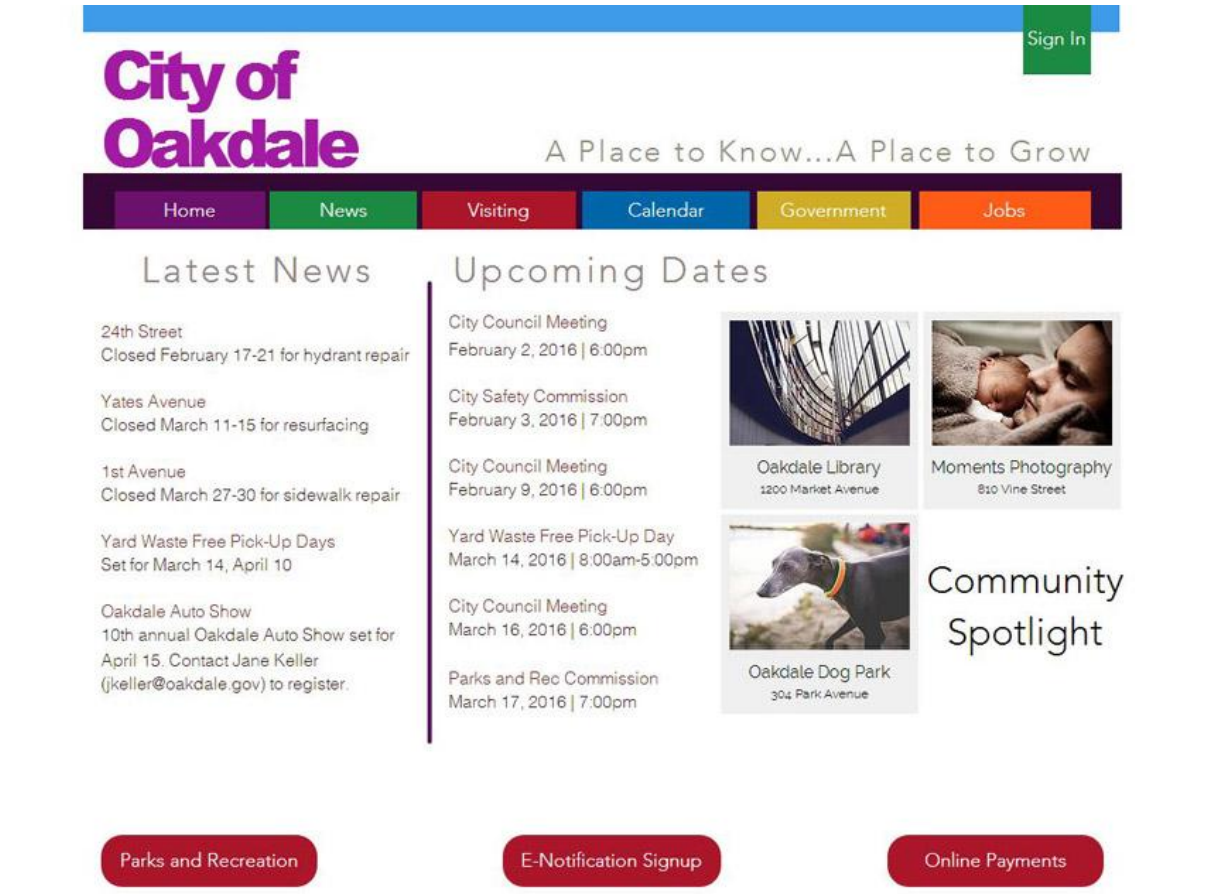


Figure 67. Enlarged screenshot of Website 8: High Androgynous.

