AFFECT, ATTITUDE, AND MEANING: ASSESSING THE UNIVERSALITY OF DESIGN IN A TRANSNATIONAL MARKETING CONTEXT

A Dissertation
Submitted to
the Temple University Graduate Board

In Partial Fulfillment
of the Requirements for the Degree
DOCTOR OF PHILOSOPHY

---

by
Dan Zhang
August, 2012

Examining Committee Members:

Anthony Di Benedetto, Ph.D. (Chair), Marketing and Supply Chain Management
Eric Eisenstein, Ph.D., Marketing and Supply Chain Management
Masaaki Kotabe, Ph.D., Strategic Management
Robert D. Hamilton, Ph.D., Strategic Management

ABSTRACT

The present research investigates the universality of design in a transnational marketing context. Specifically, it looks into designers' expertise transfer and knowledge calibration across cultures and explores cross-cultural differences in consumer responses (affect, attitude, and meaning) to design in two studies.

With 256 graphic designs created by 16 Chinese designers and 16 U.S. designers, study 1 explores the universality of design by comparing consumer responses in a series of surveys among Chinese and American college students. Study 2 involves 64 product designs created by 8 Chinese designers and 8 U.S. designers and investigates the effect of culture and expertise level on design responses of consumers from China and the U.S.

The results suggest that universality of design is a complex, multi-faceted phenomenon. Affect and attitude appear to be universal while meaning of design seems less universal and is difficult to be transferred cross-culturally. The results suggest a mixed effect of culture on design expertise transfer. Design expertise can be transferred to another culture without decrease in order to elicit positive affect among consumers. However, design expertise transfer is moderated by culture with regard to attitude and meaning. Expert designers' designs receive less positive attitudinal responses in a foreign market than in the home market and can convey intended meaning much better in the home market than in a foreign market. When it comes to knowledge calibration, the results indicate that both expert designers and non-expert designers are poorly calibrated and overconfident. The paper also discusses theoretical and managerial implications as well as limitations and future research directions.

ACKNOWLEDGMENTS

I would like to express the deepest appreciation to my committee chair, Professor Anthony Di Benedetto, who has provided tremendous research guidance as I have worked my way through the Ph.D. program and dissertation process over the past few years. Without his guidance and persistent help, this dissertation would not have been possible.

I would like to express my sincerest thanks to my second committee member, Professor Eric Eisenstein, for his input as I moved from an idea to a completed study. With his extensive knowledge about experimental design, Dr. Eisenstein has offered valuable insights and help in terms of the methodology of my dissertation.

I would like to thank Professor Masaaki Kotabe, my third committee member, who has offered helpful insights on the conceptual model and theoretical construction of my dissertation. I am also grateful to him for his valuable guidance and friendly encouragement when I was working with him on a joint research paper and assisting him with his book revision.

I also would like to thank the external member of my committee, Professor Robert Hamilton, who took time away from his own research to provide extensive, insightful, helpful feedback on this research.

Finally, but most importantly, I would like to offer special thanks to my dearest parents and my best friend forever, Peng Hu, who have always been a source of support, love, help, and encouragement. Without them, I would never have been where I am.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

Globalization and competitive pressures have steadily commoditized the production and manufacture of goods, and increasingly the greatest profit in the value chain comes from innovating products, not simply producing them. As a key component of innovation, the physical design of products has been recognized as a major determinant of the marketplace by both practitioners and researchers (e.g., Bloch 1995; Lawrence & McAllister 2005; Miller & Adler 2003). In addition, the attraction of emerging markets such as China and India to U.S. firms, and the attractiveness of the large consumer markets in the developed world have ensured that companies must produce products for consumption in countries other than their home country. The pressures of globalization, particularly in the form of outsourcing decisions, have also pushed corporations to design and produce products outside their home countries, even if consumption will eventually be at home.

Although practitioners and researchers have increasingly realized the importance of product design (e.g., Gemser & Leenders, 2001; Ulrich & Eppinger 2008), the extant literature has focused on new product development projects, firms, and consumers (e.g. Borja de Mozota, 1990; Hise, O'Neal, McNeal, & Parasuraman, 1989; Swan, Kotabe, & Allred, 2005; Veryzer & Hutchinson, 1998; Yamamoto & Lambert, 1994). Designers, who play the critical role in design, have not appeared in the extant marketing literature

until very recently (e.g., Henderson, Giese, & Cote, 2004; Orth & Malkewitz, 2008). However, the role of designers in their research is professional raters of design characteristics only; and no further exploration of designers themselves has been examined.

Given the centrality of product design to firms, there is surprisingly little research on the transferability (or lack thereof) of design expertise across national borders, especially from the U.S. to the major developing markets of China and India and from these centers of talent to the U.S. Despite the well-established research on various domains of expertise, such as sports, physics, mathematics, meteorology, psychology, arts, law, medicine, etc. (e.g., Allard & Starkes, 1991; Anzai, 1991; Charness, 1991; Ericsson & Polson, 1988; Gentner, 1988; Koehler, Brenner, & Griffin, 2002; Soloway, Adelson, & Ehrlich, 1988; Sloboda, 1991), little research has been conducted in the domain of design from the viewpoint of psychology despite the emerging interest in design expertise in the design community, which to a large extent focuses on qualitative investigations that have "severe limitations" (Cross, 2004).

Essentially, in order to understand how well designers can design for markets across borders, i.e., how well design expertise can be transferred cross-culturally, it is necessary to comprehend how universal aesthetic design can be. The more universal aesthetic design is, the easier design expertise can be transferred. In the extant literature on psychology of aesthetics, there has been an ongoing debate on universality of visual aesthetics. Some researchers suggest that universal visual aesthetic criteria may exist. For example, Gestalt psychologists believe that a given percept, such as symmetry, closure,

and proximity, causes an object to be perceived as a whole rather than as a simple sum of parts (Koffka, 1935; Palmer, 1990). Also, aestheticians have long been interested in whether people find rectangles with certain ratios, especially the "golden ratio" (i.e., the Φ, phi, rectangle, which has a ratio of approximately 1.618), to be more pleasing than other ratios (e.g., Alberti, 1988; Huntley, 1970; Lawlor, 1982). In their investigations, Fechner (1871, 1876; for a recent translation, see Fechner 1997) and other early researchers (e.g., Lalo, 1908; Thorndike, 1917; for a review, see Green, 1995) discover a preference for the Φ rectangle. However, Berlyne (1971) finds that the preference of the golden ratio is not the case in Japan and thus is not cross-culturally universal. Actually, some researchers believe that visual aesthetics is cultural specific and less than universal. For instance, Fischer (1959) finds that artists in hierarchical societies are more likely than others to produce arts containing many dissimilar elements, little irrelevant space, and enclosed figures. Kavolis (1968) suggests that dynamic patterns tend to occur in the art of societies with dynamic economies. Consistent with this stream of thoughts, the model by Bloch (1995) indicates that consumer preferences of design are influenced by culture.

