PERCEIVED VISUAL AESTHETICS OF EMOTIONALLY EVOCATIVE HOMEPAGES: AN INVESTIGATION OF AFFECTIVE QUALITIES IDENTIFIED WITH EMOTIONAL DIMENSIONS

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DEDICATION

To my family.

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ABSTRACT

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PERCEIVED VISUAL AESTHETICS OF EMOTIONALLY EVOCATIVE
HOMEPAGES: AN INVESTIGATION OF AFFECTIVE QUALITIES IDENTIFIED
WITH EMOTIONAL DIMENSIONS

Kim, Lee, and Choi (2003) identified design factors for homepages that elicited aesthetic

dimensions in Web users viewing homepages. However, their study was not cross-

cultural. The focus of this investigator's study was to test 13 homepages used by Kim et

al. with participants from the United States and determine whether the same aesthetic

dimensions were evoked in U.S. participants. The resulting survey data of U.S.

participants were compared with the survey data for South Korean participants. An initial

analysis determined that U.S. participants generally agreed with South Korean

participants about which aesthetic adjectives were in an aesthetic category. Other

analyses showed no shared perceptions for homepages or adjective sets in aesthetic

dimensions. This investigation suggested that aesthetic design principles for homepages

from one culture are unlikely to predictably influence other cultures. A regression

analysis was also used to investigate aesthetic design elements that prompt responses in

U.S. participants.

CHAPTER ONE: INTRODUCTION AND BACKGROUND

Importance of Aesthetic Design

This research compares the preferences for aesthetic dimensions in homepages for U.S. and South Korean participants. In their study, Kim et al. (2003) claimed that they determined the particular elements of homepages that consistently evoked "secondary emotions" (p. 903) as expressed by adjective selections (e.g., sexy, cute, powerful, vibrant, mystic) in participants. Why is this a good idea? Because appropriate aesthetics and emotional responses help add appeal and value to homepages, especially for advertising purposes (J. Kim, Lee, & Choi, 2003).

In addition, recent investigations into aesthetics and human-computer interaction have revealed that aesthetics play an important role in user perception of Web and other interfaces (Ben-Bassat, Meyer, & Tractinsky, 2006; Picard, 1997). In short, positive aesthetic responses result in positive interface interactions (Angeli, Sutcliffe, & Hartmann, 2006; Hartmann, 2006; Schenkman & Jonsson, 2000). Such responses may even be a factor in the perceived trust or credibility of online sites (Fogg, 2003; Karvonen, 2000; J. Kim & Moon, 1997; Tractinsky, 2004), as well as an important part of the first impressions of interfaces (Ben-Bassat, Meyer, & Tractinsky, 2006). Moreover, aesthetics may be the single most important characteristic for influencing perceptions of other Web-site characteristics (e.g., usability, credibility, memorability, attractiveness) (Lavie & Tractinsky, 2004).

Decades ago, Herbert Zettl (1973) began advocating the understanding of aesthetics for television and film. Now that same understanding is needed for successful human-computer interaction for Web and other interfaces. Given that aesthetic elements

are being recognized as important facets of design, the ability to precisely design the aesthetic impression of homepages becomes an important skill and promotes the idea that "aesthetic consideration should eventually be translated into actual blueprints for design activities" (Tractinsky, 2004, p. 777). Such blueprints would be helpful, for example, if designers wanted to create an elegant homepage to reflect the image of an upscale jewelry store. They could, ideally, use the Kim et al. research as a convenient template or starting point to communicate elegance or sophistication.

However, the Kim et al. research was conducted in South Korea using only South Korean participants. In short, the study was not cross cultural and did not examine the aesthetic dimensions for homepages in other contexts, such as the United States using U.S. participants. Consequently, no certainty exists that any of the Kim et al. findings for South Korean participants would be similar for U.S. participants. Therefore, this investigator explored that issue. Using the 13 representative homepages and 30 aesthetic adjectives from the Kim et al. research, this study conducted a survey (modeled on the Kim et al. survey) to determine the aesthetic dimensions U.S. participants identified in the South Korean-designed for homepages.

Importance of Aesthetic Design for Homepages

Homepages are rapidly becoming more than just an entry to a company's website; they also act as a form of advertising for the person or group they represent (Schenkman & Jonsson, 2000). For example, Geissler (1998), citing a study that examined the Web sites of corporations, noted that nearly all functioned as fact sheets about aspects of the company. Moreover, Geissler speculated that the primary goal for creating such Web pages was to provide "a leading-edge image" (p. 16). In essence, homepages function as

advertisements and brand images for an organization to attract viewers and communicate. At its core, according to Travis (2000) and Gobé (2001), a brand links companies to their customers by prompting aesthetic responses in people.

As the first page typically seen on the site, homepages often become the litmus test that determines whether viewers wish to spend time exploring the current site. In fact, such first impressions may be key to many subsequent user judgments regarding the site (Ben-Bassat, Meyer, & Tractinsky, 2006). Because making a good first impression is difficult, viewers must be given incentives to remain at the homepage. Yet many homepages simply are not inviting for reasons ranging from attractiveness to truthfulness. Fogg (2003) placed some of this disinterest under the broad heading of credibility, while Gobé (2001) attributed this to a lack of aesthetic attraction. Other researchers have also echoed these thoughts on attractiveness. They believed that product appearance was key in helping users bond with an interface or product (Angeli, Sutcliffe, & Hartmann, 2006; Norman, 2004) and contributing to users' satisfaction (Cyr & Trevor-Smith, 2004). Likewise, Norman (2004) contended that the aesthetic side of design might ultimately be more important to users than practical considerations. Norman further identified part of the aesthetic solution as visceral design: "Effective visceral design requires the skills of the visual and graphic artist and the industrial engineer…. Visceral design is about immediate emotional impact" (p. 69). Boorstin (1990) and Anderson (1996) also found similar skills were needed in the cinema to create a visceral scene that aesthetically resonated with viewers.

All these views underscore the importance of human-computer interaction design—particularly the aesthetic aspects of visual design—to capture viewers' attention,

persuade them to stay, and communicate the target message of the homepage to them. Brave and Nass (2003) described these aesthetically derived benefits for human-computer interaction in terms of better attention, memory, performance, and assessment. Similarly, Gobé (2001) proposed that for Web sites to attract people, designers must create the correct aesthetic allure for every interaction. Fogg (2003) elaborated further by emphasizing that "[o]ne key element in surface credibility is visual design. People can quickly take in the design of a site—the colors, the layout, the images, and other design elements" (p. 168). One effort to relate visual design of homepages to participants' aesthetic dimensions is the Kim et al. research (p. 921).

Their study documented 13 aesthetic dimensions for South Korean participants viewing homepages. If the Kim et al. design approach is applicable to U.S. participants, human-computer interaction designers in the United States could have another tool for quickly attracting viewers' attention and appropriately matching homepages to the desired brand image of an organization or product. However, the Kim et al. research was not cross cultural. Cross-cultural research (as explored in the Discussion chapter) has shown that participants from different cultures perceive Web pages in different ways and often have different preferences for designs. To examine whether the Kim et al. research applies to U.S. participants, this investigator studied whether the Kim et al. representative homepages evoked different aesthetic responses in U.S. participants compared to the aesthetic responses evoked in the South Korean participants.

CHAPTER TWO: LITERATURE REVIEW[1]

To help understand emotional design, this chapter examines three aspects of the aesthetic design elements used in such design:

- The identification and examination of aesthetic elements.

- The control of aesthetic elements.

- The influences of aesthetic elements on HCI.

Identifying and Examining Aesthetic Elements

Interfaces and other things arouse us; and the efforts to explain this have been expressed from a variety of perspectives:

Daniel Berlyne, experimental aesthetic researcher, has argued

that the stimulus variables that mediate arousal fall into three categories;

'psychophysical' variables, which are the intrinsic physical properties of

the stimulus such as music tempo; 'ecological' variables, which are the

learned associations between the stimulus and other events or activities of

biological importance; and 'collative' variables which are the

informational properties of the stimulus such as its degree of

novelty/familiarity or complexity. (North & Hargreaves, 2006, p. 105)

Boorstin (1990) likewise divided arousal (for films) into these three categories: voyeuristic (variables of sight and story); vicarious (variables of feeling); and visceral (variables of primal reactions). Norman (2004) has outlined an approach that entwines emotion and cognition into three levels of design: visceral (design of the physical appearances); behavioral (design of pleasing use); and reflective (design of thinking).

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[1] Cross-cultural literature is reviewed in the Discussion chapter.

However, not all researchers have attempted to identify such encompassing descriptions. Most expressed the concept in terms of their experiences and observations because, as Zettl (1990) explained, "[m]any of the aesthetic principles…have been developed through keen observations and educated insight. Because aesthetics is contextual and not a rigorous science, the empirical method does not reign supreme" (p. viii).

For example, Picard (1997) has noted the potential for computers to influence longer-term user aesthetics. Addressing reactions to affect and aesthetics, Sharpe and Stenton (2003) concluded that the visual impact of an information tool matters beyond mere stylishness, and Schell (2003) equated aesthetics with the power of presentation and the interest it generates. Fogg (2003) similarly concluded that computers could at least simulate some aesthetic responses. Researchers have also found that expressing feelings was a basic element for projecting the impression of life (Brave & Nass, 2003; Sutcliffe, 2003).

Acknowledging that the design of the interface provides its aesthetic effects is just the first step in leveraging and controlling the design. Specific design elements (e.g., motion, color, and sound) are relevant to aesthetics; and identifying these elements is the next step to applying their influence to an interface.

Dissanayake (2006) observed that many sensory factors entice us, particularly if they involve pleasant and repeated patterns of some sort. Sharpe and Stenton (2003) have noted that affect is generated from the senses (e.g., from a sudden movement or harsh sound). Citing physiological pattern research, Arnheim (1986) and Picard (1997) likewise confirmed that motion, color, and shape were important visual elements to influence

human reactions. Using a media perspective, Zettl (2002) argued for sound, motion, and color as primary sensory elements of aesthetics. More specifically, Norman (2004) identified temperature, taste, smell, faces, and touch as well as sound, color, and motion as sensory items that generated automatic positive affects in humans. Some researchers have also contended that the media type can influence people's reactions to the content (Arnheim, 1986; Reeves & Nass, 1998; Zettl, 2002). Sutcliffe (2003), however, disagreed and argued that content determined appeal more than the form of media.

Concentrating specifically on the Internet, Lavie and Tractinsky (2004) identified classical aesthetics and expressive aesthetics as the major aesthetic dimensions for Web pages. Brave and Nass (2003), focusing on interfaces, concluded that color use, though complicated, could predictably be used to impact user moods. Zettl (1973) also found media created moods based on the coldness or warmth of the color.

And even simple text on computers conveyed feelings (Bickmore & Picard, 2005; Reeves & Nass, 1998). Gobé's (2001) and Watzman's (2003) observations that a typeface could provide an aesthetic message further supported the idea. One example of such connotations is Fogg's (2003) creation of a dominating interface by employing only "bold, assertive typefaces for the text" (p. 96). A submissive computer interface was also created by using only an italicized font.

Examining Specific Aesthetic Elements

Aesthetics was first conceived as a means of applying logic to our senses (Brown & Volgsten, 2006); so the fact that aesthetic elements are interpreted through our senses is not surprising. These very senses are the conduit for our affective communication (Picard, 1997). In fact, studying individual aesthetic elements, explained Brave and Nass

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(2003), provides the foundation needed for designing aesthetics into interfaces. Many aesthetic-prompting elements exist. Gobé (2001) cites odor, for example, as an excellent trigger of feelings. Yet, for now, odor does not apply to the Web. For this study, only a few examples of elements currently relevant to homepages will be considered: sound, faces, and color.

Examining Specific Aesthetic Elements: Sound

Sound, in particular music, because of its importance to people, makes it an important interface tool for evoking aesthetic responses. A person's working memory is comprised, in part, with two information stores—one for the visual and a second for the aural (Card, Moran, & Newell, 1983). This division suggests that what we perceive through our ears is equally as important as what we perceive through our eyes. In fact, Anderson (1996) and Reeves and Nass (1998) found that clarity of sound influenced listeners more than the clarity of video. Remarkably, Reeves and Nass found that high-quality sound convinced people that visual quality was higher as well. Not unexpectedly, the aesthetic elements of sound appear to bypass conscious awareness (Boorstin, 1990; Gobé, 2001; Strandberg & Wallin, 2006) and produce *immediate* visceral reactions. In other words, people can react to a sound before they even think about it.

Sounds are patterns that correlate aesthetics to events (Moncrieff, Dorai, & Venkatesh, 2002). In essence, sound often corresponds to aesthetic feelings, and music is a prominent means of evoking feelings (Jones & Jones, 2006; Picard, 1997). "In fact, it is almost impossible to conceive of a visceral [movie] scene without music behind it. In such a subjective world, music creates the emotional space. Yet music in this context is

basically a form of emotional sound effect" (Boorstin, 1990, p. 131) that can sway a person or even entire groups of people (Strandberg & Wallin, 2006).

The musical "sway" of particular interest to homepage designers is what Berlyne termed a psychophysical variable (North & Hargreaves, 2006) and what Brown (2006) called directed stimulation—influencing the feelings of music listeners without relying on any external or learned associations of the music. A number of musicology theories divide music into two levels—one associated with linguistic meaning and the other with aesthetic meaning (Brown, 2006). This aesthetic-psychophysical level of music includes many elements of musical structure. These elements are just a few of the identified examples:

- Scale, interval, chord, rhythm, tempo, and volume suggested varying aesthetic feelings (Brown, 2006).

- Major scales suggested happy or positive thoughts; minor scales produce unhappy or negative ones (Brave & Nass, 2003).

- Fast tempo suggested "activity, surprise, happiness, pleasantness, potency, fear, anger" (Gobé, 2001, p. 76); slow tempo suggested "sadness, boredom, disgust" (Gobé, 2001, p. 76); low pitch suggested "boredom, pleasantness, sadness" (Gobé, 2001, p. 76); high pitch suggested "surprise, potency, anger, fear, activity" (Gobé, 2001, p. 76); small amplitude modulation suggested "disgust, anger, fear, boredom" (Gobé, 2001, p. 76); and large amplitude modulation suggested "happiness, pleasantness, activity, surprise" (Gobé, 2001, p. 76).

- "[S]low tempos, soft volume, minor keys, [and] dissonant harmonies" (Bullerjahn, 2006, p. 218) suggested sadness.

- Rhythm suggested "calmness and relaxation to stress and high tension" (Strandberg & Wallin, 2006, p. xi); harmonies suggested "countless mood settings and emotional nuances" (Strandberg & Wallin, 2006, p. xi); interaction between chords suggested "a variety of things: the progress of events, the characters of a narrative, emotions such as joy and sadness, threats" (Strandberg & Wallin, 2006, p. xi); and melody suggested a "character's presence" (Strandberg & Wallin, 2006, p. xi).

Such elements of music can communicate numerous aesthetic feelings and moods to people (Strandberg & Wallin, 2006). Clearly, music has a profound impact on humans; but, as Berlyne (1968) cautioned and Brown (2006) warned, these "effects must be analyzed on a case-by-case basis as the uses of music are so incredibly diverse" (p. 23). Nor are these elements explicitly tailored for inducing aesthetic responses on homepages.

Examining Specific Aesthetic Elements: Faces

Faces are an extremely important way of displaying and evoking aesthetic responses in humans. Humans are especially sensitive to faces—especially the eyes. People looking at faces, spend about 50% of that time scanning the eyes for information (Reeves & Nass, 1998). People likewise scan the mouth for feedback concerning communication and reactions (Ali & Marsden, 2003; Boorstin, 1990). Brave and Nass (2003) believed people primarily evaluate someone's feelings from their face. Picard (1997) noted that facial expressions evoked aesthetic responses in both the expresser and the viewer.

A person does not even have to be aware of seeing a face to react to it. Smiling or frowning faces flashed too quickly to be consciously recognized can easily influence mood and judgment (Brave & Nass, 2003; Picard, 1997). In fact, Picard (1997) concluded that an unconsciously perceived stimulus had more aesthetic impact than when it was consciously perceived. "In other words," Reeves and Nass (1998) concurred, "priming works. What you see at one moment activates a way of thinking that influences subsequent evaluations" (p. 245). Picard (1997) observed that people still recognized facial expressions better with motion rather than in still images. Nonetheless, whether preconsciously perceived or not, how faces explicitly relate to aesthetic elements for homepages is unknown.