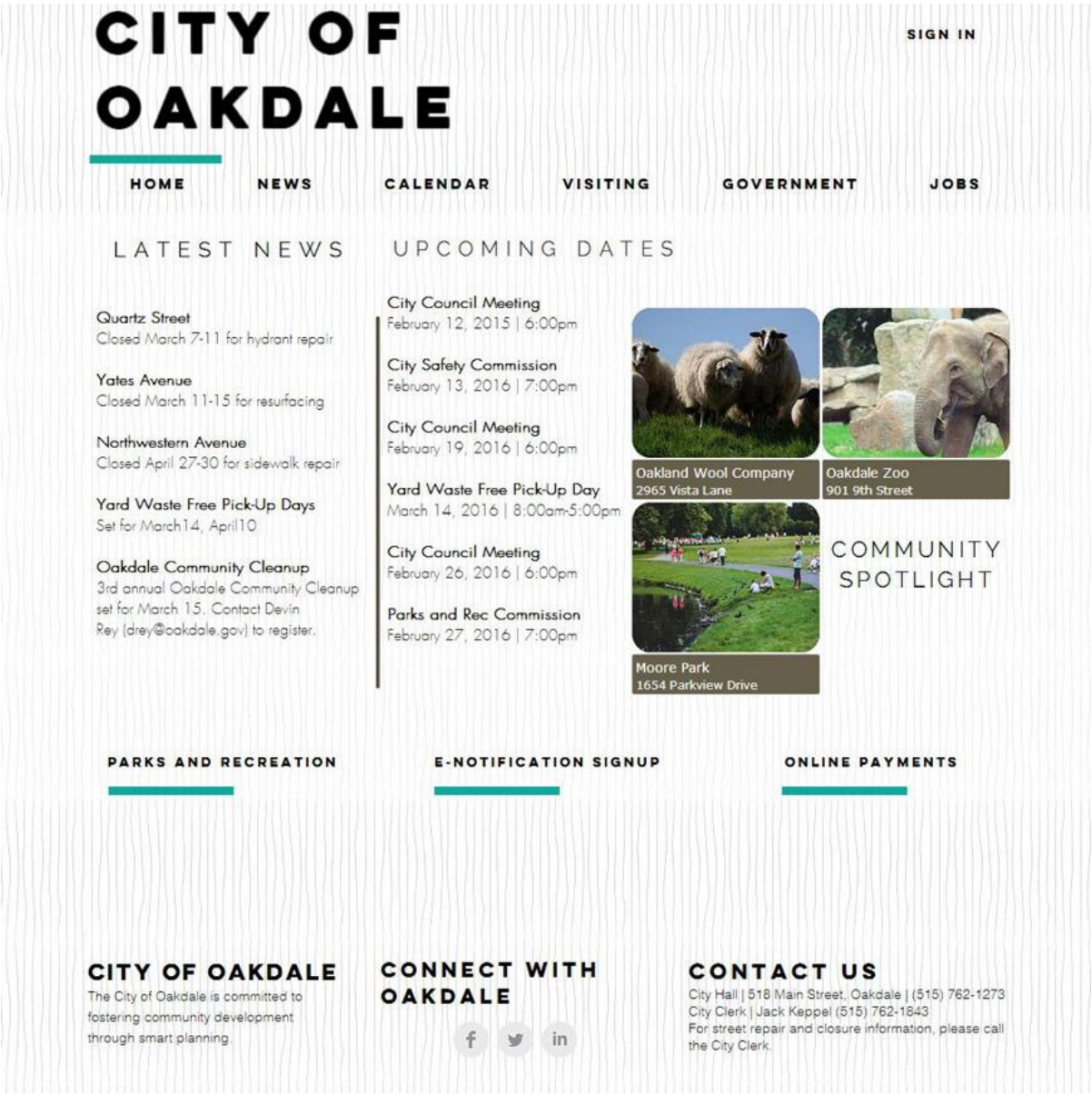


Figure 68. Enlarged screenshot of Website 9: Low Androgynous.