The ongoing debate on the universality of visual aesthetics suggests that, rather than arguing about whether or not universal visual aesthetic criteria exist, it would be interesting to explore how universal visual aesthetics could be at different levels. The present research aims to fill this gap as well as those in design expertise and product design by investigating real designers' expertise transfer and knowledge calibration across cultures and by exploring the cross-cultural differences in consumer responses to product design. Accordingly, this research seeks to address the following questions:

1. How universal is visual design at different levels including affect, attitude, and meaning?
2. How transferable is design expertise across cultures? How does design expertise level (experts vs. non-experts) affect design ability and the transfer of those designs across cultures?
3. How well do designers understand how design elements evoke specific states in consumers' minds? Does this expertise vary cross-culturally?

Specifically in this research, I choose to look at the U.S. and China as the two nations because they represent quite different stages of economic development and background culture. More importantly, these countries are major trading partners. Outsourcing of production to China has become the norm in many industries and Chinese companies are starting to capture a greater portion of the value chain by designing and developing products of their own for the global market.

The remainder of the paper is organized as follows. First, a brief literature review is summarized on the universality of design and design expertise. Next, hypotheses and a conceptual model are developed. The third and the forth sections introduce two studies respectively. Finally, a general discussion including theoretical implications, managerial implications, and research limitations and future research directions is provided.

CHAPTER 2

LITERATURE REVIEW

This study investigates the universality of design related to aesthetics in terms of design expertise transfer across borders. Literature is reviewed from two aspects: universality of design and design expertise. For universality of design, this review first introduces the concepts of universal design and universality of design. Second, it presents relevant literature on the ongoing debate on universality of visual aesthetics. Third, this review highlights the exploration of universality of design in the marketing literature.

With regard to design expertise, this review starts with a brief introduction of the definition of expertise, expert and novice differences, and Shanteau's theory of expert competence. This is followed by a review of research on knowledge calibration. Finally, it reviews the extant literature on design expertise.

Universality Of Design

Universal Design And Universality Of Design

Universal design is a term created by Ronald L. Mace to describe the concept of designing all products and the built environment to be aesthetic and usable to the greatest extent possible by everyone, regardless of their age, ability, or status in life (http://www.ncsu.edu/). According to Mace, Hardie, and Place (1991), universal design "is a sensible and economical way to reconcile the artistic integrity of a design with

human needs in the environment." Consequently, universality of design is defined as the extent of how aesthetic and usable a design is to everyone.

Researchers in product design have concentrated on the functional aspect of universal design, especially design for individuals with a disability (e.g., Luck, Haenlein, & Bright, 2001; Sangelkar, Cowen, & McAdams, 2012). The present research focuses on the aesthetic aspect of universality of design. To understand it, it is necessary to review the literature on universality of visual aesthetics.

Universality Of Visual Aesthetics: An Ongoing Debate

In psychology of aesthetics, universality of visual aesthetics has been an ongoing debate. On the one hand, some researchers suggest that universal aesthetic criteria may exist. On the other hand, some researchers argue that aesthetics is cultural specific and less than universal.

A classic example is the "golden ratio" (i.e., the Φ, phi, rectangle, which has a ratio of approximately 1.618), which has attracted extensive attention because of its interesting mathematical properties (Huntley, 1970) since the classical Greek and Hellenistic epochs. Instances of the golden ratio has been pointed out in the plans and facades of architecture (e.g., classical Greek temples, Gothic cathedrals, and Renaissance palaces, etc.), in the composition of paintings from the Renaissance to the twentieth century, as well as in many vegetable and animal forms, including mammalian, particularly human, bodies (Berlyne, 1971). The immense instances are believed to support a deep aesthetic significance of the golden ratio. In their experiments, Fechner

(1871, 1876; for a recent translation, see Fechner 1997) and other early researchers (e.g., Lalo 1908; Thorndike 1917) exposed subjects to rectangles with sides of various proportions and asked about their preferences of the rectangles. Although there were a wide range of preferred proportions, the Φ rectangle was the most popularly preferred rectangle.

However, Berlyne (1971) points out that the investigations of the preference of the golden ratio were confined to art of the early Mediterranean civilizations and their offshoots and were carried out with European and American subjects. Consequently, he suggests that "only cross-cultural comparisons can enable us to determine whether the appeal of the golden section depends on certain deep-seated universal characteristics of the human nervous system and optical apparatus or whether it may be a cultural and therefore learned factor characteristic only of certain social settings" (p.229). In his experiment with Japanese and Canadian subjects, he and his colleagues found a preference for rectangles nearer to the square than the golden ratio among Japanese and no special preference for the golden-ratio rectangles among Canadians although the Canadian subjects gave the highest mean rankings to rectangles in the general vicinity of the golden ratio.

Universality Of Visual Aesthetics

In his study, van Damme (2000) differentiates two types of universals—transcultural and pancultural. According to him, transcultural aesthetic universals concern stimulus properties appealing to all human beings, regardless of cultural background, and

thus are across (trans) cultural boundaries. Pancultural aesthetic universals mean principles that are found to be operative in evaluating stimuli in all (pan) cultures. Although the present research explores the transnational universality of visual aesthetics according to van Damme's categorization, I will first review pancultural aesthetic universals and then transcultural aesthetic universals.

Pancultural aesthetic universals. Based on his comparison data drawn from several dozen cultures, van Damme (1996) suggests the existence of four universal visual aesthetic principles: symmetry and balance, clarity, smoothness, and novelty.

Balance, of which symmetry is a special case, has been intensely studied in experimental aesthetics in connection with the visual arts. As the most important proponent of the holistic processing theory, Gestalt school attempts to explain for symmetry, along with other particular properties of a given percept, such as closure and proximity. Gestalt psychologists believe that the processes of perceptual organization within the nervous system decide the fact that people see configurations or patterns rather than individual elements. This causes particular properties including symmetry, closure and proximity, to be perceived as a whole rather than as a simple sum of parts (Koffka, 1935; Palmer, 1990).

Clarity, as a second widespread standard, is summarized as "denoting a preference for easily recognizable visual compositions, made up of readily perceptible parts" (van Damme, 2000, p.265).

Smoothness is widely admired as a property of not only the human body or as a characteristic of its rendition in sculpture, but also, sometimes, of other manmade objects such as dwellings (e.g., Blier, 1987).

As a last widespread standard, novelty is observed to be admired in many cultures all over the world. For example, Schneider (1971) uncovers the major role of novelty in the evaluation of visual attractiveness. However, there is no absolute novelty but only relative novelty (Berlyne, 1971).

From the perspective of evolutionary psychology, researchers (e.g., Symons, 1995) suggest that universal preference for smoothness is due to panhuman appreciation of a smooth skin, which is an index of health, and similarly, that the preference of symmetry is because body symmetry is seen as an indication of developmental stability. For preference of novelty, it is proposed that human beings would experience pleasurable feelings when displaying exploratory behavior in the sense that "a certain measure of exploratory behavior may well be beneficial for survival and reproduction, since it may be instrumental in finding such essentials as water, food and mates, in spotting predators and other dangers, in discovering escape route, and so on" (van Damme, 2000, p.271). Overall, van Damme summarizes that "our basic preferences ultimately derive from initially arbitrary proclivities which, since they led to behavior which turned out successful in an evolutionary sense, have procured their own survival" (p.273).