Examining Specific Aesthetic Elements: Color

Color is an obvious and important element for influencing humans. Not only is the impact of color immediate but also powerful (Watzman, 2003). Partially colored advertisements are twice as likely to be noticed as black and white advertisements; full color ads are five times as likely to be noticed as the black and white ones (Watzman, 2003). In other words, "[c]olor is about conveying crucial information" (Gobé, 2001, p. 77). These characteristics not only apply to the informational aspects of color but to the aesthetic aspects as well (Watzman, 2003). In the cinema, color details of the costumes and the settings are vital for uniting a scene and evoking a specific mood (Boorstin, 1990). Attention to such aesthetic-evoking detail is hardly surprising. Zettl (1973) likewise suggested that particular moods were influenced greatly by even the coldness or warmth of the color.

Color influences the nervous system and stimulates aesthetic responses in the brain (Gobé, 2001). While color elements in an interface can definitely impact a user's mood, determining the individual response to particular color elements can be complicated. "Nevertheless, as any artist will attest, carefully designed color schemes (combined with other design elements) can produce reliable and specific influences on mood" (Brave & Nass, 2003, p. 88). Such influences are comprised of many elements. These are just a few examples of them:

- Warm colors suggested forward-moving elements and cool colors suggested retreating elements (Marcus, 2003; Zettl, 1973).

- Gray suggested the serious and professional; navy blue suggested a reliable color; pale blue suggested a relaxing and peaceful color; and yellow-orange suggested a hospitable color (Gobé, 2001).

- Background colors with low saturation suggested an image with greater depth (Sutcliffe, 2003).

- Dark, warm browns and off-whites suggested neutral and objective feelings; green colors suggested feelings of efficiency; saturated and bright reds suggested happy and energetic moods; and desaturated pastels suggested softness (Zettl, 1973).

While these examples are derived from many observations and years of experience, they are not necessarily adapted specifically to homepages. Nor do they provide a technique for evoking specific aesthetic responses from homepage viewers. Unfortunately, these generalizations are not sufficiently detailed to reliably induce aesthetic responses on homepages.

Controlling Aesthetic Elements

A number of aesthetic elements exist that can evoke responses in people, and computers can be a medium to convey those elements. However, identifying the correct element to evoke the desired response from a homepage has not been defined. In fact, associating homepage design elements to aesthetic responses is only in an embryonic phase of research now (Angeli, Sutcliffe, & Hartmann, 2006). Thus, not surprisingly, almost all the studies that have addressed this topic have provided only modest (if any) such techniques.

Most research performed to date on evoking responses to aesthetic elements has been in film and television and used such techniques as film grammar and applied media aesthetics (Dorai & Venkatesh, 2002; Zettl, 2002). The methodologies for these techniques are not readily transferable to a homepage medium and are not quantifiable. Much of the history of human-computer interaction (and likewise of Web-page development) has been devoted to usability and efficiency concerns. Only recently has consideration of affect and aesthetics begun to emerge as a subject of research and application (Lavie & Tractinsky, 2004). Schenkman and Jonsson (2000) studied aesthetics and preferences of Web pages and had participants judge them according to several parameters (including complexity, legibility, order, beauty, meaningfulness, and comprehension). Although they found "a combination of pictures and beauty" (p. 375) as highly important to preference, they did not explore any specific design elements.

After reviewing the available literature targeting user interfaces and aesthetics, Karvonen (2000) felt that almost all studies had "made up" (p. 86) the parameters they looked at "without any justification from existing theories of the aesthetic" (p. 86). She

also felt that a "formal analysis" (p. 86) of aesthetic elements would provide Web page designers with more useful tools. Tractinsky (2004), likewise, felt that rather broad measures were employed in most aesthetic-focused studies. In their research, Karsvall (2002), Reeves and Nass (1998), and Picard (1997) all noted that people favor interfaces that mirror their own personality traits. In fact, Karsvall connected the preferred design elements of "high colour contrasts, saturated hues, and bold or sharp-edged shapes" (p. 217) with extroverted personalities. Likewise, he associated "de-saturated colours, green hues, and thin or rounded shapes" (p. 217) with introverted personalities. Zettl (1973) likewise associated personalities with color but connected introverts with blue and extroverts with red. Researching sound, Brown and Theorell (2006) found that background music bothered introverts doing a task but not extroverts.

Classical aesthetics and expressive aesthetics were identified by Lavie and Tractinsky as the major aesthetic dimensions for Web pages. While users were found to perceive and react to both classical and expressive aesthetics of Web sites, the perceived usability of the site was more strongly linked to the classical form (Lavie & Tractinsky, 2004).

Research also suggests that a pattern of elements (rather than just a single element) is more likely to reliably induce a desired response (Arnheim, 1986; Brave & Nass, 2003; Hartmann, 2006; Picard, 1997). For example, Kim and Moon (1997) found that very specific combinations of interface color and clipart evoked feelings of trustworthiness for cyber banks. Remarkably, such efforts are akin to what computers do with pattern recognition—coordinating inputs (e.g., sounds, facial expressions, and gestures) to specific aesthetic responses (Picard et al., 2004). With so many potential

aesthetic elements to combine on homepages, designers truly need a pattern-recognition framework or technique to control aesthetic elements on homepages (Zettl, 2002).

For this investigation, the most useful research focusing on control was the study by Kim et al. (2003). These researchers claimed to have identified design factors for homepages that were associated with specific aesthetic adjectives (representing 13 aesthetic dimensions) using three studies. The initial part of the first study involved collecting and winnowing adjectives that described homepages and resulted in 278 applicable words. The secondary part of the first study directed a dozen professional homepage designers to each create four unique homepages. In a subsequent brainstorming session, all the designers then arranged "the pages they had brought into categories according to the emotions or feelings that the individual pages induced" (p. 905). From each of the resulting 12 categories, the designers debated and ultimately selected one homepage that best represented that aesthetic category emotion. Lastly, 418 student participants that were "native speakers of Korean" (p. 905) viewed some of the representative homepages and identified their immediate feelings using emotive scales derived from the 278 applicable words. Using cluster analysis, the student results were ultimately consolidated to 13 aesthetic dimensions. The design professionals then debated and agreed on 30 aesthetic adjectives that best described the dimensions.

The second study assigned 36 professional homepage designers to one of the 13 aesthetic dimensions. Each designer was required to create a homepage that evoked the aesthetic adjectives corresponding to that aesthetic dimension (resulting in a total of 52 homepages [4 x 13 = 52]). Analysis of the videotaped words and actions of the design process revealed "design factors that professional designers frequently used to evoke

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target emotions in their homepage development" (p. 909). These design factors were assigned to one of these pattern groups: "objects on the homepages, backgrounds, and relations between the two" (p. 910).

The design factor for the relations between objects and backgrounds was matching "the colour of three types of screen objects and backgrounds. The three types are title, menu and main images; the attributes of colour used for matching are hue, brightness, and saturation…. The title hue in this case means the difference between title hue and background hue" (p. 911). The design factors for objects and backgrounds were the same for both: shape, text, and color. However the sub-factors and sub-factor values for each varied. "For example, partition was identified as an important sub-factor of the shape for the backgrounds…, whereas regularity was identified as significant for the objects" (p. 911).

In the third study, 515 student participants evaluated the 52 homepages from the second study using questions derived from the 30 aesthetic adjectives selected in the first study. The results produced "regression equations in which key design factors…were found to have significant impacts on the corresponding emotional dimensions" (p. 915). Table 1 shows an example of the design elements, their associated equations (located in parentheses), and the derived design recommendations that describe the homepage that evokes the tense adjective.

Table 1

Elements Identified for the 'Tense' Homepage Design

Design Feature	Comment and Equation	Resulting Design Recommendation to Evoke 'Tense' Adjective
Shape of title	Tense feeling evoked "when the shape of the title is not mixed (0.397 T_shape_mix)" (p. 920).	"Title: Use both rectangle and circle shape" (p. 916).
Main image	Tense feeling evoked when the main image "consists of different shapes of textures (0.722 I_texture_s)" (p. 920).	"Image: use texture for shape" (p. 916).
Main image	Tense feeling evoked when the main image "is neither yellow nor red in colour (-0.399 I_hue_yr; -0.370 I_hue_rp)" (p. 920).	"Image: do not use yellow hue colour" (p. 916). "Image: do not use rp [red-purple] hue colour" (p. 916).
Main image	Tense feeling evoked when the main image "contains dark colour (-0.300 I_brightness)" (p. 920).	"Image: decrease the brightness" (p. 916).
Background	Tense feeling evoked when the background "[is not] partitioned (-0.646 B_shape_part) …" (p. 920).	"Background: do not use partition" (p. 916)
Background	Tense feeling evoked when the background "[does] not contain yellow colour (-0.194 B_hue_y)" (p. 920).	"Background: do not use y [yellow] hue" (p. 916).
Relation between background and title	"Need to use similar colour in terms of hue in order to elicit a higher degree of tension" (p. 920). "(-0.646 RBT_hue)" (p. 926).	"Match: use similar colour hue between background and title" (p. 916).

However, the Kim et al. study was not cross cultural and understanding a target culture is important to successful communication. One method of understanding cultural differences is through the work of Geert Hofstede. He researched the cultures of 53

countries and summarized their cultural dimensions as "power distance, collectivism/individualism, femininity/masculinity, uncertainty avoidance, [and] long-and short-term time orientation" (Marcus, 2003, p. 450). Table 2 displays the scores (Marcus, 2003, p. 452) of the United States and South Korea for each of these dimensions.

Table 2

Cultural Dimension Scores for the United States and South Korea

	Power Distance	Collectivism/ Individualism	Femininity/ Masculinity	Uncertainty Avoidance	Long-Term Short-Term Time Orientation
United States	40	91	62	46	29
South Korea	60	18	39	85	75

For example, the United States, with a score of 91, is much more individualistic than South Korea, and South Korea is much more group oriented than the United States. In her examination of Hofstede's results for South Korea and the United States, Scholes (2003) concluded that, culturally speaking, the two countries stand nearly diametrically opposed. With such cultural differences to consider, the homepages of the Kim et al. study may communicate very different perceptions to U.S. participants.

Aesthetic Elements: Influences on Human-Computer Interaction Design

Movies are in the business of using aesthetics to evoke particular responses (Reeves & Nass, 1998). In fact, they are so adept at evoking aesthetic responses that researchers often use movies as stimuli in their research. One study found that people gave answers clearly biased by the movies they had just seen (Picard, 1997).

The explanation for these observations is twofold. First, according to Zettl (1990), aesthetic elements stimulate people in predictable ways. Second, according to Brave and

Nass (2003), "On-screen mood can also lead to perceived contagion effects: [For example, one] …smiling or frowning face on the screen can influence users' perceptions of other faces that they subsequently see on the screen, perhaps as a result of priming" (p. 88). If aesthetic elements in movies affect viewers, will they also affect homepage viewers? And if they do, how are the elements controlled on the homepage?

Many researchers are now confident that aesthetic factors make a difference in human-computer interaction design. Norman (2004) outlined the core concept regarding the role of aesthetics and attractive products in making people feel good. He argued that this helps them to think more creatively and in turn makes it easier to find solutions to the problems they encounter in their daily lives. However, Sutcliffe (2003) believed that designing with aesthetics serves only to attract users.

While Norman pointed out some positive aspects of aesthetics, Brave and Nass (2003) and Picard (1997) acknowledged that negative aesthetic feelings evoked by an interface could result in negative evaluations. Thus, precisely controlling the aesthetic responses evoked is important. For designer of very visual games (e.g., Quake and Halo), control is especially important. These designers are the human-computer interaction designers closest to the aesthetics of cinematography. They are especially mindful of influencing their users' emotions to ensure a satisfying user experience (Pagulayan, Keeker, Wixon, Romero, & Fuller, 2003). With the importance of these influences in mind, many researchers have encouraged designers to satisfy their users by making the user feel positive about the interface and having the interface induce positive feelings in the user.

However, this advice to consider aesthetics is generally not being heeded. In Gobé's (2001) opinion many Web pages are only focused on functionality and usability—possibly because of the programming or engineering orientation of the designers. The flaw of this exclusive fixation on usability is, as Norman (2004) explained, that "[u]sable designs are not necessarily enjoyable to use" (p. 8). This idea certainly does not mean that enjoyable design elements are the only tools a designer needs. Just as a chair needs several legs to stand, interfaces appear to require several types of supporting design elements as well. Building on the ideas of art, theorist Stephen Pepper and others explained this support as the usable interface being necessary to help eliminate misunderstandings, while the attractive interface is required to influence motivation (Bickmore & Picard, 2005; Zettl, 1990). If a designer makes interfaces too simple, the user is overcome with boredom; if interfaces are too complex, the user becomes cognitively overloaded (Berlyne, 1968; Hassenzahl, Platz, Burmester, & Lehner, 2000).

For now, this usability-only orientation has prompted designers to create interfaces with only the (supposedly) objective goals of usability and functionality. However, this objectivity is an illusion. In Picard's (1997) opinion, bias always existed in computers (or their creators) and eliminated any claim to objectivity. For that matter, Picard continued, "[e]xamples such as the Tamagocchi [*sic*] remind us that a human-computer interaction can [already] strongly influence human emotions" (p. 110). Indeed what Windows user has not, at least once, suffered annoyance (or worse) on encountering the Microsoft Office Assistant at some inopportune time? (Bickmore & Picard, 2005)

Even decades ago, people "conversing" with ELIZA, a text-only therapist program, experienced real feelings because of the interactions (Weizenbaum, 1976).

Aesthetics have always been a part of the interface; pretending to be totally objective or using objective tools does not change the fact that feeling and thinking cannot be completely compartmentalized within the brain (LeDoux, 1998; Reeves & Nass, 1998).

Justification for the Study

The internationalization of U.S. Web sites is often critiqued negatively because the results are typically just slightly modified U.S. designs that ignore the preferences of non-U.S. cultures (Badre, 2000; Chau, Cole, Massey, Montoya-Weiss, & O'Keefe, 2002; Faiola, 2005; Kamppuri, Bednarik, & Tukiainen, 2006; Shen, Woolley, & Prior, 2006; Simon, 1999). These cultural preferences are important because culture and personality have been repeatedly found to influence what people learn (Badre, 2000; Marcus, 2003; Nisbett, 2003; Norman, 2004; Picard et al., 2004; Simon, 1999; Tractinsky, 2004; Zettl, 1973). This learning, in turn, creates perspectives that influence how people interpret aesthetics and events for various experiences (Anderson, 1996; Karvonen, 2000; Lavie & Tractinsky, 2004; Zettl, 1990).

Web sites are just one example of those experiences that exhibit cultural preferences. For example, Badre (2000) identified many design elements (e.g., colors, borders, backgrounds, images, circles, rectangles, and lines) that he classified as cultural markers and characterized as "design elements found in web pages…[that] prove to be highly prevalent within a particular cultural group" (Badre, 2000, p. 5). Likewise, Simon (1999) found that Asians disliked triangles and squares on Web pages, while North

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American and European participants had no such objections and even preferred combinations of shapes. Additional studies of culture have suggested the same possibility of cultural preference related to Web-page design (Chau, Cole, Massey, Montoya-Weiss, & O'Keefe, 2002; Cyr & Trevor-Smith, 2004; Singh, Fassott, Zhao, & Boughton, 2006).

While all these studies found evidence that culture matters for various design aspects for Web pages, none of them explicitly concentrated on aesthetic design for Web pages. Badre (2000) focused on cultural usability; Simon (1999) focused on communication perceptions and user satisfaction; Cyr et al. (2004) focused on language, layout, symbols, content and structure, navigation, multimedia, and color; Chau et al. focused on relevance, confusion, entertainment, information content, and transformational content; and Singh et al. (2006) focused on presentation, navigation, attitude, and purchase intention.

Although these studies did not concentrate on aesthetic design for Web pages, many investigations have (Angeli, Sutcliffe, & Hartmann, 2006; Hartmann, 2006; Heijden, 2003; Karsvall, 2002; J. Kim, Lee, & Choi, 2003; J. Kim & Moon, 1997; Lavie & Tractinsky, 2004; Nakarada-Kordic & Lobb, 2005; Schenkman & Jonsson, 2000). However, these studies were not cross cultural. In fact, aside from acknowledging or speculating that cultural context influences design aesthetics, few investigations explicitly compared aesthetic design (i.e., aesthetic dimensions) for Web pages between cultures. For example, Karvonen (2000) discussed a study involving Finnish participants that was repeated with Swedish participants. The study found both cultures associated clean and simple Web design with trust.