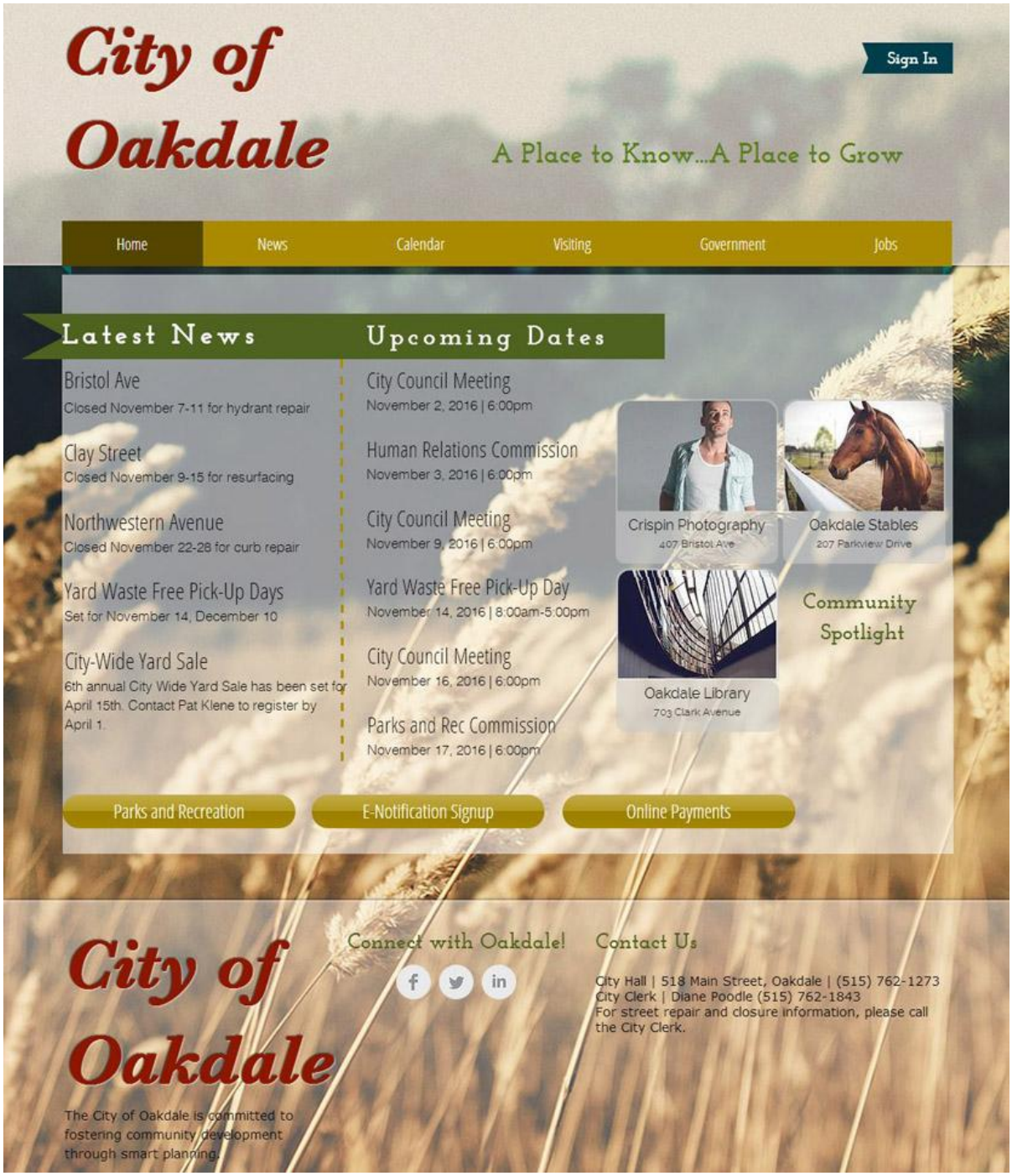


Figure 69. Enlarged screenshot of Website 10: "Middle of the Road" Neutral.