Transcultural aesthetic universals. Among the experimental studies in transcultural aesthetics the most well-known are those by Irvin Child and his collaborators (e.g., Child & Siroto, 1971). A comparison of aesthetic ratings by U.S. art

connoisseurs with the evaluations of people from Congo-Brazzaville, Greece, Fiji, Japan and Pakistan reveals a tendency towards transcultural agreement in the evaluations of visual stimuli. Similarly, the studies by Eysenck and his collaborators (e.g., Götz, Borisy, Lynn, & Eysenk, 1979) uncover a statistically significant transcultural accord in aesthetic assessment among people from England, Germany, Egypt, Hong Kong, Singapore and Japan in a test consisting of designs and polygons.

In terms of specific aesthetic properties, Singh and his colleague (Singh, 1993; Singh & Suwardi, 1995) suggest a particular characteristic of female body shape (i.e., hourglass shape, with waist-to-hip ratio of .70 or .60, depending on the ratio range included in the tests) seems to appeal to all human beings. They then interpret the results in an evolutionary context, suggesting the preference for low waist-to-hip ratio is "selected for" as a result that ancestral males who happened to prefer mates with a low waist-to-hip ratio might have had greater reproductive success.

A transnational study of color by Adams and Osgood (1973) also shows support for the existence of universal visual aesthetics. In their 23-culture semantic differential study of affective responses of color, they find cross-cultural similarities in feelings about colors. Their data together with the analysis of eighty nine previous studies of color and affect reveals strong universal trends in the attribution of affect in the color domain.

Cultural Particularity In Visual Aesthetics

In contrast to the above mentioned evidence for universality of visual aesthetics, many contemporary scholars "insist on the cultural specificity or indeed uniqueness of

evaluations of visual beauty" (van Damme, 2000, p. 258) and many "anthropologists consistently emphasized that aesthetic preference is to a significant extent culture-bound" (p.274) and inspired by socio-cultural values or ideals.

This is consistent with the findings in experimental aesthetics. For example, the cross-cultural investigation by Fischer (1959) reveals that dissimilar elements, little irrelevant space, and enclosed figures are more likely to be found in designs in hierarchical societies than others. Kavolis (1968) finds that dynamic patterns tend to occur in the art of societies with dynamic economies, rigidity tends to appear in active aristocratic society, and that spontaneity is typical where there is a functionless aristocracy.

Investigations On Visual Aesthetics In Marketing

Research On Visual Aesthetic Design

Researchers in product innovation and development have provided evidence on the importance of product design or its component elements such as aesthetics and ergonomics in customer preferences (Gemser & Leenders, 2001). By affecting consumers' beliefs about products, product form can have an impact on consumer preferences (Berkowitz, 1987; Sewall, 1978). The aesthetic aspects of product design, as well as the applications of design principles such as unity and prototypicality have been investigated and found to exert influences on consumers' responses (Veryzer, 1993, 1995, 1998; Veryzer & Hutchinson, 1998). Even in the context of industrial products where aesthetics is assumed to be least influential, the appearance of industrial products

is found to have a non-trivial influence on choice although the manager respondents stated that appearance should not and did not influence product evaluation (Yamamoto & Lambert, 1994).

More recently, a special issue on aesthetics in the Journal of Consumer Psychology reveals a group of explorations of visual aesthetic design. In their review paper, Patrick and Peracchio (2010) classify those explorations into four categories. Due to the nature of the present research, I will include the articles which are related to visual aesthetics only.

Multisensory aesthetic experiences. Madzharov and Block (2010) provide evidence that consumers unwittingly use packaging aesthetics to determine how much to eat and demonstrate that when a product package displays a greater number of snack items, consumers eat more of this snack.

Conceptual processing of aesthetics. Hoegg, Alba, and Dahl (2010) examine the influence of design on feature performance when aesthetics clashes with performance and find a negative aesthetic effect, a bias favoring unattractive products when aesthetics and feature functionality conflict. Their findings challenge the assumption that an attractive product will be universally more appealing than an unattractive product. Reimann, Zaichkowsky, Neuhaus, and Weber (2010) look into the aesthetics of package design from behavioral, neural, and psychological perspectives. With functional magnetic resonance imaging (fMRI), they provide evidence that reward value plays an important role in the appreciation of aesthetic experiences. Pandelaere, Millet, and Bergh (2010)

explore aesthetic appreciation and find an order of exposure effect such that aesthetic stimuli viewed earlier are preferred over related, later encountered stimuli.

Aesthetic design preferences. Townsend and Shu (2010) investigate the influence of aesthetic design in financial decision-making and find that the aesthetics of financial and investment documents does influence stock valuation and investment behavior such that aesthetic design increases a company's value. Venkatesh, Joy, Sherry, and Deschenes (2010) explore the impact of aesthetics in consumers' everyday lives and uncover the nature of the aesthetic meaning derived from fashion and how body perception is integrated with the aesthetics of fashion. Cho and Schwarz (2010) investigate the impact of processing fluency on consumers' preferences for a mirror image versus a regular image of a familiar versus unfamiliar person and find that processing fluency, the process underlying aesthetic preference, is engaged only when a familiar person wearing the accessory is presented from the viewpoint under which they are normally viewed. Deng, Hui, and Hutchinson (2010) look into aesthetic self-design in an online athletic shoe color configuration task. They find support for the visual coherence perspective and the small palette principle because, in their studies, selected colors either matched or were closely related to each other and a small number of colors were used in the average design. Kumar and Garg (2010) examine the connections between aesthetic principles and cognitive appraisals and find that consumers prefer balance in the level of attention and pleasantness when evaluating an aesthetic experience.

Individual differences in evaluating aesthetics. Meyers-Levy and Zhu (2010) find that both gender and need for cognition have impacts on whether consumers rely on

descriptive versus hedonic meanings when developing perceptions regarding aesthetic stimuli. They show that females base their aesthetic preferences on the descriptive and hedonic meanings of aesthetic stimuli, while for males, the level of need for cognition determines which meaning is processed. Yang, Zhang, and Peracchio (2010) explore how consumers' self-concept impacts evaluations of the stylistic properties of images and find that a downward looking camera angle is preferred by those consumers who are motivated by duties and obligations, an ought-self, as compared to consumers motivated by hopes and aspirations, an ideal-self. When a product is viewed from an upward camera angle, consumers with an ideal self, offer more favorable evaluations than consumers with an ought-self.

Universal Aesthetic Design

In spite of the emerging research on aesthetics in marketing, universality of aesthetic design has been generally under-researched. In his conceptual work, Bloch (1995) suggests that consumer preferences of design are influenced by culture. Some tentative insights about universality of design are found in the limited number of empirical studies. Based on the argument of universal preference of the golden ratio, Raghubir and Greenleaf (2006) find that the ratio of the sides of a rectangular product or package can influence purchase intentions and is related to marketplace demand. The respondents in their study showed an aesthetic preference for the golden ratio of rectangles. Specifically, participants were presented with an invitation to a concert. The only difference between experimental conditions was that the invitation was printed on

rectangular cards of one of two ratios: 1.38:1 or 1.62:1 (the golden ratio). It is found that participants receiving the invitation conforming to the golden ratio rated the concert as more harmonious and indicated a higher likelihood of purchasing a CD of the performance than participants receiving invitations with a 1.38:1 ratio did.