This dearth of cross-cultural studies explicitly comparing aesthetic design for Web pages prompted this question: If the Web-page characteristics from cross-cultural studies revealed preferences between cultural groups, would aesthetic dimensions for Web pages also reveal cultural preferences? The question is particularly important for two reasons. First, aesthetic design is now recognized as improving many aspects of Web interactions (Angeli, Sutcliffe, & Hartmann, 2006; Hartmann, 2006; Karvonen, 2000; J. Kim & Moon, 1997; Norman, 2004) and will be applied more often in future designs. Second, companies are extending their Web sites to cultures beyond the United States (Chau, Cole, Massey, Montoya-Weiss, & O'Keefe, 2002; Simon, 1999; Singh, Fassott, Zhao, & Boughton, 2006), while the number of non-U.S. users interacting through the Internet continues to increase (Cyr & Trevor-Smith, 2004). Therefore, the consequences of applying one culture's aesthetic dimensions to Web pages targeted at a different culture needs to be explored. In this way, HCI designers can begin to learn what aesthetic dimensions can be applied or rejected for a given cultural context. Furthermore, because the cross-cultural study of aesthetic dimensions for Web pages is relatively unexplored, this investigator's study may incrementally advance this area of human-computer interaction.

As a convenient means to explore this area, the Kim et al. study was used. Using adjective sets, the Kim et al. study claimed to have identified aesthetic dimensions for South Koreans that were "found to be stable regardless of different homepages and different users" (p. 922). Using these same adjective sets, U.S. participants evaluated 13 South Korean-designed homepages that evoked the 13 emotional dimensions that Kim et

al. identified. This data was then used to determine the aesthetic dimensions evoked in U.S. participants.

Hypotheses

H1:   When choosing from the same 30 adjectives, U.S. and South Korean participants will select the same adjectives for the same aesthetic concepts.

H2:   When choosing from the same 30 adjectives, U.S. and South Korean participants will select different groupings of adjectives for each aesthetic dimension.

H3:   When viewing the same 13 homepages, U.S. and South Korean participants will have different aesthetic reactions to each one.

H4:   Using the investigator's design factors in homepages will increase the aesthetic rating.

H5:   Using high-color contrast in homepages will increase the aesthetic rating.

H6:   When using both the investigator's design factors and high-color contrast in homepages, the design factors will primarily influence the aesthetic rating.

CHAPTER THREE: METHODOLOGY

Participants

For this investigation, 107 U.S. participants were drawn from a convenience
sample; however, only 54 participants completed the entire survey (possibly because the
survey was very long). All participants were self-selected volunteers and not screened.
The participants were approximately 40 percent male and 60 percent female with an age
range of 18 to over 41 years old. All participants grew up speaking English as their first
language. Demographic details are displayed in Table 3. One participant was color blind
and was excluded from the analysis.

Table 3

Demographics for U.S. and South Korean Participants

Web-Survey Demographics		
	U.S. Participants	South Korean Participants
Number of Participants	107	515
Age Range (years old)	18-21: 2—3.3% 22-25: 1—1.6% 26-30: 1—1.6% 31-40: 19—30.6% 41+: 38—62.9% (the remaining participants did not answer)	"most of them in their twenties" (J. Kim, Lee, & Choi, 2003, p. 912)
Gender	Male: 25—41.7% Female: 35—58.3% (the remaining participants did not answer)	"gender of respondents was balanced" (J. Kim, Lee, & Choi, 2003, pp. 912-913)
Education	unknown	"undergraduate students" (J. Kim, Lee, & Choi, 2003, p. 912)

After obtaining IRB approval, 293 adults were sent an email (see Appendix A) using email addresses obtained from the investigator's and his advisor's personal, business, and academic address books. The email explained the research being conducted on homepages and asked people to view 13 homepages (on a Web-based survey) and choose how strongly they felt between sets of adjectives (for example, bright-not bright). The invitees were assured that no identifying information would be asked nor were they required to take or even finish the survey. No payments or incentives were offered to the participants of the study.

Informed consent was required before participating in the Web survey. While online, participants read the consent form to be aware of risks, benefits, alternatives, confidentiality, costs, payments, compensation for injury, contact information, and the voluntary nature of participating in the study. Participants that acknowledged their agreement with the consent form were allowed to take the Web survey.

Materials

Participants were invited to take a Web-based survey. The survey page (see examples in Appendix B) was arranged into four areas. The text in all areas used a simple sans-serif font. The first area was at the top of the page and displayed the name of the survey on the left side and the "Exit this survey >>" link on the right side. The second area was below the first and displayed the homepage identifier (e.g., Homepage05) on the left side below the name of the survey. The third area was below the second area and displayed these instructions: "Click a button on the right to rank each adjective based on your feelings about the homepage. For example, if the adjective was 'ugly' and you felt the homepage was beautiful, you might click the button under Not Ugly. However, if you

felt the homepage was somewhat ugly, you might click a button closer to Ugly." The instructions were left-justified, and each sentence was separated by white space for easier reading. The fourth area was below the third area and was divided into two parts. The first part displayed an image of a homepage (framed inside Internet Explorer 6.0 with the standard buttons and address bar hidden on the Windows XP operating system with screen resolution at 1024 by 768 and 32-bit color quality on a 19-inch monitor) to the left. On the right, the second part was divided into two lines. The first line displayed an adjective set (e.g., "Valuable Not Valuable"). The first word of the set was left justified, and the remaining words of the set were right justified. The second line displayed seven radio buttons with the leftmost radio button under the first word of the adjective set and the rightmost radio button under the remaining words of the adjective set. The homepage image was displayed 29 times (one below the other) on the page with a new adjective set beside each homepage (see Appendix B for the 13 homepage images; see the next section for a list of the 30 adjective sets). The image was repeated to ensure the participants could always see the homepage as they scrolled down and evaluated the adjective sets.

The next 12 pages followed the same pattern except they displayed a different homepage. The final page of the survey was arranged into four areas. The text in all areas used a simple sans-serif font. The first area was at the top of the page and displayed the name of the survey on the left side and the "Exit this survey >>" link on the right side. The second area was below the first and displayed "Final Questions" on the left side below the name of the survey. The third area was below the second area and displayed this text: "Thank you for your answers about the homepages. These are the final questions for this survey. Again, thank you for your help." The text was left-justified, and

each sentence was separated by white space for easier reading. The fourth area was arranged with a question (left justified and bolded) on one line, answers to the question (not bolded) on the next line, and radio buttons below the answers. These question and answer were displayed in the fourth: "What is your gender? Male, Female; What is your age? 18-21, 22-25, 26-30, 31-40, 41+; Are you comfortable using the Internet? Yes, No; Are you color blind? Yes, No; Did you grow up speaking English as your first language? Yes, No".

Procedure

Participants clicked on the link provided in the invitation email to display the Web survey site. After participants studied and agreed to the consent form, the site displayed the Web survey. All homepages were viewed online and all participant responses were provided by clicking radio buttons online. Participants were allowed to take as much time as needed when responding to the Web survey. No effort was made to limit any apparatus participants used to access the Internet. Participants were free to use computers, cell phones, etc. to view the Web survey.

For each homepage, participants were asked to rank these 30 adjective sets according to their feelings when viewing the homepage:

- Adorable-not adorable
- Balanced-not balanced
- Bright-not bright
- Calm-not calm
- Classical-not classical
- Colorful-not colorful

- Concise-not concise

- Conventional-not conventional

- Cute-not cute

- Deluxe-not deluxe

- Elegant-not elegant

- Familiar-not familiar

- Fresh-not fresh

- Futuristic-not futuristic

- Hopeful-not hopeful

- Mystic-not mystic

- Plain-not plain

- Popular-not popular

- Powerful-not powerful

- Promising-not promising

- Sexy-not sexy

- Sharp-not sharp

- Simple-not simple

- Static-not static

- Strong-not strong

- Surreal-not surreal

- Tense-not tense

- Vague-not vague

- Valuable-not valuable

■ Vibrant-not vibrant

The adjective sets were ranked using a 7-point scale; participants could click one

of seven radio buttons that best expressed the aesthetic fit of the adjective to the

homepage. For example, at one extreme would be futuristic and at the other extreme

would be not futuristic (see Figure 1). In the Web survey, the first homepage was

displayed on the left and the adjective set was displayed on the right (see Figure 1).

Under that, the same homepage was displayed again, and the next adjective set was

displayed on the right (see Figure 2). This sequence was repeated for each of the

adjective sets for the first homepage. The same process was duplicated for the subsequent

12 homepages (see Appendix B for additional graphics of the Web survey).
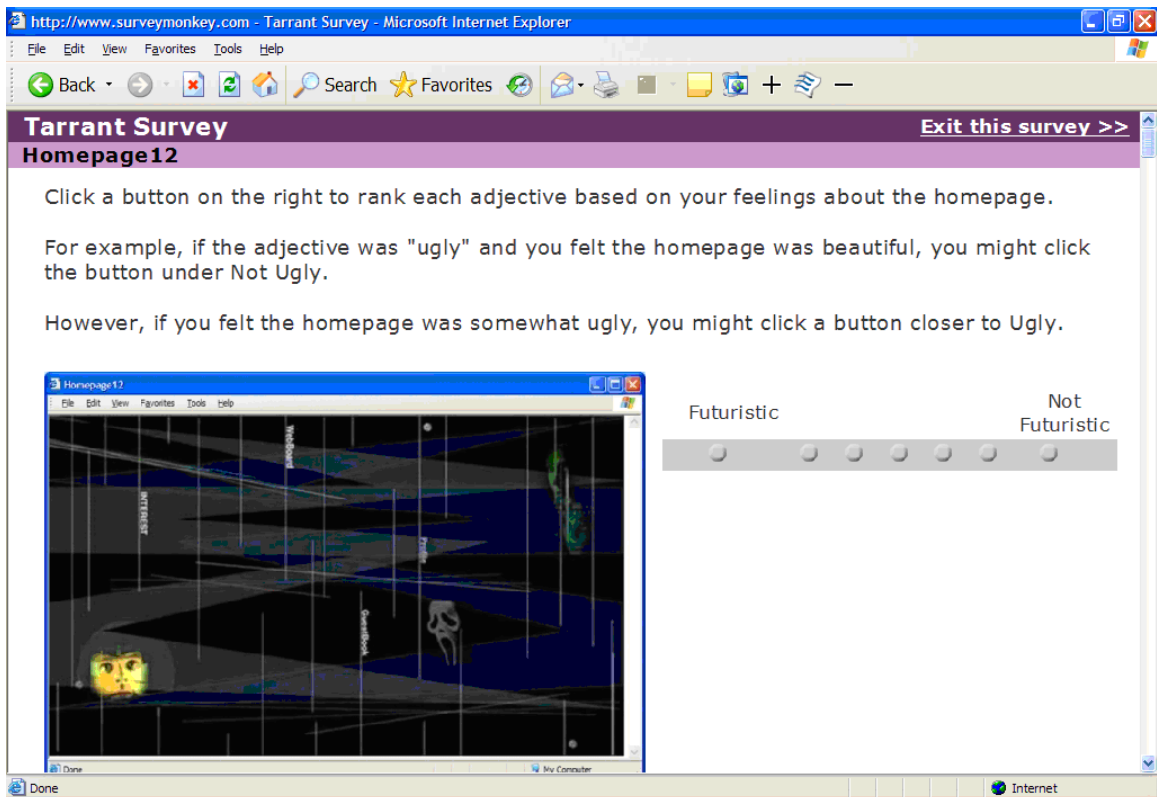
Figure 1. Example of U.S. participants' Web survey.
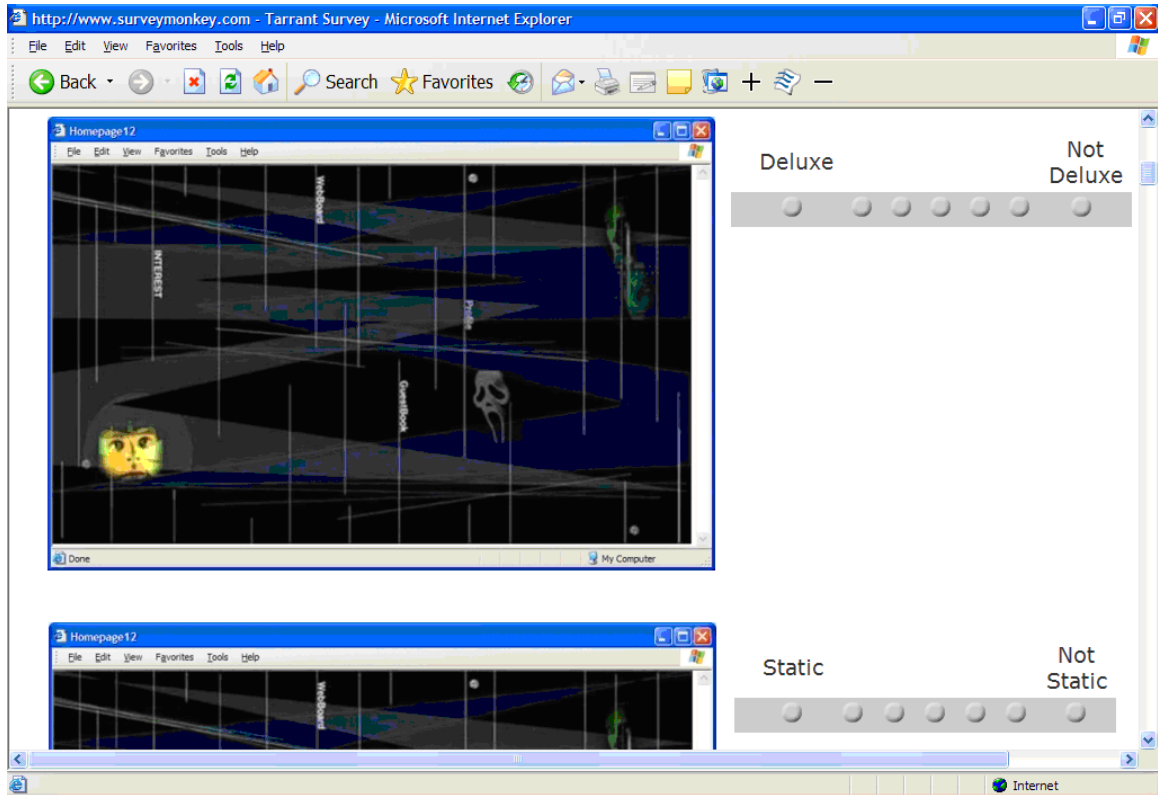
Figure 2. Second example of U.S. participants' Web survey.

An online, commercial survey site was used to create and host the survey. This

site was chosen for two reasons: first, the ability to display both graphics and a 7-point

scale and second, economic feasibility. The Kim et al. survey employed a custom tool

that randomly displayed a homepage for each participant as well as randomizing the

adjective sets for that homepage. Because the survey site did not have the functionality

for randomizing the order of homepages nor randomizing the order of adjective scales, an

online site was used to generate random strings of digits from 1 to 30 were generated 13

times to represent the order of the 30 adjectives for each homepage. For example, the

order of adjectives for Homepage05 were 5-sharp, 26-surreal, 28-vague, 16-adorable, 27-

mystic, 3-fresh, 23-classical, 21-simple, 9-calm, 10-balanced, 6-strong, 20-sexy, 30-

promising, 14-popular, 13-valuable, 17-cute, 19-vibrant, 4-tense, 29-hopeful, 11-deluxe,

18-colorful, 12-elegant, 24-conventional, 15-familiar, 7-powerful, 2-plain, 1-bright, 22-concise, 25-futuristic, and 8-static.

Data Analysis

Data from the Web survey was analyzed using three methods: descriptive analysis, visualizations, and regression analysis. Descriptive statistics supplied the mean and standard deviation of the participants' attitude (positive or negative) toward the adjectives. Visualizations were created using isometric feature mapping (ISOMAP), multidimensional scaling (MDS), and principal component analysis (PCA) for the 30 adjectives as well as the 13 homepages. Regression analysis was used to evaluate the influence of individual and combinations of design factors to determine their aesthetic importance to U.S. participants.