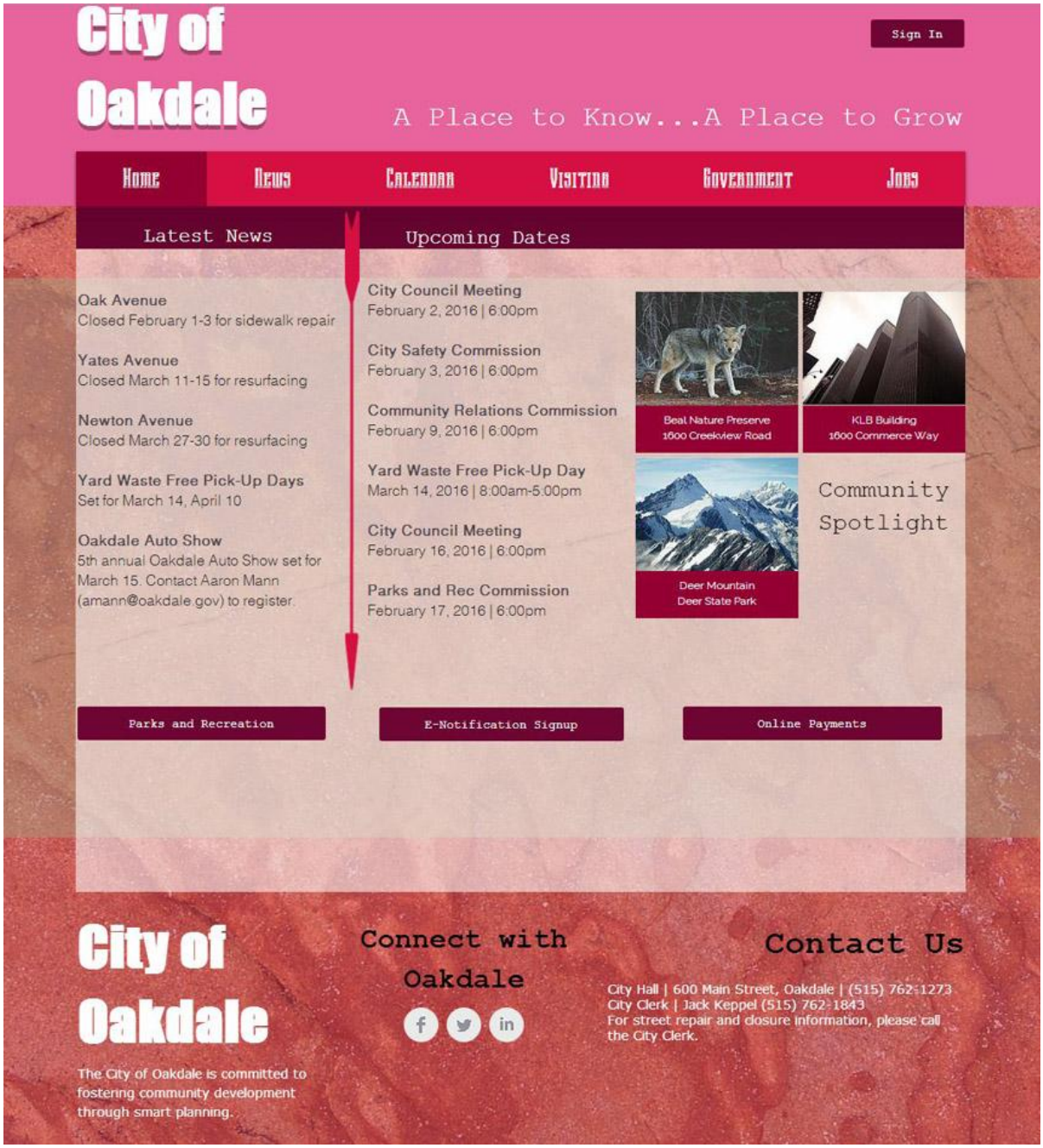
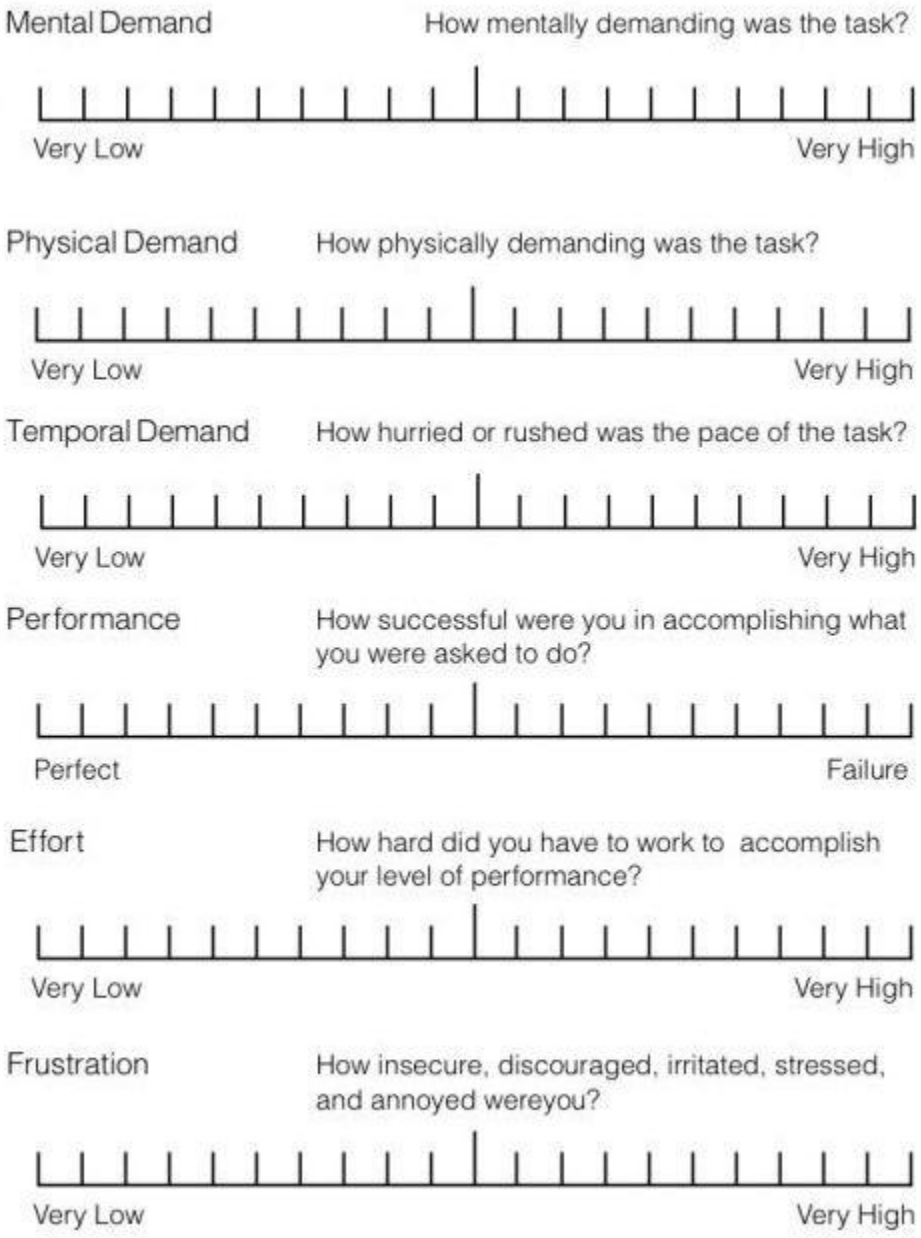