In their cross-cultural study on logo design, van der Lans et al. (2009) conclude that universal dimensions underlying logo design exist across countries. The dimensions include elaborateness (defined as "a design's richness and its ability to capture the essence of an object"), naturalness (defined as "commonly experienced objects"), and harmony (defined as "the congruency of the patterns and parts of a design") (p.969). They also find that responses to logo design dimensions and elements are relatively consistent despite the minor differences.

Summary Of The Literature Review On Universality Of Design

The literature review above suggests that universality of aesthetics and cultural particularity of aesthetics are coexisting phenomena. While there are evidences suggesting the existence of visual aesthetics universals, such as aesthetic principles (e.g., balance and symmetry, smoothness, clarity, and novelty) and dimensions (e.g., elaborateness, naturalness, and harmony), there are at the same time proofs that visual aesthetics is influenced by culture (e.g., designs with dissimilar elements, little irrelevant space, and enclosed figures, are more likely to be found in hierarchical societies). The investigations in consumer psychology indicate that aesthetics influences consumers' judgment and decision making in many aspects of everyday life, such as consumption of

food, financial decisions, judgment of product performance, etc. However, it is still unknown with regard to in what aspects and to what extent visual aesthetics could be universal. This present research aims to address this unknown issue and explores to what extent visual aesthetics is universal in terms of various aspects of consumer responses to design, including affect, attitude, and meaning.

Design Expertise

Expertise, Expert-Novice Differences, And Shanteau's Theory Of Expert Competence

Expertise as an intriguing subject for investigation emerged as a result of work in the mid- to late-sixties largely due to developments in artificial intelligence and cognitive psychology (Glaser & Chi, 1988). According to Webster (1979), an expert is someone who displays special skills or knowledge derived from training or experience.

Expert-Novice Differences

As a core topic in expertise research, expert-novice differences have been widely explored in various domains, including sports, physics, mathematics, meteorology, psychology, arts, law, medicine, and skills such as typewriting (e.g., Allard & Starkes, 1991; Anzai, 1991; Charness, 1991; Ericsson & Polson, 1988; Gentner 1988; Koehler, Brenner, & Griffin, 2002; Soloway, Adelson, & Ehrlich, 1988; Sloboda, 1991). Major characteristics of experts based on the current research on expert-novice differences in various domains can be generalized as follows (Glaser & Chi, 1988):

1. Experts excel mainly in their own domains.

2. Experts perceive large meaningful patterns in their domains.

3. Experts quickly solve problems with little error and are faster than novices at performing the skills of their domains.

4. Experts have superior short-term and long-term memory.

5. Experts see and represent a problem in their domain at a deeper level than novices while novices tend to represent a problem at a superficial level.

6. Experts spend a great deal of time analyzing a problem qualitatively.

7. Experts have strong self-monitoring skills.

Shanteau's Theory Of Expert Competence

In order to explain experts' performance, Shanteau's theory of expert competence (Shanteau, 1988, 1992a) suggests that expert competence is based on five factors: domain knowledge, psychological traits, cognitive skills, decision strategies, and task characteristics. Adequate domain knowledge is a prerequisite for expert performance (Shanteau, 1992a). In order to achieve high levels of performance, experts require specific cognitive skills as well as mastery of specific decision strategies which help experts overcome cognitive limitations (Shanteau, 1988, 1992a). Experts also possess certain psychological traits, including strong self-confidence, excellent communication skills, the ability to adapt to new situations, and a clear sense of responsibility (Shanteau, 1992a). Finally, characteristics of the task are critical in determining whether there will be any bona fide experts in the domain (Alba & Hutchinson, 1987; Blattburg &Hoch,

1990; Hoch & Schkade, 1996; Hutchinson & Alba, 1991; Klayman, 1988; Shanteau, 1992a).

Knowledge Calibration

The study of expertise also investigates decisions under uncertainty (Shanteau & Stewart, 1992). According to Wright (2002), knowledge calibration is a person's knowledge and beliefs about any type of cognitive process or mental activity. Knowledge calibration can be assessed by comparing confidence with accuracy. If people are high in confidence where their knowledge is accurate and low in confidence when it is inaccurate, they are defined as well-calibrated (Alba & Hutchinson, 2000).

Many studies of calibration have found that domain experts in most fields, such as medicine, law, psychology, sports, etc., are as poorly calibrated as novices (e.g., Christensen-Szalanski & Bushyhead, 1981; Lichtenstein, Fischoff, & Phillips, 1982; Shanteau & Stewart, 1992). Both experts and novices are overconfident—the assessed probabilities are higher than the proportion of correct answers to knowledge questions (Shanteau & Stewart, 1992). The major exceptions are the high level of calibration of experts in meteorology and bridge playing, which leads to speculation that large numbers of repetitions with immediate outcome feedback may improve calibration (Hutchinson & Eisenstein, 2008).

As concluded in their review paper of the literature of knowledge calibration, Camerer and Johnson (1991) suggest that expert judgments in most areas are no more

accurate than those of novices and that expert judgments have been worse than those of the simplest statistical models.

Design Expertise

Different from such fields as sports and playing a musical instrument, which rely largely on physical skills, designing involves both physical skills, notably drawing, and cognition (Lawson & Dorst, 2009). According to Lawson and Dorst (2009), the central tasks in design require designers to look and think, which should be treated as a complex and high level skill (Bartlett, 1958). Since design involves both physical acts and mental processing, acquiring expertise is likely to be a more complex affair (Lawson & Dorst, 2009).

Levels Of Design Expertise Development

In line with the majority of expertise research, most researchers in design expertise (e.g., Ahmed, Wallace, & Blessing, 2003; Ho, 2001; Seitamaa-Hakkarainen & Hakkarainen, 2001) embrace the concepts of novice and expert. Borrowing and adapting the model from Dreyfus (2003), Lawson and Dorst (2009) propose a phase model of the development of expertise comprising six phases of: novice, advanced beginner, competent, expert, master and visionary. According to this six-phase model, a novice considers the objective features of a situation as given by experts and follow strict rules to deal with the problem. An advanced beginner sees situational aspects and sensitivity to exceptions to the hard rules of novices. A competent problem solver sees the most

important issues in a situation, develops an appropriate plan to achieve the goals, and reasons out what to do. An expert responds to a specific situation intuitively and performs the appropriate action straight away, without problem solving and reasoning that can be distinguished at this level of working. A master has an acute sense of context and openness to subtle cues, seeing the standard ways of working that experienced professionals use not as natural but as contingent. At the high end of the scale, some designers develop into "visionaries" who introduce completely new concepts and constructs to the profession.