The U.S. survey data was first analyzed using descriptive statistics to determine the U.S. participants' attitudes toward the 30 aesthetic adjectives. A mean below four meant the participants had a more positive reaction to the adjective; a mean above four meant a more negative reaction. In general, the participants' preferred concise (M=3.74, SD=1.85) the most and sexy (M=2.07, SD=1.49) the least. Next, the South Korean and U.S. adjective and homepage data was examined using MDS, PCA, and ISOMAP visualizations to inspect for obvious patterns.
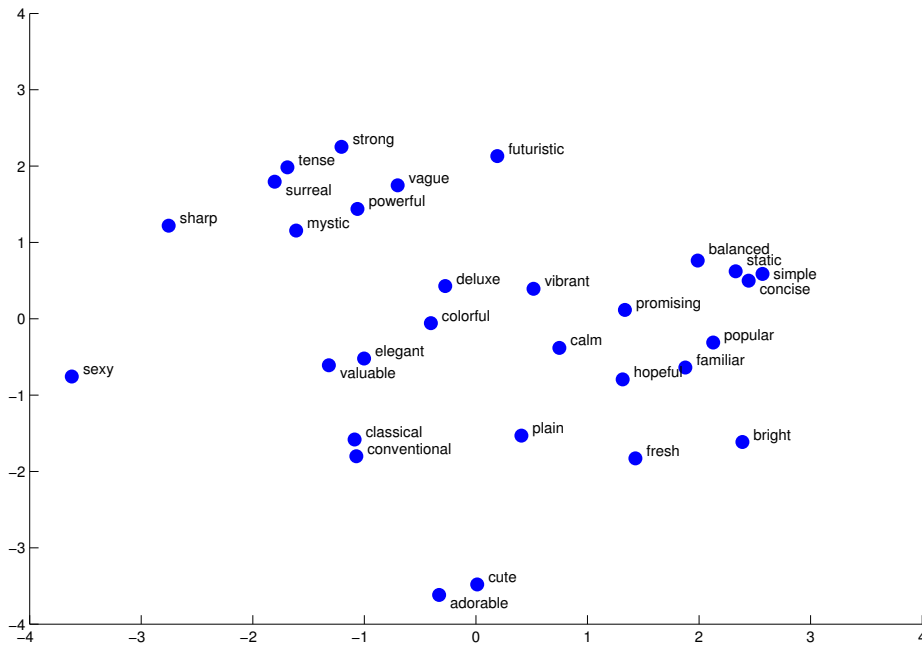
Figure 3: MDS visualization for South Korean groupings of aesthetic adjectives.
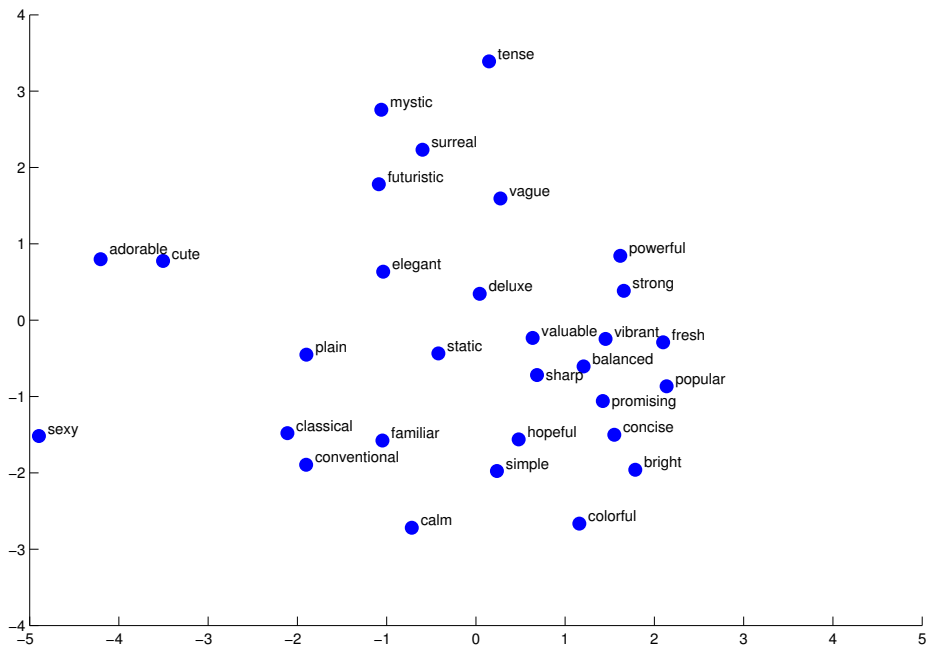
Figure 4: MDS visualization for U.S. groupings of aesthetic adjectives.
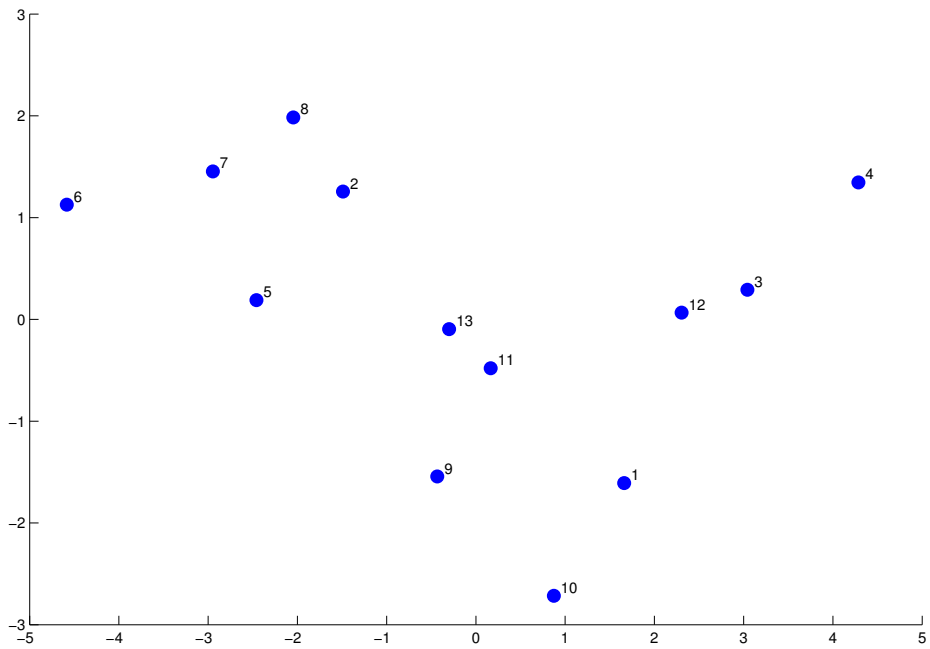
Figure 5: MDS visualization for South Korean groupings of homepages.
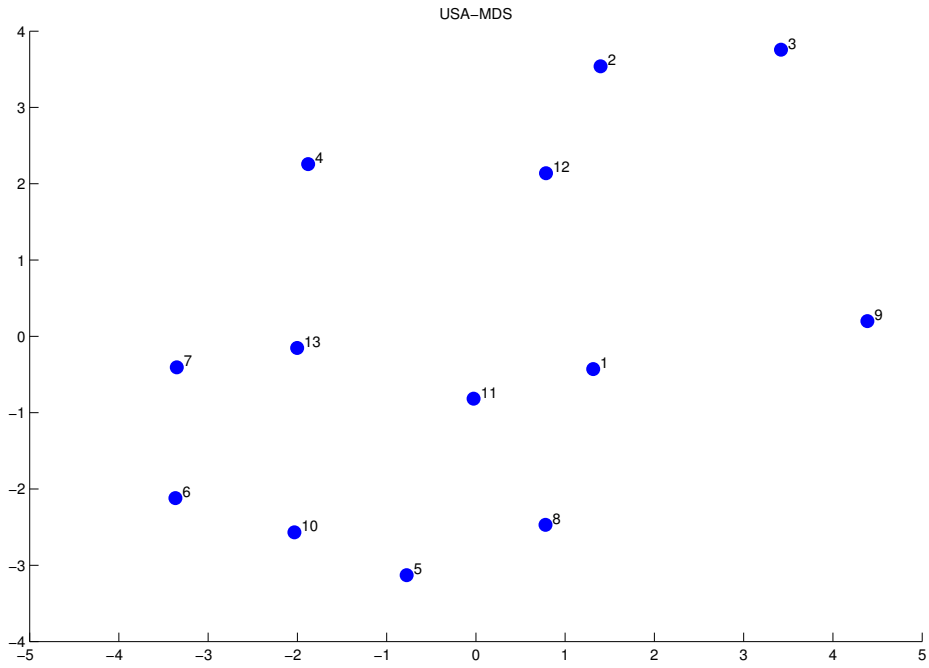
Figure 6: MDS visualization for U.S. groupings of homepages.
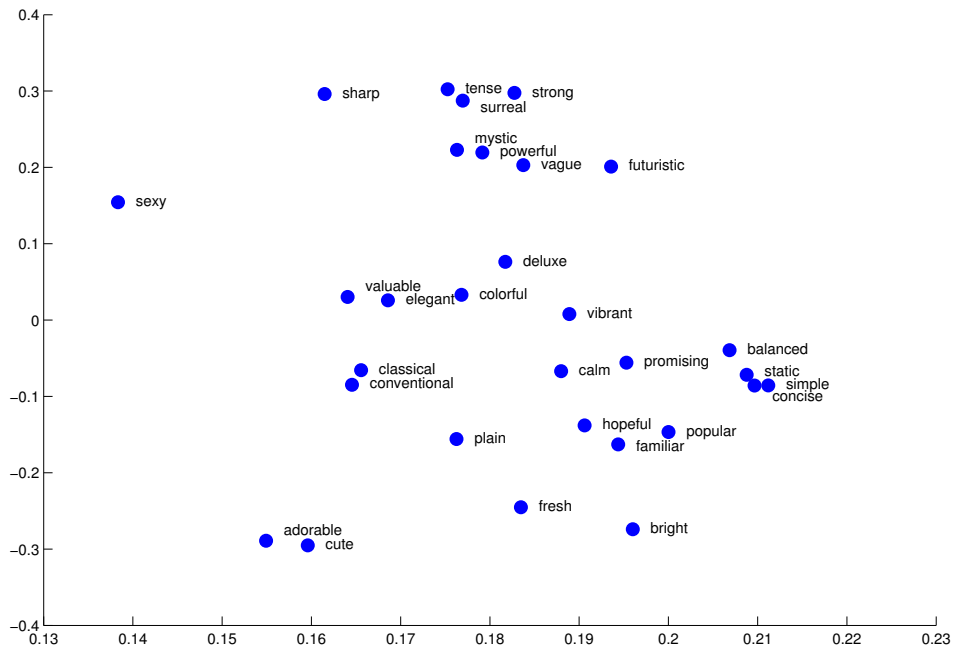
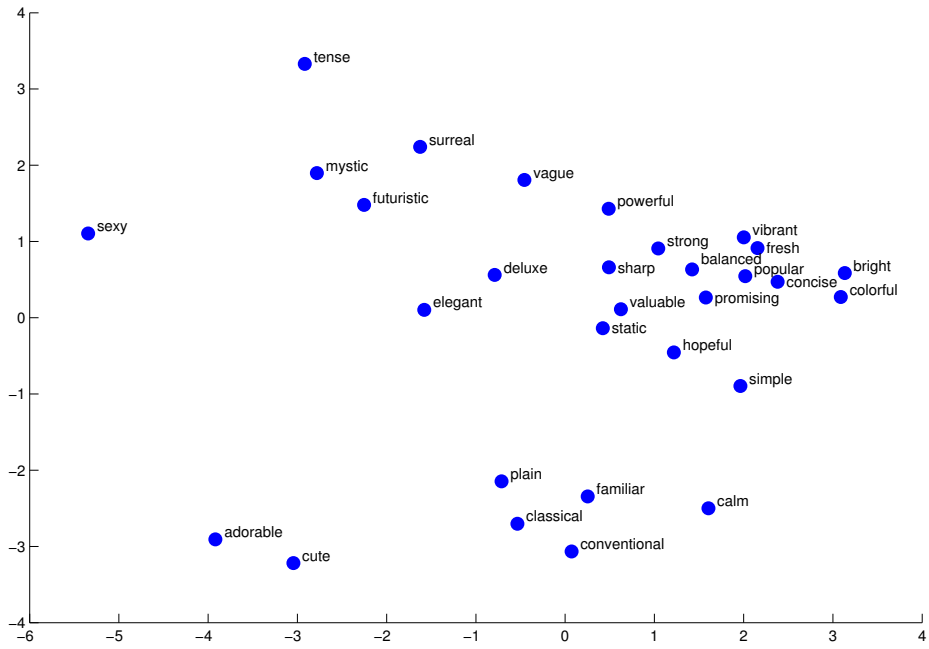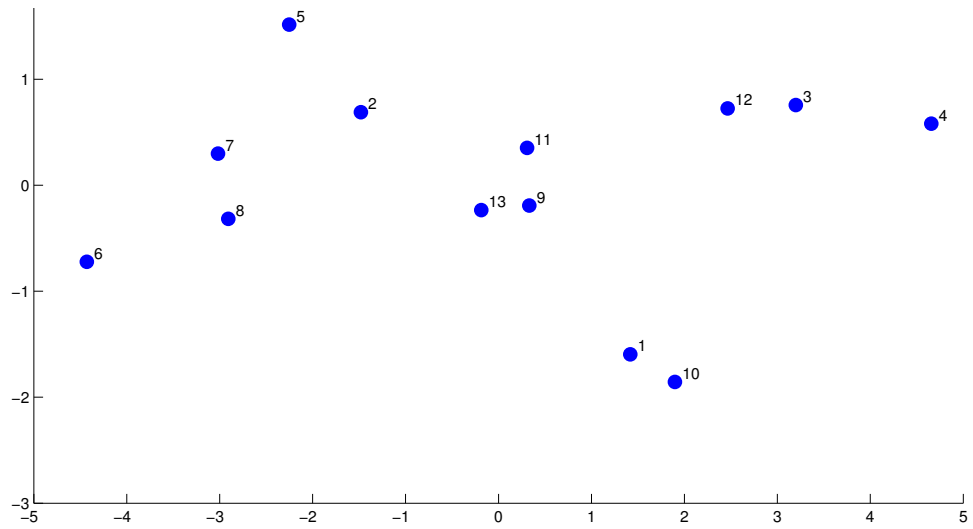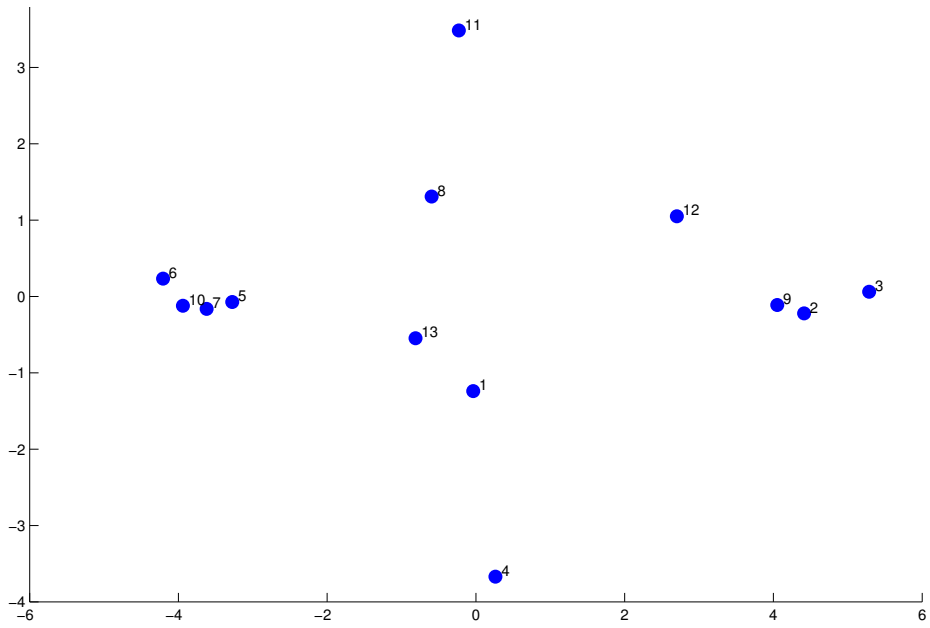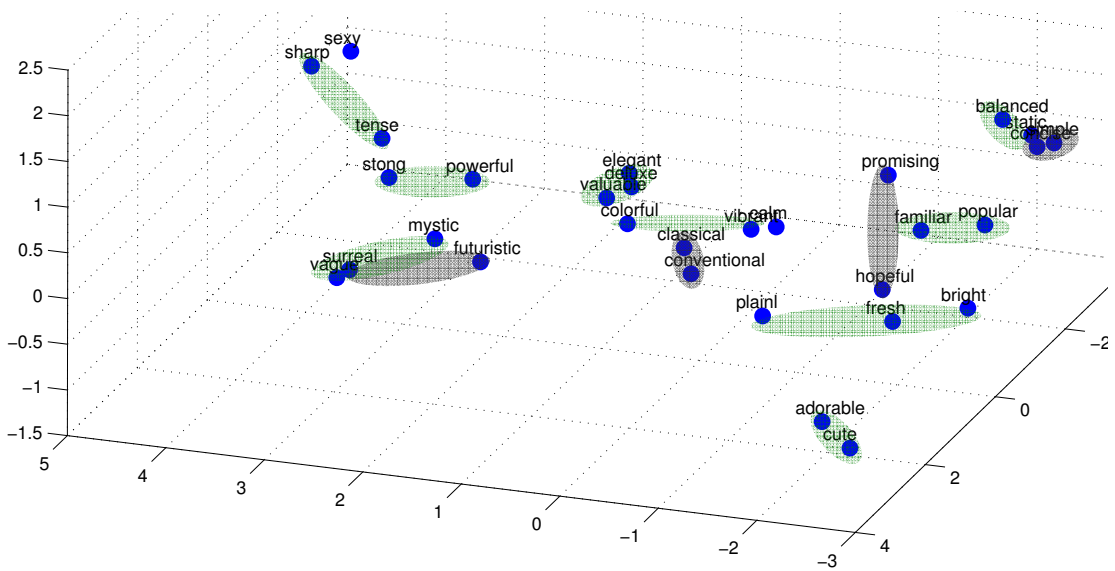Figure 7: PCA visualization for South Korean groupings of aesthetic adjectives.