Figure 70. Enlarged screenshot of Website 11: Gender Discordant.

APPENDIX C: NASA TLX



APPENDIX D: STUDY 2 UASBILITY, LIKABILITY, and VISUAL APPEAL

Usability

I am satisfied with the ease of completing tasks on this website

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

It was easy to find the information I needed

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

Characters on the screen are readable

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

I am satisfied with the amount of time it took to complete tasks on this website

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

Likability

I liked this website

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

Visual Appeal

Please rate the visual appeal of the website.

Ugly 1 2 3 4 5 6 7 Beautiful

APPENDIX E: STUDY 2 PREFERENCE

Which website did you like the most?

Why did you like that website the most?

Which website did you like the least?

Why did you like that website the least?

APPENDIX F: STUDY 2 POST-EXPERIMENT QUESTIONNAIRE

When viewing the websites, what most affected your perception of femininity?

When viewing the websites, what most affected your perception of masculinity?

Please name three (3) ways in which you feel a website could be made more masculine.

Please name three (3) ways in which you feel a website could be made more feminine.

Please name three (3) ways in which you feel a website could be made more gender neutral.

Please rank the following design elements in order of their effect on how you determined a website's masculinity and femininity

Images

Font

Color

Texture

Shape and Line

APPENDIX G: STUDY 2 DEMOGRAPHIC QUESTIONNAIRE

What is your age?

What is your gender?

How would you classify yourself?

a. American Indian/Native American
b. Asian
c. Black/African American
d. Hispanic/Latino
e. White/Caucasian
f. Pacific Islander
g. Other

What is the highest level of education you have completed?

h. Less than high school
i. High school/GED
j. Some college
k. 2-Year college degree
l. 4-year college degree
m. Masters Degree
n. Doctoral Degree
o. Professional Degree

What is your native country?

What language are you most comfortable speaking?

What is your primary source of news?

a. Printed Newspapers or Magazines
b. Websites
c. Television
d. Radio

How many hours do you spend on the web per week?

What kind of device are you using to take this survey?

a. Desktop Computer
b. Laptop Computer
c. Large Tablet (8-inch screen or larger)
d. Small Tablet (7-inch screen size or smaller)
e. Smartphone