Differences Between Novice Designers And Expert Designers

After reviewing studies in design expertise (e.g., Ahmed, Wallace, & Blessing, 2003; Ho, 2001; Lloyd & Scott,1994; Schön, 1988; Seitamaa-Hakkarainen & Hakkarainen, 2001), Cross (2004) generalizes the differences between novice designers and expert designers as follows:

Expert designers appear to rely on "problem scoping" and on a focused or directed approach to gathering problem information and prioritizing criteria; while novice designers seem to be over concentrated on problem definition.

Processes of structuring and formulating the problem, defined as "problem framing", are frequently identified as key features of design expertise. Compared with their novice counterparts, expert designers are found to be pro-active in problem framing, actively imposing their view of the problem and directing the search for solution conjectures.

Novice designers are problem-focused; while expert designers are solution-focused. In particular, experience in a specific problem domain enables expert designers to move quickly to identifying a problem frame and proposing a solution conjecture.

Besides the differences between novices and experts, some features of expert designs are found to be contradictory to the conventional wisdom. For example, rather than generating a wide range of alternative solution concepts as recommended by theorists and educationists, expert designers take the strategy of generating a relatively limited amount of alternatives, are inclined to become readily attached to single, early solution concepts, and are reluctant to abandon them in the face of difficulties in developing these concepts into satisfactory solutions. Meanwhile, productive design behavior seems to be associated with frequent switching of types of cognitive activity, which may be related to the need to make rapid explorations of problem and solution in tandem, in the co-evolution of problem and solution. Finally, contrary to conventional wisdom about the nature of problem-solving expertise, expert designers' intuitive features of design behavior are found to be the most effective and relevant to the intrinsic nature of design.

Summary Of The Literature Review On Design Expertise

The literature review above suggests that, in contrast to the well established work on understanding expertise in various fields and contexts, including chess, music, problem-solving, science and sports, expertise in design has received only limited attention (Cross, 2010). When it comes to expertise transfer and knowledge calibration

specifically, little research has been conducted in the extant literature of design expertise. The present research will apply Shanteau's theory of expert competence and the literature on knowledge calibration to fill these gaps by exploring design expertise transfer and knowledge calibration in a cross-cultural context using quantitative research method.

CHAPTER 3

CONCEPTUAL MODEL AND HYPOTHESIS DEVELOPMENT

According to Bloch (1995) and Lawson (1997), all design starts from a design problem or task brought up from clients, users, project managers, legislators or designers themselves. Upon receiving a design problem or task, designers as problem solvers recognize a state of affairs that needs improving and a target state of affairs that would represent the improvement (Lawson, 2004b). In this process, designers define the problem, analyze it to formulate requirements, and then generate solutions. As a planner who plans for "arranging elements in such a way as to best accomplish a particular purpose" (Faimon & Weigand, 2004, p.13), designers choose design elements, such as line, shape, materials, texture, color, etc., decide how to arrange or mix these elements and determine the desired level of congruity among them (Arnheim, 1974; Bloch, 1995; Davis, 1987; Faimon & Weigand, 2004; Landa, 2011; Lauer, 1990; Lawson, 1983; Zelanski & Fisher, 1984). These design activities result in design solutions which are then viewed by consumers who show a series of design responses.

This process is essentially a course of information transmission between designers and consumers. In the present research, I will apply the information theory and Shanteau's theory of expert competence to explain this process, to develop hypotheses and to build a conceptual model.

Information Theory And Design Information Transmission

Basic Concepts Of Information Theory

Information theory was developed from the work of Shannon (1948) on the "mathematical theory of communication". According to Shannon, a basic system of communication comprises five elements including source, transmitter, channel, receiver and destination. The information source creates a message which is encoded into a signal carried by transmitter and transmitted through a channel. The receiver decodes the signal and the message arrives at the destination.

The most important quantities of information are entropy, which is the information in a random variable, and mutual information, which is the amount of information in common between two random variables. The former quantity indicates how easily message data can be compressed while the latter can be used to find the communication rate across a channel.

Essentially, entropy measures the uncertainty involved in predicting the value of a random variable (Ihara, 1993), usually in units such as bits (Brillouin, 2004). It quantifies the expected value of the information contained in a message and is usually expressed by the average number of bits needed to store or communicate one symbol in a message. For example, a single toss of a fair coin has an entropy of one bit; while a series of two fair coin tosses has an entropy of two bits. The entropy rate for the coin is one bit per toss. Nevertheless, if the coin is not fair, then the uncertainty is lower and thus the entropy is lower. Likewise, specifying the outcome of a fair coin flip (two equally likely outcomes)

provides less information (lower entropy) than specifying the outcome from a roll of a die (six equally likely outcomes).

Mutual information measures the amount of information that can be obtained about one random variable by observing another. This is important in communication where it can be used to maximize the amount of information shared between sent and received signals. The more mutual information shared between sent and received signals, the higher the communication rate is.

Integrating Information Theory In Design

From the mid-20th century, the Franco-German school of "informational aestheticians" started to attempt to establish a new foundation of aesthetics in information theory (Alsleben, 1962; Bense, 1965; Frank, 1959; Gunzenhäuser, 1962; Kiemle, 1967; Moles, 1958). In his exploration of aesthetics and psychology, Berlyne (1971) applies the information theory to explain information transmission in art.

In product design, Monö (1997) has applied Shannon's basic model of communication to explain the design process. Crilly, Moultrie, and Clarkson (2004) visualize the process in a model. As the source of the message, designers (corresponding to what is depicted as "design team" in Crilly et al.'s model) input information into design/design solutions ("product" in Crilly et al.'s model), which can be viewed as the transmitter of the message. The environment in which consumers interact with the design can be viewed as the channel. Consumers' perceptual senses can be seen as the receiver

of the message and their responses to design can be regarded as the destination (see Figure 1).

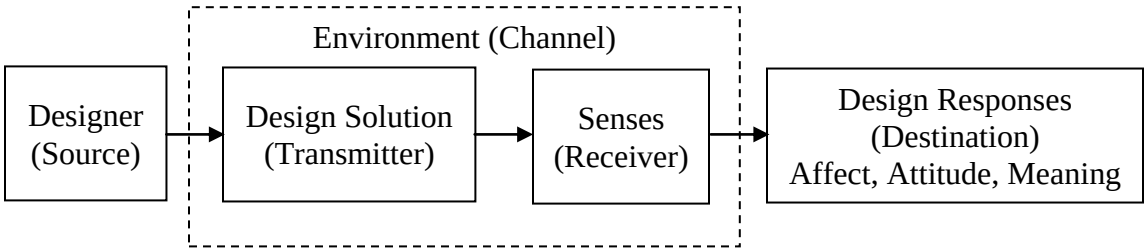

Figure 1. Information Transmission of Design. Adapted from Crilly et al., 2004.

Similar to the information transmission in art as suggested by Berlyne (1971), since design/design solutions are produced by designers, there is information from designers to consumers through the design. Different from the information transmission in art, a design can not only affect consumers' internal processes, such as thoughts (i.e., beliefs) and emotions (i.e., affect), but also give rise to corresponding actions. Each element of the information transmission of design is discussed below based on Crilly, Moultrie, and Clarkson (2004).

Elements Of Information Transmission Of Design

Designer as information source. Design message is generated once a designer creates a design. The designer decides what information to input into the design based on his understanding of the design problem/task and the design goals and constraints.