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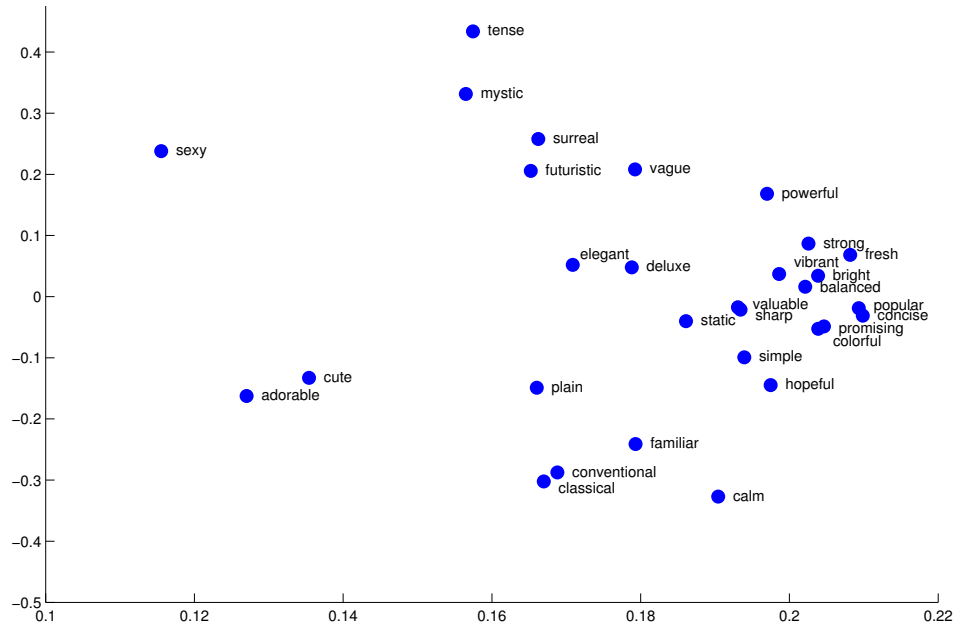
Figure 8: PCA visualization for U.S. groupings of aesthetic adjectives.
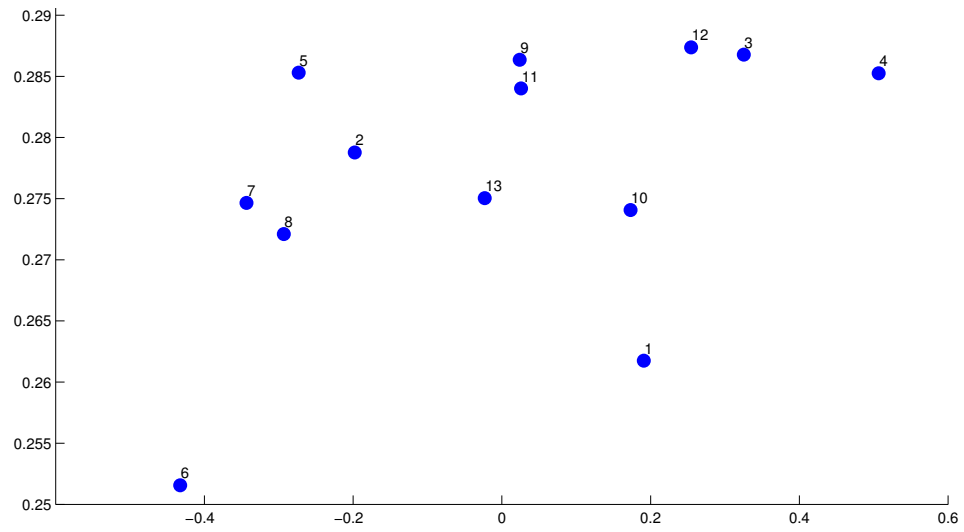
Figure 9: PCA visualization for South Korean groupings of homepages.
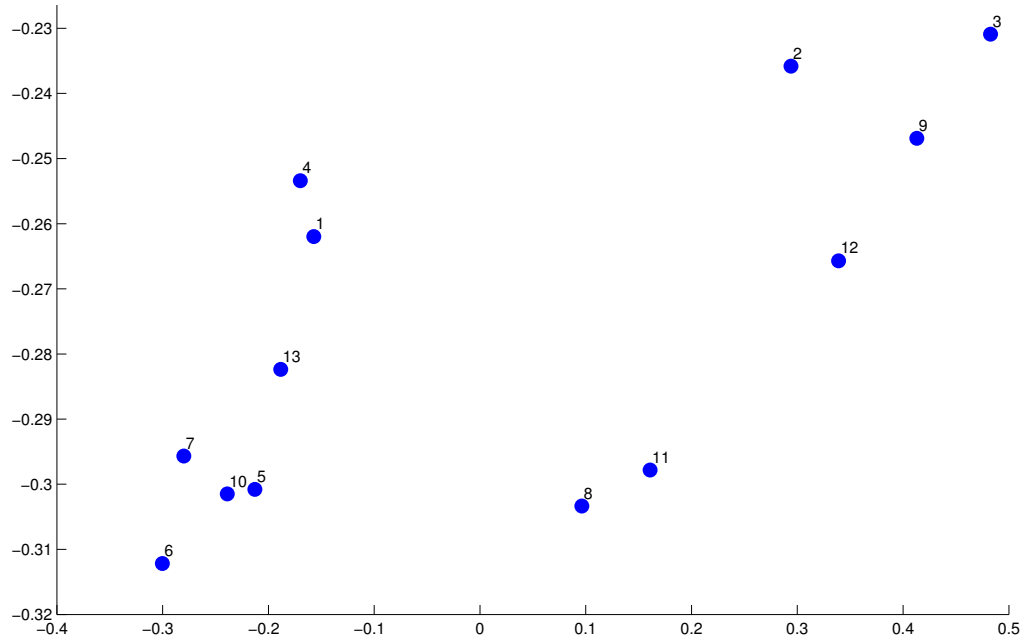
Figure 10: PCA visualization for U.S. groupings of homepages.
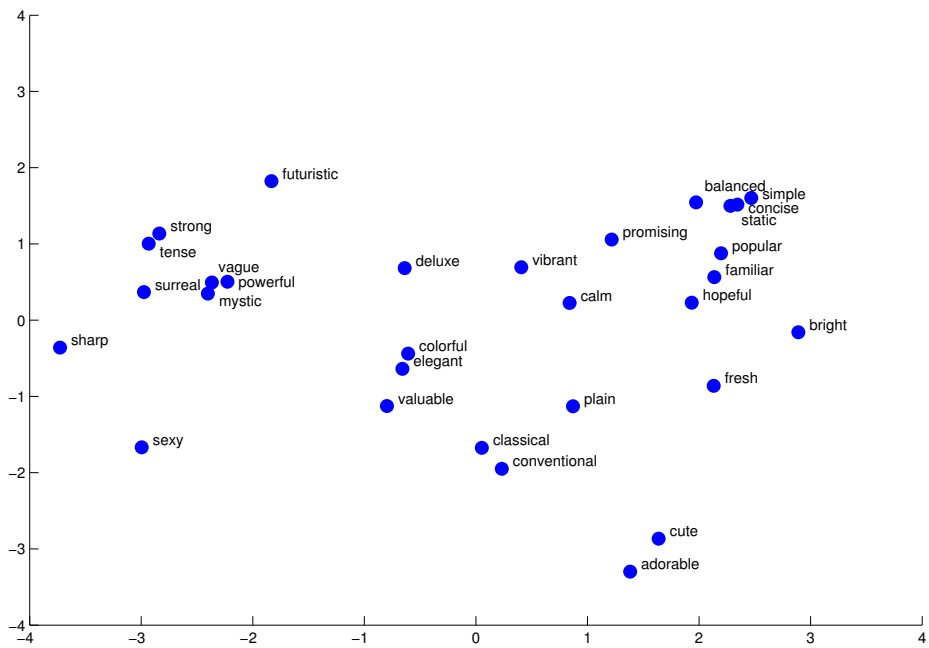
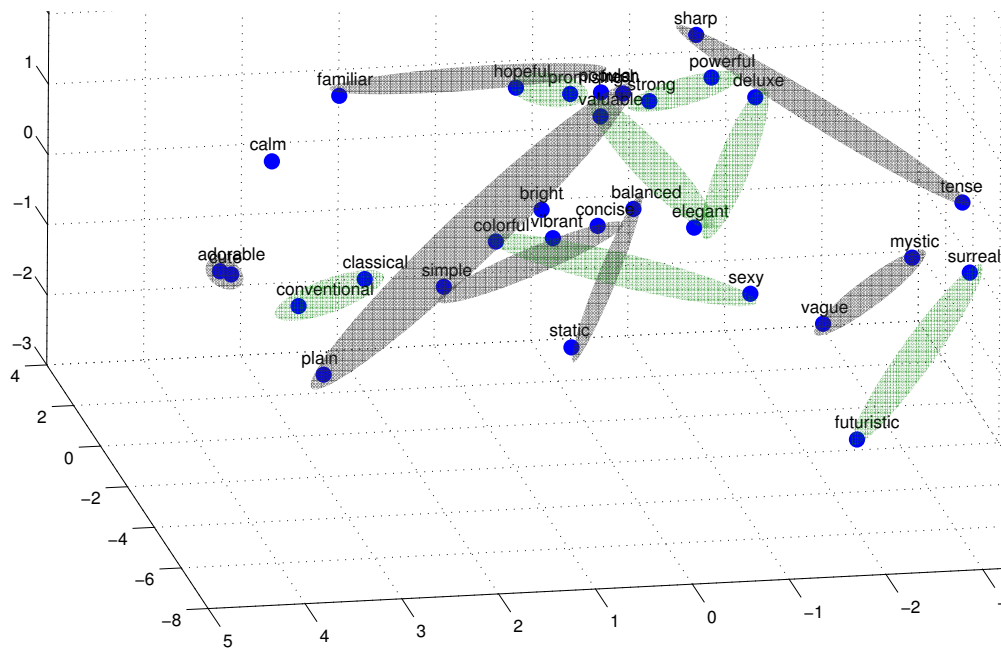Figure 11: ISOMAP visualization for South Korean groupings of aesthetic adjectives.

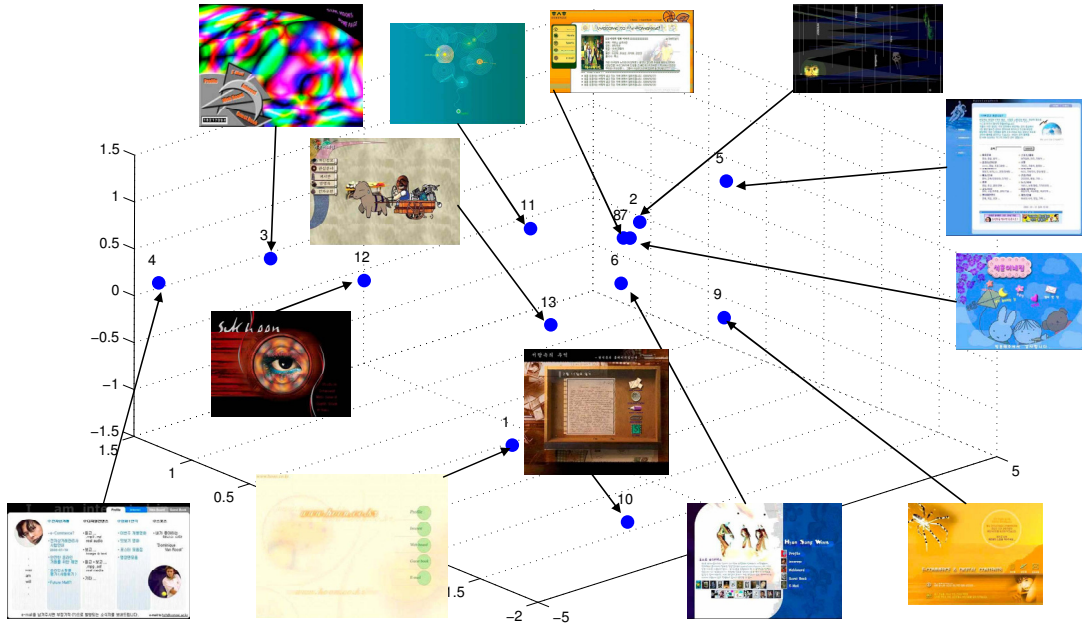Figure 12: ISOMAP visualization for U.S. groupings of aesthetic adjectives.

Figure 13: ISOMAP visualization for South Korean groupings of homepages.

Figure 14: ISOMAP visualization for U.S. groupings of homepages.

Figure 15: ISOMAP 3-D visualization for South Korean groupings of aesthetic adjectives.

Figure 16: ISOMAP 3-D visualization for U.S. groupings of aesthetic adjectives.

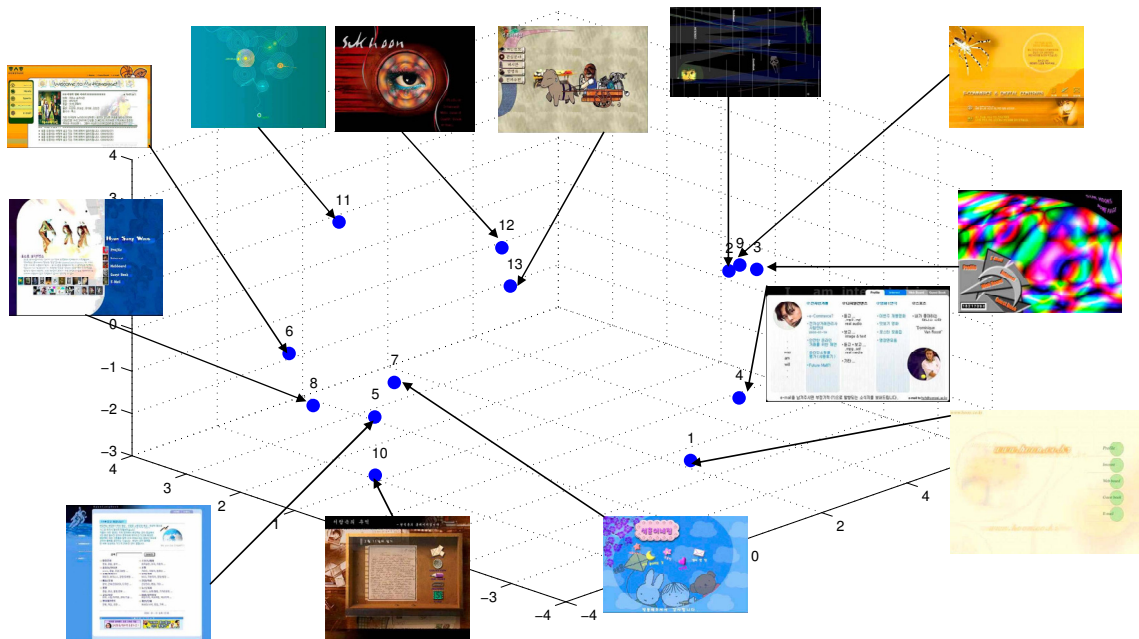Figure 17: ISOMAP 3-D visualization for South Korean groupings of homepages.

Figure 18: ISOMAP 3-D visualization for U.S. groupings of homepages.

Visual inspection of the MDS figure for South Korean groupings (see Figure 3) identified 13 groupings of aesthetic adjectives (bright, plain, and fresh; tense and sharp; strong and powerful; static, calm, and balanced; deluxe, elegant, and valuable; popular

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and familiar; adorable and cute; colorful and vibrant; simple and concise; classical and conventional; futuristic and surreal; mystic and vague; and hopeful and promising). Sexy appeared isolated from the other adjectives as well as its related adjectives (colorful and vibrant).

Visual inspection of the MDS figure for U.S. groupings (see Figure 4) identified nine groupings of aesthetic adjectives (strong and powerful; static and balanced; deluxe, elegant, and valuable; adorable and cute; simple and concise; classical and conventional; futuristic and surreal; mystic and vague; and hopeful and promising). Calm appeared isolated from its related adjectives (static and balanced).

A visual comparison of the MDS figure for South Korean homepage groupings (see Figure 5) and the MDS figure for U.S. homepage groupings (see Figure 6) identified no homepages that shared common coordinates.

Visual inspection of the PCA figure for South Korean groupings (see Figure 7) identified 13 groupings of aesthetic adjectives (bright, plain, and fresh; tense and sharp; strong and powerful; static, calm, and balanced; deluxe, elegant, and valuable; popular and familiar; adorable and cute; colorful and vibrant; simple and concise; classical and conventional; futuristic and surreal; mystic and vague; and hopeful and promising). Sexy appeared isolated from the other adjectives as well as its related adjectives (colorful and vibrant).

Visual inspection of the PCA figure for U.S. groupings (see Figure 8) identified 11 groupings of aesthetic adjectives (bright and fresh; strong and powerful; static and balanced; deluxe, elegant, and valuable; adorable and cute; colorful and vibrant; simple and concise; classical and conventional; futuristic and surreal; mystic and vague; and

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hopeful and promising). Plain appeared isolated from its related adjectives (bright and fresh). Likewise, calm appeared isolated from its related adjectives (static and balanced), and sexy appeared isolated from its related adjectives (colorful and vibrant).

A visual comparison of the PCA figure for South Korean homepage groupings (see Figure 9) and the PCA figure for U.S. homepage groupings (see Figure 10) identified no homepages that shared common coordinates.

Visual inspection of the ISOMAP figure for South Korean groupings (see Figure 11) identified 13 groupings of aesthetic adjectives (bright, plain, and fresh; tense and sharp; strong and powerful; static, calm, and balanced; deluxe, elegant, and valuable; popular and familiar; adorable and cute; colorful and vibrant; simple and concise; classical and conventional; futuristic and surreal; mystic and vague; and hopeful and promising). Sexy appeared isolated from the other adjectives as well as its related adjectives (colorful and vibrant).

Visual inspection of the ISOMAP figure for U.S. groupings (see Figure 12) identified 11 groupings of aesthetic adjectives (bright, and fresh; strong and powerful; static and balanced; deluxe, elegant, and valuable; adorable and cute; colorful and vibrant; simple and concise; classical and conventional; futuristic and surreal; mystic and vague; and hopeful and promising). Sexy appeared isolated from the other adjectives as well as its related adjectives (colorful and vibrant). Likewise, plain appeared isolated from its related adjectives (bright and fresh), and calm appeared isolated from its related adjectives (static and balanced).

A visual comparison of the ISOMAP figure for South Korean homepage groupings (see Figure 13) and the ISOMAP figure for U.S. homepage groupings (see Figure 14) identified no homepages that shared common coordinates.

Visual inspection of the ISOMAP 3-D figure for South Korean groupings (see Figure 15) identified 13 groupings of aesthetic adjectives (bright, plain, and fresh; tense and sharp; strong and powerful; static and balanced; deluxe, elegant, and valuable; popular and familiar; adorable and cute; colorful and vibrant; simple and concise; classical and conventional; futuristic and surreal; mystic and vague; and hopeful and promising). Calm appeared isolated from its related adjectives (static and balanced); sexy also appeared isolated from its related adjectives (colorful and vibrant).

Visual inspection of the ISOMAP 3-D figure for U.S. groupings (see Figure 16) identified 13 groupings of aesthetic adjectives (bright and fresh; tense and sharp; strong and powerful; static and balanced; deluxe, elegant, and valuable; popular and familiar; adorable and cute; colorful, vibrant, and sexy; simple and concise; classical and conventional; futuristic and surreal; mystic and vague; and hopeful and promising). Plain appeared isolated from its related adjectives (bright and fresh); calm also appeared isolated from its related adjectives (static and balanced).

A visual comparison of the ISOMAP 3-D figure for South Korean homepage groupings (see Figure 17) and the ISOMAP figure for U.S. homepage groupings (see Figure 18) identified no homepages that shared common coordinates.

Next, a more detailed examination was made using principal component analysis. Principal component analysis "is a way of identifying patterns in data and expressing the data in such a way as to highlight their similarities and differences" (Smith, 2002, p. 12).

The U.S. data for each homepage was mathematically rotated to reveal six aesthetic dimensions in the 13 homepages studied (see Table 5). Likewise, the South Korean data for each homepage also revealed six aesthetic dimensions in the 13 homepages studied (see Table 7). Each adjective's factor scores were also used to calculate the dependent variables for the follow-up regression analysis (see Table 8).

Factor analysis was used to explain the percentage of variance for the adjective selection (see Table 4 for U.S. results and Table 6 for South Korean results). By applying the maximum likelihood method and varimax rotation, the survey results for the 30 adjectives identified six aesthetic dimensions for each culture. For the U.S. survey results, the first aesthetic dimension data explained 21.28% of variance and the remaining five aesthetic dimensions respectively explained 8.42%, 6.28%, 4.64%, 4.35%, and 3.80%. For the South Korean survey results, the first aesthetic dimension explained 24.43% of variance and the remaining five aesthetic dimensions respectively explained 17.73%, 7.61%, 6.32%, 5.30%, and 3.66%.

Table 4

Total Variance Explained for U.S. Survey Data

Component	Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
1	6.38	21.28	21.28
2	2.52	8.42	29.69
3	1.88	6.28	35.97
4	1.39	4.64	40.61
5	1.30	4.35	44.96
6	1.14	3.80	48.75

Note: Extraction Method: Principal Component Analysis.

Table 5

Rotated Factor Matrix for U.S. Survey Data[a]

	Factor (Aesthetic Dimension)					
	1	2	3	4	5	6
Powerful	.67	-.10	.26	.03	.19	-.07
Deluxe	.67	.00	.04	.08	.03	.21
Valuable	.62	.34	.01	.06	-.07	.11
Strong	.62	-.03	.26	.04	.22	-.08
Promising	.60	.37	.07	.05	-.07	.11
Fresh	.60	.01	.09	.12	.08	.10
Sharp	.59	.11	-.06	.19	.09	.01
Popular	.58	.23	-.03	.04	.05	.27
Elegant	.55	.21	.11	.18	-.05	.10
Hopeful	.47	.34	-.08	.15	.03	.33
Familiar	.17	.69	.08	.08	.05	-.02
Conventional	.06	.66	.07	.02	.25	.00
Classical	.20	.61	-.09	.05	.19	.13
Calm	.13	.46	-.07	.15	.27	.16
Concise	.30	.33	.18	.00	.25	.09
Surreal	.08	.06	.73	.11	-.05	.03
Mystic	.15	.04	.72	.01	-.11	.04
Futuristic	.06	.09	.56	.31	-.01	-.06
Tense	.15	-.42	.49	.04	.13	-.04
Vague	.00	-.04	.47	-.09	.21	.12
Bright	.12	.02	.05	.76	.13	.03
Colorful	.11	.18	.04	.73	.16	.13
Vibrant	.37	.00	.21	.66	.06	.10
Plain	-.05	.27	-.01	.07	.72	.02
Simple	.20	.12	-.01	.13	.66	-.01
Static	.01	.10	.06	.10	.61	.17
Balanced	.24	.16	.02	.24	.28	-.11
Adorable	.12	.15	.01	.13	.12	.79
Cute	.16	.13	.05	.08	.14	.77

	Factor (Aesthetic Dimension)					
	1	2	3	4	5	6
Sexy	.37	-.19	.19	-.07	-.16	.47

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
[a] Rotation converged in 7 iterations.

Table 6

Total Variance Explained for South Korean Survey Data

Component	Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
1	7.33	24.43	24.43
2	5.32	17.73	42.16
3	2.28	7.61	49.77
4	1.90	6.32	56.09
5	1.59	5.30	61.39
6	1.10	3.66	65.05

Note: Extraction Method: Principal Component Analysis.

Table 7

Rotated Factor Matrix for South Korean Survey Data[a]

	Factor (Aesthetic Dimension)					
	1	2	3	4	5	6
Strong	.80	-.08	.04	.05	-.01	-.09
Tense	.80	-.14	.02	.04	-.12	-.01
Sharp	.79	-.16	.00	.01	-.09	.10
Powerful	.78	-.03	.08	.08	.14	-.05
Surreal	.67	.00	.01	.12	-.38	-.11
Futuristic	.65	.08	.15	.21	-.13	-.25
Sexy	.61	.25	-.06	.16	-.09	.20
Mystic	.57	.11	.07	.29	-.44	-.03
Colorful	.49	.43	-.14	.23	.25	-.11

	Factor (Aesthetic Dimension)					
	1	2	3	4	5	6
Cute	.00	.86	.09	.01	.01	.17
Adorable	.03	.85	.09	.02	-.01	.16
Bright	-.18	.69	.27	.18	.16	-.06
Fresh	-.15	.67	.33	.29	.09	.02
Vibrant	.47	.51	.01	.20	.23	-.12
Hopeful	.13	.50	.31	.30	.31	-.08
Simple	.06	.15	.84	.02	.13	.00
Concise	.07	.16	.83	.03	.17	.02
Static	.06	.19	.69	.31	.14	-.12
Balanced	.08	.08	.61	.31	.21	-.06
Elegant	.24	.13	.10	.81	.04	.16
Valuable	.31	.18	.10	.78	.03	.16
Deluxe	.34	.09	.21	.74	.04	.00
Plain	-.17	.46	.27	.52	-.12	.20
Calm	-.14	.14	.47	.49	-.18	.23
Vague	.29	-.01	-.13	-.03	-.65	.14
Familiar	-.12	.19	.31	.03	.63	.30
Popular	-.07	.21	.35	-.02	.63	.26
Promising	.14	.15	.35	.39	.43	.03
Conventional	-.08	.08	-.06	.11	.05	.87
Classical	-.03	.08	-.01	.21	.11	.84

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
[a] Rotation converged in 8 iterations.

These six aesthetic dimensions (see Table 5) identified the groupings of the 30

adjectives U.S. participants used: Aesthetic Dimension 1—Powerful (.67), deluxe (.67),

valuable (.62), strong (.62), promising (.60), fresh (.60), sharp (.59), popular (.58),

elegant (.55), and hopeful (.47); Aesthetic Dimension 2—Familiar (.69), conventional

(.66), classical (.61), calm (.46), and concise (.33); Aesthetic Dimension 3—Surreal (.73),

mystic (.72), futuristic (.56), tense (.49), and vague (.47); Aesthetic Dimension 4—Bright

(.76), colorful (.73), and vibrant (.66); Aesthetic Dimension 5—Plain (.72), simple (.66),

static (.61), and balanced (.28); Aesthetic Dimension 6—Adorable (.79), cute (.77), and

sexy (.47).

These six aesthetic dimensions (see Table 7) identified the groupings of the 30

adjectives South Korean participants used: Aesthetic Dimension 1—Strong (.80), tense

(.80), sharp (.79), powerful (.78), surreal (.67), futuristic (.65), sexy (.61), mystic (.57),

and colorful (.49); Aesthetic Dimension 2—Cute (.86), adorable (.85), bright (.69), fresh

(.67), vibrant (.51), and hopeful (.50); Aesthetic Dimension 3—Simple (.84), concise

(.83), static (.69), and balanced (.61); Aesthetic Dimension 4—Elegant (.81), valuable

(.78), deluxe (.74), plain (.52), and calm (.49); Aesthetic Dimension 5—Familiar (.63),

popular (.63), and promising (.43); Aesthetic Dimension 6—Conventional (.87) and

classical (.84). Note: Vague was excluded from the fifth aesthetic dimension because of

its very low score.

Using the previous analysis results from the U.S. data, a regression model about

attitudes toward homepages was examined (see Table 8). In the first equation, male (β = -

3.01) and younger (β = -.70) preferred positive adjectives to describe homepages with an

R^2 = .11. The second equation examined gender/age and homepage design elements. This

equation showed that participants preferred icons (β = 5.83), frames (β = 3.19), and

margins (β = 4.54) and had less preference for navigators (-1.72) and typography (-

10.63). The large negative score for typography was possibly caused by the U.S.

participants' reaction to the text written in South Korean characters. The third equation

examined only gender/age and the RGB primary and secondary color factors. Addition of

the primary colors red ($\beta = 9.53$), green ($\beta = 8.61$), and blue ($\beta = 14.63$) and the

secondary colors red ($\beta = -8.28$), green ($\beta = -11.65$), and blue ($\beta = -10.79$) to the equation

showed that contrasting (i.e., positive primary and negative secondary) were preferred.

The addition of primary and secondary color factors increased the R^2 to .33. The last

equation examined gender/age, homepage design elements, and primary and secondary

color factors. This combination of factors in the equation demonstrated the most

reliability ($R^2 = .41$) and showed that navigators ($\beta = 10.13$), icons ($\beta = 3.61$), and

margins ($\beta = 9.19$) were important to aesthetics when their primary colors contrasted with

their secondary colors. Blue was a particularly important primary color ($\beta = 18.33$).

Table 8

Regression Analysis from U.S. Survey Results for Predicting Aesthetics with
Demographics, Homepages, and Color Mappings

	Aesthetics			
	1	2	3	4
Gender (Male)				
Female	-3.01**	-2.91**	-3.07**	-2.85**
Age	-.70	-.83	-.83	-.86
Design-Navigator	-	-1.72	-	10.13*
Design-Icons	-	5.83***	-	3.61*
Design-Frames	-	3.19	-	-3.62
Design-Margin	-	4.54*	-	9.19**
Design-Typography	-	-10.63***	-	7.79
Primary Color Red	-	-	9.53***	-7.14
Primary Color Green	-	-	8.61***	3.46
Primary Color Blue	-	-	14.63***	18.33**
Secondary Color Red	-	-	-8.28**	4.67
Secondary Color Green	-	-	-11.65*	-20.68
Secondary Color Blue	-	-	-10.79**	-12.85
F	4.03	14.28	10.47	10.35
R^2	.11	.36	.33	.41

Note. * $p < .05$, ** $p < .01$, *** $p < .001$.

The implications of these results are examined in the next chapter.

CHAPTER FIVE: DISCUSSION

This study investigated the aesthetic cross-cultural perceptions of U.S. and South Korean participants when viewing the same 13 South Korean-designed homepages by examining the 30 aesthetic adjective selections that each group made for each of the 13 homepages. This study was performed in an attempt to test these hypotheses:

H1:   When choosing from the same 30 adjectives, U.S. and South Korean participants will select the same adjectives for the same aesthetic concepts.

Result: Partially supported to fully supported depending on the visualization used.