Design as information transmitter. The physical design as information transmitter may be characterized by its shape, materials, texture, color, etc., which are determined by

the designer (Arnheim, 1974; Bloch, 1995; Davis, 1987; Faimon & Weigand, 2004; Landa, 2011; Lauer, 1990; Lawson, 1983; Zelanski & Fisher, 1984). The design carries information which will be transmitted to and received by the receiver.

Environment as information channel. The environment within which the design is to be perceived is the information channel. It may be characterized by the conditions of the interaction context, such as the layout of a store where the design is presented, the package of the design, etc.

Senses as information receiver. The information transmitted by the design is received by the physiological senses of consumers. Sensory aspects of design include touch, taste, smell, hearing, and vision. The present research focuses on the visual aspect of design and thus vision is of primary interest.

Design responses as information destination. Once information is received by senses, it will elicit various design responses (Bloch, 1995), which may include affect, attitude, and shared meaning (e.g., Henderson & Cote, 1998; Seva & Helander, 2009).

Semantic Information And Expressive Information

Similar to the information transmission of art in the theorization of Berlyne (1971), the process of information transmission of design is influenced by and therefore conveys information from events in the external environment by which designers have been affected. In other words, design may transmit information about the external characteristics of the world in general as well as social conditions including the values prevalent in a particular culture or subculture to which the artist may or may not belong.

In accordance with Berlyne, information transmitted from external conditions is *semantic information,* of which *social information* is a subcategory.

According to Lawson (1983), designers can select or modify visual form elements to fulfill desires for self-expression while accomplishing professional goals. Therefore, a design can also carry *expressive information* peculiar to designers. The self-expression goals of an individual designer may conflict with the constraints defined by the design problem/task. For example, "a designer may seek a greater level of novelty and impact in a product form than the marketplace is willing to accept" (Bloch, 1995, p.19).

Positive Interaction Uncertainty And Information Correspondence

Positive interaction uncertainty. Based on the theorization of Berlyne (1971), if a particular combination of input elements always gives rise to the same output combination and a particular output combination always arises from the same input combination, it is considered as complete information transmission between the input and the output. If a combination of elements transmits information that is not to be found in any of its components acting alone, it is called *positive interaction uncertainty* (Garner, 1962; McGill, 1954). Similar to art, positive interaction uncertainty may exist in design. This notion may be bound up to the concept of "style" in design. For example, Arne Jacobsen's "7 chair" made of form-bent wood and chromed steel tells about not only the chair as a piece of functional furniture but also the designer's Scandinavian design ideology of simple designs, minimalism, functionality, and low-cost mass production. But we cannot separate the parts of the chair that carry information about the designer's

social background and the parts that carry information about the chair. All parts convey information about both. Since design usually depicts not only what an object is but also show a certain style, it is expected that design is associated with positive interaction uncertainty, which requires mutual information shared between designers and consumers.

Information correspondence. In absence of positive interaction uncertainty, if each element of the information that the consumer receives is able to be identified with a corresponding input information element determined by the designer, it is called *informational correspondence* based on Berlyne's theorization (1965). It means that every output element corresponds to an input element. According to Berlyne, a special case of informational correspondence involves *isomorphism*, which means two systems have the same structure and implies a correspondence of elements in the two systems as well as a correspondence of relations between elements in the two systems. The information correspondence between a map and a geographical region is an example of isomorphism. In the case of design, isomorphism may also exist. For example, customized design requires isomorphism, or similar structure, so that a designer may create a design which meets the specific needs of a customer. A simple example may be customization of M&M chocolate candies. A customer chooses words to put on the M&Ms and selects colors he wants. This process involves isomorphism between the customer and the designer/manufacturer of the M&Ms so that the customer can get exactly what he wants. *Iconicity*, which is a special case of isomorphism according to Berlyne, implies a similarity in other respects, such as color and shape in paintings, besides structure. Iconicity may also exist in design. For instance, in a culture where

people use pink to represent female and blue for male, a designer may use this knowledge and put gender iconicity information in his design, which will be easily transmitted to a consumer with the same knowledge.

Mutual Information

According to information theory, the more mutual information between two random variables, the higher the communication rate will be (Shannon, 1948). In the context of design, in order for the information, whether semantic, social, or expressive, that designers input in their design to be successfully transmitted to consumers, mutual information between the designers and the consumers is required. Since positive interaction uncertainty exist in most, if not all, designs, it is crucial for designers and consumers to share mutual information. Isomorphism and iconicity, as special forms of information correspondence, may require the highest level of mutual information between designers and consumers.

The Effect Of Culture And Expertise Level On Design Responses

Culture, Expertise Level, And Information Transmission

As illustrated above, successful information transmission of design requires mutual information shared between designers and customers. In the process of information transmission, a designer's individual difference will affect the information to be carried into a design. Two important factors include a designer's cultural context and expertise level.

According to Lawson and Dorst (2009), contextual and experiential knowledge is essential to a designer. Since preferences for product form are shaped by cultural and social forces (McCracken, 1986), a designer needs contextual knowledge about the culture/market which his design is targeted. Without such knowledge, it will be difficult for the designer to identify appropriate semantic information and/or social information to be input into his design. From the perspective of consumers within the culture, such information is necessary for them to receive and interpret the message transmitted by the design. Otherwise the information transmission of design will become difficult and even fail. Therefore, the more mutual cultural information a designer shares with consumers in a culture, the more likely it will be for the designer to successfully communicate his design with consumers.

Another type of knowledge, experiential knowledge, is what a designer gradually builds up through practice. It will become a repertoire of information about earlier solutions that can be applied by the designer in their design (Gero & Rosenman, 1990; Lawson, 2004a, 2004b, 2009; Schön, 1983; Tham et al., 1990; Vermaas & Dorst, 2007). According to Shanteau's theory of expertise competence (Shanteau, 1992a, 1992b), sufficient knowledge of the domain is a prerequisite for being an expert and practice is highly correlated with expertise level (Hutchinson & Eisenstein, 2008). Therefore, the higher design expertise level is, the more sufficient information a designer will contain to apply from to his design, and meanwhile, the better the designer will be at balancing expressive information and semantic information. In other words, expertise level is

associated with the experiential knowledge a designer possesses and can be used as a variable to measure such knowledge.

When a designer has sufficient contextual and experiential knowledge, the information uncertainty is the lowest because he can select the most efficient information to be input in a design for successful transmission to consumers. However given a certain experiential knowledge, when the context of design, such as cultural settings, changes, the designer's expertise will be negatively affected and thus the information uncertainty increases.

In summary, when culturally specific mutual information is necessary between designers and consumers, culture match between designers and target markets will have a main effect on design responses. Specifically, designers are expected to create better design for their home market than a foreign market. Culture match will also moderate the effect of design expertise level on design responses. While expert designers are expected to do a better job than non-expert designers when designing for their home market, this difference will be smaller when designing for a foreign market. By contrast, when no culturally specific mutual information is necessary, culture match between designers and target markets will be expected to have neither main effect nor moderating effect as suggested above.