H2:   When choosing from the same 30 adjectives, U.S. and South Korean participants will select different groupings of adjectives for each aesthetic dimension.

Result: Supported.

H3:   When viewing the same 13 homepages, U.S. and South Korean participants will have different aesthetic reactions to each one.

Result: Supported.

H4:   Using the investigator's design factors in homepages will increase the aesthetic rating.

Result: Supported for navigators, icons, and margins.

H5:   Using high-color contrast in homepages will increase the aesthetic rating.

Result: Supported.

H6:   When using both the investigator's design factors and high-color contrast in

        homepages, the design factors will primarily influence the aesthetic rating.

Result: Supported for navigators, icons, and margins.

To test these hypotheses, this investigator created a Web survey (produced from the Kim et al. survey description) that allowed U.S. participants to view the 13 South Korean-designed homepages and rank how well, in their opinion, each of the 30 aesthetic adjectives applied to each homepage. The data from this survey were analyzed using visualizations (MDS, PCA, and ISOMAP), rotated factors (PCA), and regression analysis. Each of these is examined next.

Visualizations

Survey data from South Korean and U.S. participants was displayed visually using multidimensional scaling (MDS), principal component analysis (PCA), and Isometric feature mapping (ISOMAP). Each of these methods provides a different view of the data for comparison purposes.

All methods examining adjective preferences showed that the South Korean participants identified all 13 aesthetic concepts (although calm and sexy were sometimes outliers and could not always be included in adjective group). For the U.S. participants, the number of aesthetic concepts identified depended on the visualization method used. MDS showed U.S. participants identified nine aesthetic concepts (with calm as an outlier). PCA and ISOMAP (2-D) both showed U.S. participants identified 11 aesthetic concepts (with plain, calm, and sexy as outliers). ISOMAP (3-D) showed U.S. participants identified 13 aesthetic concepts (with plain and calm as outliers). Thus H1

was partially supported using MDS, PCA, and ISOMAP 2-D and fully supported using ISOMAP 3-D.

The previous methods were also used to visualize the coordinates of each homepage as derived from each participant group's survey data. The results showed that no homepage had the same coordinates as any other homepage and suggested that U.S. and South Korean participants had different aesthetic reactions to each homepage. Thus H3 was supported.

<center>Rotated Factors</center>

Survey data from South Korean and U.S. participants was mathematically rotated using PCA (see Table 5 and Table 7) to identify six aesthetic dimensions for each group of participants. None of the adjectives groups matched any other adjective groups. Thus H2 was supported.

<center>Regression Analysis</center>

Many studies in the literature have suggested design factors for Web pages that claim to influence Web page characteristics (e.g., attractiveness, credibility, usability). This investigator chose eight factors to examine: demographics (gender/age), navigator, icons, frames, margins, and typography. A regression analysis of the design factors (see Table 8) showed that reliability (aesthetic rating) increased for the navigator, icons, and margin. Thus H4 was supported. Another regression analysis of the primary and secondary page colors showed that the reliability (aesthetic rating) increased for color contrast (positive primary and negative secondary colors). Thus H5 was supported. A final regression analysis of all design factors, primary color, and secondary color showed that the primary and secondary colors were no longer significant (except for primary

<center>53</center>

blue), while the navigator, icon, and margins were significant. (Interestingly, the contrast of primary and secondary colors remained.) Thus, H6 was supported.

Although U.S. and South Korean participants generally recognized the same 13 aesthetic concepts (e.g., adorable, classical, mystic, etc.) used in the Kim et al. study, the PCA examination showed this was not the case for the aesthetic dimensions (see Table 5 and Table 7). In fact, neither group selected any of the exact same combination of adjectives for any other aesthetic dimension. Furthermore, when mapped, neither group's selection of adjectives for each homepage coincided in that mapped space. In essence, U.S. and South Korean participants did not agree in their selections of aesthetic adjectives. This lack of consensus was not a surprise however. Possible reasons for this result are discussed next.

<center>The Influence of Cultural Differences</center>

The lack of consensus about what adjectives are included in each emotional dimension was expected because cultural differences matter. The ideal design scenario would have all participants categorized simply as *Homo sapiens*, assume all *Homo sapiens* think and respond the same ways, and begin designing from that fundamental commonality (Hassenzahl, 2004; Nisbett, 2003; Reeves & Nass, 1998). In spite of how biologically alike humans may be, we are not conveniently homogenous for research purposes. Human responses can be attributed to a number of factors: age, context, culture, education, emotional maturity, ethnicity, experience, gender, goals, mood, personality, priming, religion, social class, temperament, etc. (Abraham, 2005; Brave & Nass, 2003; Brown & Theorell, 2006; Engelberg & Sjoberg, 2005; Fogg, 2003; Gobé, 2001; Karsvall, 2002; Karvonen, 2000; Lavie & Tractinsky, 2004; Norman, 2004; Pan et

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al., 2004; Picard, 1997; Reeves & Nass, 1998; Stone, Jarrett, Woodroffe, & Minocha, 2005; Strachan, 2006; Tractinsky, 2004; Zettl, 1973).

For this investigation, the cross-cultural divide figures prominently and suggests a major explanation for the differences seen in U.S. participants' ranking of aesthetic adjectives in the Web-survey results. Cultural issues have often complicated interactions between people (Badre, 2000; Brave & Nass, 2003; Cyr & Trevor-Smith, 2004; Nisbett, 2003). For example, when this investigator worked at CompuServe, their information-management software used an interface icon of a metal mailbox with a red flag mounted on a post to represent email. This choice worked fine in the United States but proved perplexing when exported to European customers who had different cultural experiences with mailboxes. Others have likewise observed the difficulty of cross-cultural communication using only icons (Graham, 2003; J. H. Kim & Lee, 2005; Stone, Jarrett, Woodroffe, & Minocha, 2005; Watzman, 2003).

Images (e.g., icons or homepages) involve many properties or patterns (Anderson, 1996; Arnheim, 1986; Berlyne, 1968; Picard, 1997; Schenkman & Jonsson, 2000) of elements (e.g., foreground, background, depth, form, or color). Reactions to these elements are not necessarily the sole results of "hard-wiring" in our brains but are also influenced by our experiences and subsequent interpretations to some degree (Anderson, 1996; Arnheim, 1986; Badre, 2000; Gobé, 2001; Marcus, 2003; Reeves & Nass, 1998; Schenkman & Jonsson, 2000; Simon, 1999; Sutcliffe, 2003). Other researchers have suggested the same inferences regarding the influences of music (Brown, 2006; Brown & Theorell, 2006; Martin, 2006; North & Hargreaves, 2006; Volgsten, 2006). Thus, the perceptual impact of these elements appears related to the context (and quite possibly

other factors) of the viewer (Anderson, 1996; Angeli, Sutcliffe, & Hartmann, 2006; Ben-Bassat, Meyer, & Tractinsky, 2006; Brown, 2006; Brown & Theorell, 2006; Bullerjahn, 2006; Carmi & Itti, 2006; Cyr & Trevor-Smith, 2004; Del Bimbo, Pala, & Vicario, 2002; Dissanayake, 2006; Engelberg & Sjoberg, 2005; Fogg, 2003; Hartmann, 2006; Hassenzahl, 2004; Lavie & Tractinsky, 2004; Lazar, 2003; Norman, 2004; Picard, 1997; Reeves & Nass, 1998; Strachan, 2006; Tagg, 2006; Tractinsky, 2004; Volgsten, 2006; Zettl, 1990).

At its core, the Kim et al. study was built on what the South Korean designers and participants had implicitly or explicitly learned in their lives (i.e., their combined subjective perceptions). The design elements were then teased and filtered from that context of learning. However, learning is influenced by the personality and culture of the learner (Badre, 2000; Marcus, 2003; Nisbett, 2003; Norman, 2004; Picard et al., 2004; Simon, 1999; Tractinsky, 2004; Zettl, 1973) just as cultural factors impact the interpretation of aesthetics (Karvonen, 2000; Lavie & Tractinsky, 2004). Because of what people have learned, they perceive events in a manner that fits the patterns of their existing perspectives (Anderson, 1996; Zettl, 1990). In fact, such explanations may not be merely figurative. After much preliminary research, Nisbett (2003) argued that for Asians and Westerners, "the world is literally *viewed* in different ways" (p. 109). East Asians appear to be more holistic and perceive elements of a scene in terms of the relationships between elements. Westerners, on the other hand, are much more focused and tend to perceive only elements of a scene without observing the relationships between other elements or the scene as a whole (Nisbett, 2003).

Furthermore, many of the design elements (e.g., colors, borders, backgrounds, images, circles, rectangles, and lines) that Kim et al. defined were also identified by Badre (2000). He classified such factors as cultural markers and characterized them as "design elements found in web pages…[that] prove to be highly prevalent within a particular cultural group" (Badre, 2000, p. 5). Faolia (2005) also identified "color, graphic design, and typographic elements" (p. 96) on Web pages as capable of evoking responses in viewers. Likewise, Simon (1999) found that Asians disliked triangles and squares on Web pages, while North American and European participants had no such objections and even preferred combinations of shapes. Interestingly, Nisbett (2003) concluded that East Asians perceived much more of a scene's elements and interrelationships than Westerners and were more attentive to changes in the background than to elements in the foreground. In addition, the more holistic the person, the greater his or her unwillingness to ignore elements in a scene. In other words, East Asians (compared to Westerners) concentrated on differing aspects of a scene (e.g., homepage). Based on the perspective of such research, the Kim et al. investigation possibly identified only the specific South Korean contextual patterns of Web cultural markers that were aesthetically significant to their unique audience. Other studies of culture have suggested the same possibility of cultural preference (Cyr & Trevor-Smith, 2004; Faiola, 2005; Khaled, Biddle, Noble, Barr, & Fischer, 2006; Singh, Fassott, Zhao, & Boughton, 2006).

Color is a prime example in issues of cross-cultural communication. Numerous colors are known to convey different meanings in different cultures (Badre, 2000; Cyr & Lew, 2003; Cyr & Trevor-Smith, 2004; Gobé, 2001; Hutchings, 2004; Marcus, 2003; Park & Guerin, 2002; Stone, Jarrett, Woodroffe, & Minocha, 2005; Watzman, 2003).

Red, for example, represents death in Korea [they did not specify which Korea], love in the United States on St. Valentine's Day (Watzman, 2003), and joy in China (Stone, Jarrett, Woodroffe, & Minocha, 2005). One researcher found North American participants liked bright colors on Web sites, while Asians did not (Cyr & Trevor-Smith, 2004). Furthermore, studies of Web sites in Japan, Germany, and the United States showed different uses of colors depending on the country (Cyr & Trevor-Smith, 2004). Park and Guerin (2002) examined cultural (United States, England, Korea [they did not specify which Korea], and Japan) preferences to hue, value, and chroma combinations in interior color palettes. Their research revealed that Korean and United States viewers preferred different interior color palettes: Korean participants liked medium-high contrasts, while U.S. participants liked low-value contrasts and medium-chroma contrasts; Korean participants liked chromas that were weak, while U.S. participants favored moderate ones; Korean participants preferred neutral hues, while U.S. participants preferred warmer hues. The only common ground between Korean and U.S. participants were a preference for middle values.

Such differing color preferences extend to the cinema as well. "It is well-known that Koreans use different color palettes in films and often dislike the American color palette" MacDorman (personal communication, Aug 12, 2006). Apparently, culture also makes a difference in how films satisfy their audiences. The movie *Fatal Attraction* was shown in Japan with the original ending (Glenn Close commits suicide, and Michael Douglas goes to jail) while viewers in the United States saw a different ending (Glenn Close is killed) (Boorstin, 1990). In fact, underscoring the perceptions of culture in the cinema, researchers found that domestic movies invoked more meaning when competing

against foreign movies (Russell & Russell, 2003). Moreover, cultural differences are not limited to just conspicuously different groups. Bjerke and Polegato (2006) found that even European women (grouped by Latin or non-Latin cities) had different preferences for the eye and hair color that best represented health and beauty. And according to Benard (2002), something as simple as an online shopping cart in the United States is referred to differently in England as just a basket. Graham (2003) even refers to these as shopping trolleys. Likewise, Nielsen (2000) pointed out that the term billion denotes "a thousand million" in United States English but means "a million million" in British English (p. 314).

Therefore, the lack of U.S. and South Korean participants' agreement in selecting aesthetic adjectives is not surprising. In fact, even the South Korean participants did not always agree with the defined aesthetic adjectives for the 13 homepages. The PCA examination of the South Korean survey data showed that eight out of the 13 aesthetically target homepages failed to match any defined aesthetic adjectives in first aesthetic dimension. For example, these are the adjectives for the first aesthetic dimension for the adorable/cute homepage: strong, powerful, sharp, tense, vibrant, and colorful. Adorable and cute are present in the third aesthetic dimension. The first aesthetic dimension accounts for 27.19% of the variance, and the third aesthetic dimension accounts for only 7.84% of the variance.

As the mailbox icon and other experiences have demonstrated, aspects of culture are important and must be taken into account for successful communication (Benard, 2002; Boorstin, 1990; Brown, 2006; Cyr & Trevor-Smith, 2004; Gobé, 2001; Lavie & Tractinsky, 2004; Simon, 1999; Singh, Fassott, Zhao, & Boughton, 2006). This

recommendation is particularly important for South Korea and the United States. In her examination of research about South Korea and the United States, Scholes (2003) concluded that, culturally speaking, the two countries stand nearly diametrically opposed.

But if South Korea and the United States cultures are so different, why did both U.S. and South Korean participants generally recognize the same aesthetic concepts (e.g., adorable, tense, bright)? Could the explanation be related to the fact that "[a]esthetics satisfies basic human needs"? (Tractinsky, 2004, p. 771)

The answer for this shared perception is not obvious but might be explained by what some researchers have proposed as basic emotions (often, but not always, described as "happiness, sadness, fear, anger, disgust, and surprise") (Dissanayake, 2006, p. 39). Such innate feelings may exist in all humans and involve the reaction or interaction of some basic mechanisms inherent to humans (e.g., physiological responses to danger) that are independent of cultural or individual factors (Brave & Nass, 2003; Dissanayake, 2006; LeDoux, 1998; Norman, 2004; Picard, 1997). In an optimum combination of variables, homepage elements could potentially evoke one or more of these basic feelings (Brave & Nass, 2003; Hartmann, 2006). Yet, the concept of universal, basic emotions is a contentious one and has raised many difficult questions (Brave & Nass, 2003; Brown, 2006; Brown & Theorell, 2006; Dissanayake, 2006; Lavie & Tractinsky, 2004; LeDoux, 1998; Norman, 2004; Picard, 1997; Schulze, Roberts, Zeidner, & Matthews, 2005).

Of course, the general consensus for the recognition of aesthetic concepts may be related to individual differences, such as personality, gender, or age (Brown & Theorell, 2006; Engelberg & Sjoberg, 2005; Gobé, 2001; Haslam & McGarty, 2003; Karvonen, 2000; Lavie & Tractinsky, 2004; Picard, 1997; Stone, Jarrett, Woodroffe, & Minocha,

2005; Strachan, 2006; Tractinsky, 2004; Zettl, 1973). In fact, the regression analysis for the U.S. survey data (see Table 8) suggested that gender/age, homepage design factors, and color factors were all important for predicting aesthetic reactions. Additional research is clearly needed to address these, and other, possible causes.

Nonetheless, the results of the MDS, PCA, and ISOMAP visualizations plus the rotated factor matrices suggested that U.S. participants had minimal consensus with South Korean participants when viewing South Korean-designed homepages. The basic explanation for these results is that cultural variances make a real difference for U.S. participants when viewing homepages produced by South Korean designers. What South Korean designers created for South Korean participants innately included artifacts of a specific cultural context and the presupposed perceptions that go along with that context. When viewers from a different cultural context, such as the United States, view the homepages, they perceive and interpret design elements in their own culturally distinct way.

Presumably identification of aesthetic design elements would be easier for just a single culture. Some of the possible design elements for evoking aesthetic responses in U.S. participants are discussed next.