In the next section, I will focus on design responses including affect, attitude, and meaning. Rooted in the reasoning above about culture match's main effect and moderating effect on expertise level, I will develop hypotheses with regard to each type of responses based on how culturally relevant they are.

Design Responses: Affect, Attitude, And Meaning

Affect

Affect refers to emotional responses and feelings engendered by stimuli (Breckler, 1989). Design can elicit affective responses in consumers similar to those for art works (Dumaine, 1991), including an engagement of attention and strong positive emotions. However, design can also cause negative affective reactions. The goal of design is to elicit more positive than negative responses among consumers, especially those in the target segment (Bloch, 1995).

Experimental psychologists (e.g., Collingwood, 1938; Titchener, 1909) suggest that perception of visual aesthetic stimuli is inevitably associated with emotional charge. According to Berlyne (1971), affective responses to stimuli show statistically significant consistency among subjects.

In their 23-culture semantic differential study of affective responses of color, Adams and Osgood (1973) find cross-cultural similarities in feelings about colors. Their data together with the analysis of eighty nine previous studies of color and affect reveal strong universal trends in the attribution of affect in the color domain.

A more recent comparison study by Seva and Helander (2009) explores how cellular phone attributes influence the affective responses of consumers and find similar affective responses between Singaporeans and Filipinos.

These may suggest a possible universal trend of affective responses. In other words, the information transmission of design related to affect may not be influenced by designers' and consumers' cultural background. Based on the reasoning in the previous

section, it is expected that culture will not have a main effect on affective responses. Therefore, it is hypothesized that:

H1: Affective responses to design for the home market will not differ from those for a foreign market.

Likewise, because culturally specific mutual information is not needed for affective responses, culture match between designers and target markets will not moderate the effect of design expertise level on affective responses. In other words, design expertise may not be diminished due to change in the cultural context. Consequently, it is hypothesized that:

H2: Design expertise level will be equally associated with consumer affective responses to design for the home market and a foreign market.

Attitude

While affect describes consumers' internal feeling state (Cohen, Pham, & Andrade, 2008), attitude refers to general evaluations of objects (Haugtvedt & Kasmer, 2008; Petty & Cacioppo, 1981). Design perceptions can lead to positive attitude responses such as liking, good, favorable and draw strong attention and involvement (Lewalski, 1988; Veryzer, 1993), or can result in negative attitude responses such as disliking, bad, unfavorable (Petty, Cacioppo, & Goldman, 1981). It is important to elicit positive attitude responses of design because attitudes toward products are important determinants of consumers' buying decisions (Ajzen, 2008).

The most widely accepted theory of attitude formation is the expectancy–value (EV) model. According to this model, people's evaluations of, or attitudes toward, an object are determined by their beliefs about the object, where a belief is defined as the subjective probability that the object has a certain attribute. Only beliefs that are readily accessible in memory tend to influence attitude toward an object at any given moment (Fishbein & Ajzen, 1975).

The extant literature has well recognized the effect of personal and contextual factors on attitudes (Malhotra, 2005). According to the EV model, only accessible beliefs are considered to be the prevailing determinants of a person's attitude. However, personal and contextual factors can increase or decrease the accessibility of different beliefs (Ratcliff et al., 1999).

Consistent with the EV model, researchers in product design (e.g., Bloch, 1995; McCracken, 1986) and aesthetics (e.g., Berlyne, 1971; van Damme, 2000) suggest that a given culture's visual preferences are inspired by that culture's socio-cultural values or ideals. Cultural norms regarding design tend to overwhelm inner feelings and individual preferences (Alexander, 1979).

Designers choose particular design elements to proactively encourage the creation of desirable beliefs (Berkowitz, 1987). Therefore, in order for a design to successfully elicit positive attitude, a designer needs to be aware of what is preferred in a certain culture and thus put corresponding information into the design. In other words, culturally specific mutual information between the designer and the consumers is required for the design to successfully transmit information to elicit positive attitude. This means culture

match between the designer and the target market will have a main effect on the consumers' attitudinal responses. Consequently, it is hypothesized that:

H3: Attitudinal responses to design for the home market will be more positive than those for a foreign market.

Similarly, because culturally specific mutual information is necessary for attitudinal responses, culture match between designers and target markets will also moderate the effect of design expertise level on attitudinal responses. In other words, design expertise may be diminished due to change in the cultural context. It is therefore hypothesized that:

H4: Design expertise level will be more positively associated with consumer attitudinal responses to design for the home market than for a foreign market.

Meaning

Design has been emphasized by researchers as an instrument for conveying meaning and generating brand impressions (Aaker, 1991; Batra & Homer, 2004; Orth & Malkewitz, 2008; Schmitt & Simonson, 1995). An important criterion measuring the success of design solutions is how well a design solution can evoke the same intended meaning among people (e.g., Borja de Mozota, 2003; Henderson & Cote, 1998; Henderson, Cote, Leong, & Schmitt, 2003). Design with high shared meaning can be perceived, interpreted, and remembered better than those with low shared meaning (Rodewald & Bosma, 1972).

In the literature of semiotics, it is suggested that the meaning of stimulus can be assessed by examining the core or consensual meaning it evokes (Perussia, 1988). In psychology, the notion of shared meaning or consensus in meaning is referred to as stimulus codability (Butterfield & Butterfield, 1977; Lachman, Shaffer, & Hennrikus, 1974). In their study of stimulus codability of visual shape, Daniel and Ellis (1972) find that high stimulus codability results in superior recognition performance. Highly codable stimuli may easily evoke consensually held meanings within a culture or subculture (Henderson & Cote, 1998). In the present research, I apply the concept of codability into the context of design. Based on the above-mentioned literature, design codability in this current research is defined as the extent to which a design can evoke consensually held meanings within a culture or subculture.

Meaning of design can be transmitted through semantic information. According to Crilly, Moultrie and Clarkson (2004), product semantics is what a product appears to communicate about itself. Designers should help users in correctly interpreting the product (Krippendorff, 1989). Successful transmission of semantic information requires high level of mutual information between designers and consumers.

Based on the extant literature, it is thus speculated that conveying meaning of design requires high level of culturally specific mutual information/knowledge between designers and consumers. Derived from the reasoning about its main effect, culture match between designers and target markets is expected to affect design codability. Accordingly, it is hypothesized that:

H5: Codability of design for the home market will be higher than those for a foreign market.

Due to the high requirements of culturally specific mutual information/knowledge between designers and consumers, culture match between designers and target markets will also moderate the effect of design expertise level on codability of design. Therefore, it is hypothesized that:

H6: Design expertise level will be more positively associated with codability of design for the home market than for a foreign market.

Culture, Expertise Level, And Design Calibration

Design Confidence

According to Alba and Hutchinson (2000), confidence is conceptualized as certainty. The less certainty is, the lower confidence will be. As suggested in Shanteau's theory of expert competence, almost all experts show strong outward confidence, which generally comes across as a highly-developed faith in one's own abilities (Shanteau, 1988).

However, as an important component of expert competence, domain knowledge, including theoretical, contextual, and experiential knowledge, is a prerequisite (Lawson & Dorst, 2009; Shanteau, 1988). The uncertainties increase when designers' experiential and contextual knowledge about cultures does not match specific situations.