The Influence of Aesthetic Design Factors for Homepages

Recognizing homepage design factors that prompt aesthetic responses is a relatively unexplored area of research (Angeli, Sutcliffe, & Hartmann, 2006). As such, this investigator's selection of design factors was based on an initial set of factors that other researchers had found useful for comparing Web pages. For example, Cyr and Trevor-Smith (2004) used color, color changes, symbols, layout, fonts, icons,

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multimedia, frames, and navigation tools as design factors; Hartmann (2006) used tabs, text, and small pictures; Angeli, Sutcliffe, and Hartmann (2006) mentioned menu design; and Karsvall (2002) suggests backgrounds, frames, shapes, and contrasting colors.

For this investigation, the subset of aesthetic design elements were navigator (an area of the page that performed an action when clicked), icons (small graphics or pictures that performed an action when clicked), frames (rectangular areas setting off parts of the page and typically directly adjacent to a margin), margins (distinct part of page directly adjacent to a frame), typography (subjective amount of text on the page), primary color red (mainly reds on the page), primary color green (mainly greens on the page), primary color blue (mainly blues on the page), secondary color red (some reds on the page but not primary), secondary color green (some greens on the page but not primary), and secondary color blue (some blues on the page but not primary).

The regression analysis results for these elements are available in Table 8. The equations suggested that U.S. participants found navigators ($\beta = 10.13$), icons ($\beta = 3.61$), and margins ($\beta = 9.19$) associated with positive aesthetic responses ($R^2 = .41$). These elements should be used with contrasting colors. Blue was revealed as an excellent primary color ($\beta = 18.33$) for positive aesthetic responses as well.

Unfortunately, the explanation for these results is unknown. For participants, navigators and icons are typically obvious features that function as signposts to find something on a page and provide pathways to get there. Margins can often function as spacers to prevent clutter and help guide the eye along the page. Contrasting colors, beyond their visual appeal, help create an organized page. According to Lavie and Tractinsky (2004), all these design elements fit neatly into one perception of Web sites

called classical aesthetics. Classical aesthetics focus on "orderly and clear design and are closely related to many of the design rules advocated by usability experts" (p. 269). This fit is not surprising. Pages that are attractive and incorporate thoughtful aesthetic design factors have been found to produce a halo effect—the positive aesthetics make participants feel good, and consequently, help participants perceive usability and other aspects more positively (Hartmann, 2006; Norman, 2004).

CHAPTER SIX: CONCLUSION

This study consisted of two parts: The first part examination of aesthetic responses evoked in U.S. and South Korean participants when viewing South Korean-designed homepages. The second part examined the analysis of aesthetic design factors important to U.S. participants viewing homepages.

In the first part of this study, U.S. participants evaluated aesthetic adjectives that best described their feelings when viewing South-Korean designed homepages. The survey results for the South Korean participants came from the Kim et al. study. A comparison of MDS, PCA, and ISOMAP visualizations of the survey results was used to show that both U.S. and South Korean participants generally recognized the aesthetic categories established by Kim et al.

Similar visualization of the survey's homepage data showed that U.S. and South Korean participants did not share the same perceptions of each homepage however. In fact, when mapped out, the U.S positions of homepages did not match the South Korean positions of the same homepage. PCA was next used to determine the aesthetic dimensions used by U.S and South Korean participants. Although six aesthetic dimensions were identified for each culture, none of the adjective sets in any dimension completely matched (i.e., no U.S. aesthetic dimension corresponded to any South Korean dimension).

Because the United States and South Korea are such different cultures, survey results that suggest very different perceptions of homepages were expected. However, how can the recognition of the same aesthetic concepts by both cultures be explained?

Such responses might be related to basic aesthetics, gender/age, homepage categories, color factors, or combinations of these or other influences. Additional research on these aesthetic dimensions (and the adjectives that compose them) evoked by South Korean design elements may yield some useful cross-cultural results.

In the second part of this study, a regression analysis was planned to explore design elements on homepages that prompted aesthetic responses in U.S. participants. The design elements for Web pages were identified in other studies, and these eight were chosen: navigator, icons, frames, margins, typography, primary color red, primary color green, primary color blue, secondary color red, secondary color green, and secondary color blue. The analysis suggested that navigators, icons, margins, and contrasting colors for those design elements induced aesthetic responses in U.S. participants. Blue was also found to be an important primary color for generating positive responses.

<div align="center">Limitations</div>

A number of factors may have limited the conclusions of this study: (1) Lack of the Kim et al. original survey tool; (2) Web survey; (3) survey participants; (4) mistranslation of adjectives; and (5) limitations of Web-based data collection.

Because the Kim et al. original survey tool could not be provided by the South Korean researchers, this investigator created an approximation. The differences between surveys may have impacted the results. For example, the survey tool used for this study did not present the homepages (nor the adjectives for each homepage) in random order for each participant to prevent order biasing (Brave & Nass, 2003). Likewise, technical reasons required the size the homepage graphics to be smaller than those on the Kim et al. survey. The survey's adjectives were not defined for participants in this study

(although they appear to have not been defined in the original Kim et al. study as well).

Sharp, for example, may have meant "pointed" to one participant, "intelligent" to a

second participant, "in focus" to another, and "severe" to yet another. Furthermore, other

issues aside, simply measuring preferences and emotions is inherently problematic

(Arnheim, 1986; Berlyne, 1968; Brave & Nass, 2003; Bullerjahn, 2006; Fogg, 2003;

LeDoux, 1998; Picard, 1997; Weizenbaum, 1976).

Because the participants were self-selected, no effort was made to allow for

individual differences that might skew the study's results (Haslam & McGarty, 2003;

Reeves & Nass, 1998; Schultz, Izard, & Abe, 2005; Sutcliffe, 2003). The Kim et al.

survey participants were approximately 20 years old and about 50% female. This study's

participants were almost entirely over 30 years old (with the majority being over 40 years

old) and 58% were female. As has been noted, age and gender are some of the individual

differences that can impact results (Brown & Theorell, 2006; Engelberg & Sjoberg, 2005;

Gobé, 2001; Haslam & McGarty, 2003; Karvonen, 2000; Lavie & Tractinsky, 2004;

Picard, 1997; Schultz, Izard, & Abe, 2005; Stone, Jarrett, Woodroffe, & Minocha, 2005;

Strachan, 2006; Tractinsky, 2004; Zettl, 1973). Moreover, no attempt was made to collect

a random sample of Web users; obtaining random samples of Web users is difficult (if

not impossible) for even experienced researchers (Fogg, 2003). In fact, some of the

invited participants were usability and HCI professionals whose experience with

interfaces may have influenced their responses (Brave & Nass, 2003; Lavie & Tractinsky,

2004; Reeves & Nass, 1998). In addition, none of the participants were evaluated for

current temperaments or moods (which are known to influence people's subsequent

evaluations of interfaces) (Brave & Nass, 2003; Reeves & Nass, 1998; Schultz, Izard, & Abe, 2005).

South Korea is not only culturally different from the United States but also uses Hangul, an alphabet unique to Koreans (Scholes, 2003). The adjectives for the Kim et al. survey were written in the Hangul alphabet for Korean participants, and the translation of these adjectives to English was provided by Kim et al. in their paper. How accurately the concepts were translated is unknown. Also, "language presentation such as headlines, point forms, paragraphs, and presentation of characters (i.e., right to left versus left to right)" (Cyr & Trevor-Smith, 2004, p. 1201) on Web pages appears to be a cultural factor as well (Badre, 2000).

Because the data collection was conducted on the Web, many factors were beyond the investigator's control. Such factors that could skew results might include viewing contexts of participants (Watzman, 2003); screen sizes participants used (Reeves & Nass, 1998); response times of participants' Internet service providers (Lazar, 2003); and the computer platforms, operating systems, or browser types used by participants (Lazar, 2003).

Future Research

One obvious direction for future research based on this study would be the exploration of the aesthetic concepts revealed by the MSD, PCA, and ISOMAP visualizations. What makes some aesthetic concepts' adjectives (e.g., adorable/cute, conventional/classical, vague/mystic) typically appear close together in the visualizations while other aesthetic concepts' adjectives (e.g., calm, plain, sexy) typically appear far from related adjectives? Can some aesthetic adjectives be associated with culture-free

feelings? Also, would another study of U.S. participants identify the same the same aesthetic adjectives? Would a different translation of the South Korean adjectives result in different results for U.S. participants? Would participants with demographics more akin to those used by Kim et al. produce a different outcome? If the survey were hosted in a lab to control more factors, would U.S. participants exhibit different preferences? If mood or temperament were accounted for, how would the results be influenced? Would explicitly defining adjectives for participants change the results?

Summary

This study compared the aesthetic adjectives selected by U.S. and South Korean participants when viewing the same South Korean-designed homepages. Although aesthetic concepts identified by Kim et al. were generally identified by U.S. participants, other analysis did not show shared perceptions between U.S. and South Korean participants. The explanation for these different perceptions is that cultural variances make a real difference for U.S. participants when viewing homepages designed by South Koreans. What South Korean designers created for South Korean participants innately included artifacts of a specific cultural context and the presupposed perceptions that go along with that context. When U.S. participants (i.e., viewers from a different cultural context) viewed the South Korean-designed homepages, they perceived and interpreted design elements in their own culturally distinct way. Thus, U.S. participants typically perceived aesthetic dimensions that were different from those perceived by South Koreans and selected different adjectives accordingly.

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APPENDICES

Appendix A: Email Inviting Participants to Take Web Survey

From:	"Tarrant, Mark A" <matarran@iupui.edu>
To:	matarran@iupui.edu
Subject:	conducting graduate research

Dear Friends:

I am conducting graduate research about emotional reactions to Web site homepages. To complete this study, I am asking people who have English as their first language to evaluate 13 homepages by *November 13*. For each homepage, you will be asked to choose how strongly you feel between two adjectives.

For example, next to the image of a homepage, you would see a scale such as:

1. Bright O O O O O O O Not Bright

To respond, you would click the circle that was closest to the word that describes your feelings about that homepage. You will repeat the process for the next set of adjectives, as so on. At the conclusion of the online study, you will be asked these questions:

What is your gender?   Male/Female
What is your age?   18-21   22-25   26-30 31-40 41+
Are you comfortable using the internet?   Yes/No
Are you color blind?   Yes/No
Did you grow up speaking English as your first language? Yes/No

You will NOT be asked for your name or any other form of identification.

The survey is estimated to take under 30 minutes and you are free to quit at anytime if the survey is inconvenient or makes you uncomfortable. Please remember that the focus of this study is the homepages—-not you.

If you are interested in participating, please go to this website:

http://www.surveymonkey.com/s.asp?u=90902583983

Thank you for your help,

Mark Tarrant
Graduate Student @ Indiana University School of Informatics IUPUI
Human Computer Interaction Program

P.S. Your email address was obtained from my thesis advisor's or my own address book. No commercial email lists were used.

Appendix B: Graphics of the Web Survey

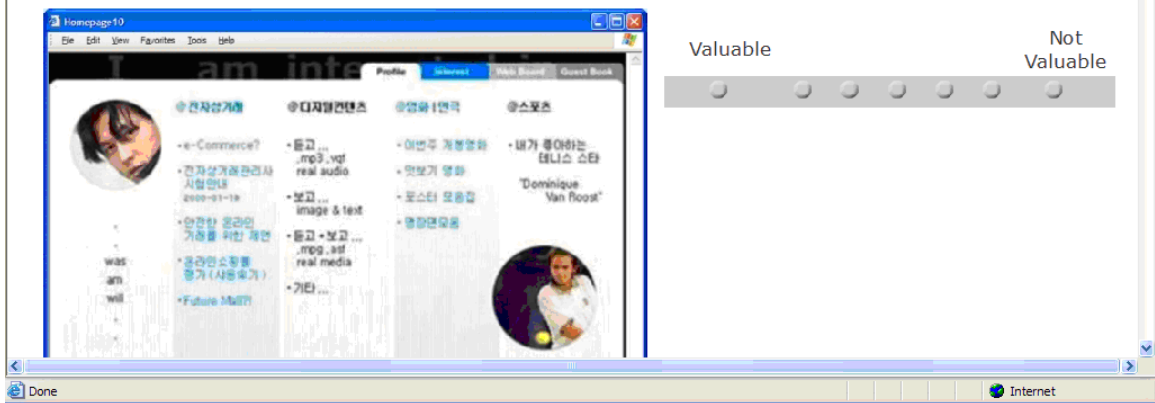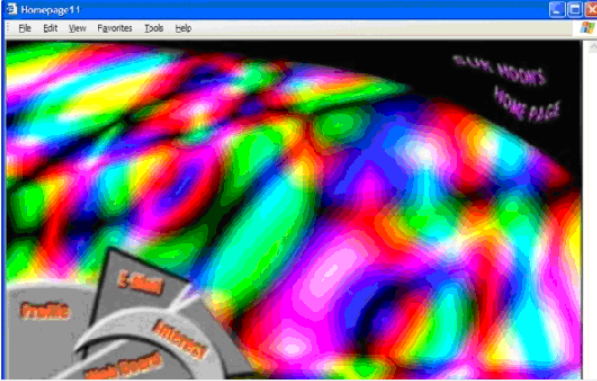File   Edit   View   Favorites   Tools   Help

Back   Search   Favorites

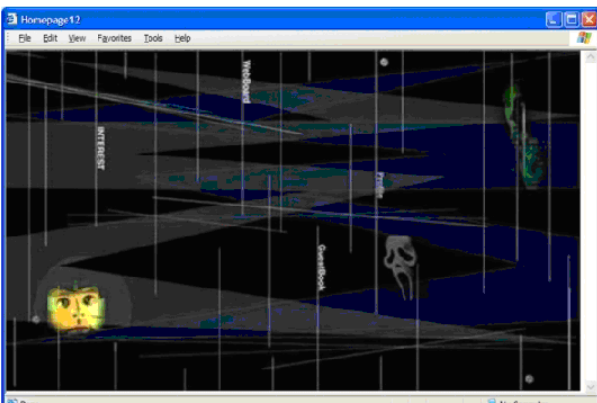## Tarrant Survey

Exit this survey >>

Homepage07

Click a button on the right to rank each adjective based on your feelings about the homepage.

For example, if the adjective was "ugly" and you felt the homepage was beautiful, you might click the button under Not Ugly.

However, if you felt the homepage was somewhat ugly, you might click a button closer to Ugly.

Elegant   Not Elegant

Done   Internet

Homepage08

Click a button on the right to rank each adjective based on your feelings about the homepage.

For example, if the adjective was "ugly" and you felt the homepage was beautiful, you might click the button under Not Ugly.

However, if you felt the homepage was somewhat ugly, you might click a button closer to Ugly.

Deluxe   Not Deluxe

Done   Internet

84

http://www.surveymonkey.com - Tarrant Survey - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back | Search | Favorites

Tarrant Survey

Exit this survey >>

Homepage13

Click a button on the right to rank each adjective based on your feelings about the homepage.

For example, if the adjective was "ugly" and you felt the homepage was beautiful, you might click the button under Not Ugly.

However, if you felt the homepage was somewhat ugly, you might click a button closer to Ugly.

Valuable   Not Valuable

Done   Internet

http://www.surveymonkey.com - Tarrant Survey - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back | Search | Favorites

Tarrant Survey

Exit this survey >>

Final Questions

Thank you for your answers about the homepages. These are the final questions for this survey.

Again, thank you for your help.

What is your gender?

Male   Female

What is your age?

18-21   22-25   26-30   31-40   41+

Are you comfortable using the internet?

Yes   No

Are you color blind?

Yes   No

Did you grow up speaking English as your first language?

Yes   No

Done   Internet

VITA

Mark A. Tarrant

Education

Master of Science in Human-Computer Interaction, Expected May 2007
Indiana University-Purdue University at Indianapolis
Advisor: Dr. Anthony Faiola

Master of Technical and Scientific Communication, May 1990
Miami University, Oxford, OH

Bachelor of Science in Physical Science, May 1988
Kansas State University, Manhattan, KS

Research Interests

- Impact of interface aesthetics on users
- Cultural preferences for interface designs
- Application of preconscious perceptions to enhance interfaces

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Experience

Freelance Technical Communicator
2005 to Present

Technical Communicator
Brooksource, 2005-2005

Technical Communicator
Professional Data Dimension, 2004-2004

Technical Communicator
Xerox Connect, 2002-2003

Technical Communicator
Powerway Inc., 2000-2002

Lotus Notes Developer
Praxair Surface Technologies, 1999-2000

Lotus Notes Developer/Technical Communicator
Romac-Source Consulting, 1996-1999

Technical Communicator
CompuServe, 1990-1996