Accordingly, cultural context and relevant experiential knowledge in the cultural context of a designer affect his expert status. As suggested by Ahmed et al. (2003), while

novices tend to implement ideas immediately and then evaluate them, expert designers evaluate ideas before implementation. Compared with novices, expert designers are able to recognize situations and perform almost instant forward evaluations of them as a result (Lawson, 2009). These evaluative skills can contribute to lowering uncertainties and thus improve the chance of success. With decreased uncertainties, expert designers with more experiences and knowledge tend to show more confidence than their novice counterparts. However, once the cultural context changes, the special skills of an expert are diminished (Anderson, 1990) and the uncertainty increases accordingly. Consequently, it is likely that designers will be more confident when there is culture match between their cultural background and target markets than when there is no such match. Consequently, it is hypothesized that:

H7: Designers are more confident at designing products for the home market than for a foreign market.

H8: Design confidence is positively associated with design expertise level when designing for the home market.

H9: There is less association between design expertise level and design confidence when designing for a foreign market than for the home market.

Design Prediction Accuracy

As discussed in the literature review, experts' predictions are found to be as inaccurate as novices' in most areas except meteorology and bridge playing (Christensen-Szalanski & Bushyhead, 1981; Hutchinson & Eisenstein, 2008; Lichtenstein, Fischoff, &

Phillips, 1982; Shanteau & Stewart, 1992). Based on the exceptions found in professional meteorologists and world-class bridge players, it is speculated that large numbers of repetitions with immediate outcome feedback are necessary for calibration to be improved by experience. This relates to a dimension of Shanteau's theory of expert competence, task characteristics.

According to Shanteau (1992a), task characteristics associated with good performance in experts include repetitive tasks involving decisions about things and static, high expert agreed-upon stimuli that are characteristic of timely feedback, objective analysis, and common decision aids. By contrast, task characteristics suggesting poor performance include unique tasks involving decisions about behavior and changeable and expert disagreed-upon stimuli which are typical of unavailable feedback, subjective analysis, and rare decision aids.

Between the abovementioned two types, design falls into the latter. Prediction of design outcome involves decisions about consumer responses. Usually, design feedback is delayed or even unavailable. Also research on design expertise suggests the lack of objective decision aids and the subjective nature of design analysis. Based on the reasoning, it is thus hypothesized that:

H10: There is no difference in designers' prediction accuracy of design for the home market and those for a foreign market.

H11: The prediction accuracy is not associated with design expertise level regardless of target markets.

Figure 2 describes the conceptual model corresponding to the constructs in the hypothesis development based on information transmission of design, Shanteau's theory of expert competence, and the literature on affect, attitude, and meaning.

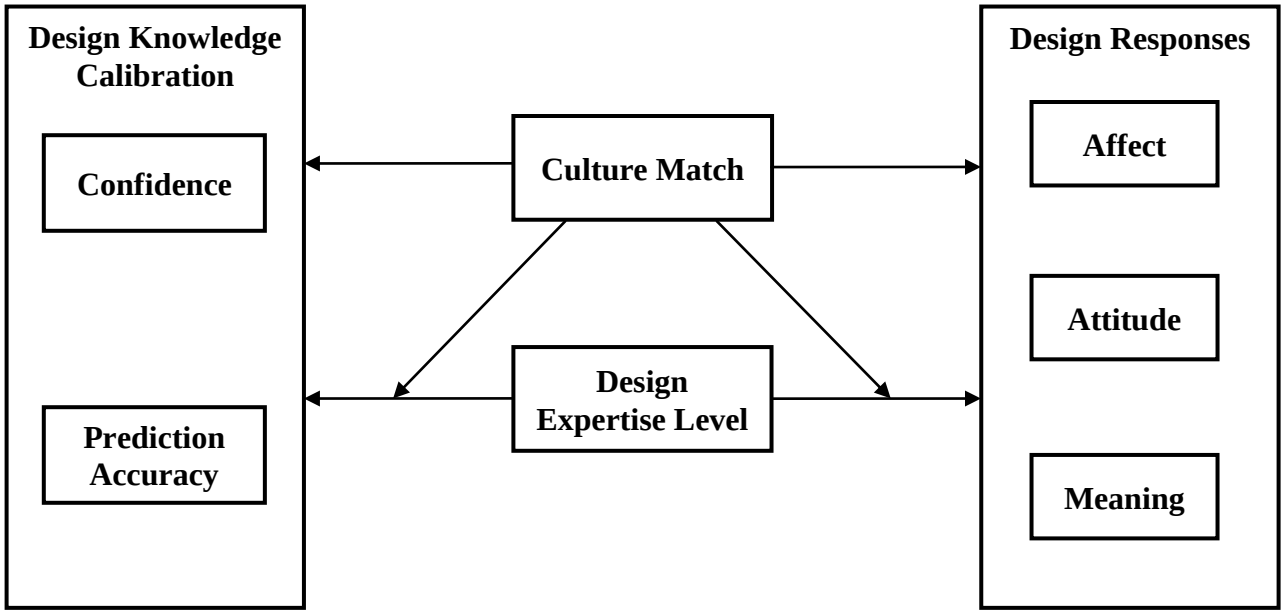

Figure 2. Conceptual Model. Culture, Expertise, Design Responses, and Knowledge Calibration.

CHAPTER 4

STUDY 1

In order to investigate universality of design, an exploratory study with a series of surveys was conducted to gain intuitive insights. Study 1 explored how universal design is by comparing consumer responses to designs created by designers from China and the U.S. specially recruited for the study.

Method

Study 1 required three stages. First, design tasks were identified through secondary research and interviews with designers from China and the U.S. Second, designers were recruited to complete design tasks and create design stimuli. Third, consumers responded to design stimuli in a series of surveys.

Phase 1: Selection Of Design Adjectives

Secondary research and interviews among professional designers from the U.S. were conducted to define a list of adjectives which are used by designers to benchmark design. The secondary research and interviews generated 48 design adjectives which are commonly applied among design professionals. The adjective list was then translated and back translated twice between English and Chinese. The twice translation process and further interviews with Chinese designers resulted in a final list of 32 adjectives by pair

(e.g., exciting/calming, feminine/masculine, etc.) which were well understood and applied among designers from both countries.

Phase 2: Creation Of Design Stimuli

After the English and Chinese adjective lists were finalized, I recruited 16 graphic design junior students (designers for abbreviation in the remainder of the paper) from a university in China and another 16 from an equivalent university in the U.S. The 32 designers were assigned 8 adjectives of each to create a total of 256 designs (8 adjectives x 4 groups x 2 countries x 2 pairing x 2 individual designers). Each design was created to evoke a specific adjective in the observer's mind. Designers were instructed that they could use only abstract graphic visual elements (e.g. line, curve, plane, etc.) and were not allow to use any concrete/figurative shapes (e.g. animals, plants, etc.) and symbols (e.g., letters, logo, sign, etc.). All designs were in black and white (grey tone was allowed) and 4'' x 4" by size. This phase generated a total of 256 design stimuli (see Figure 3).

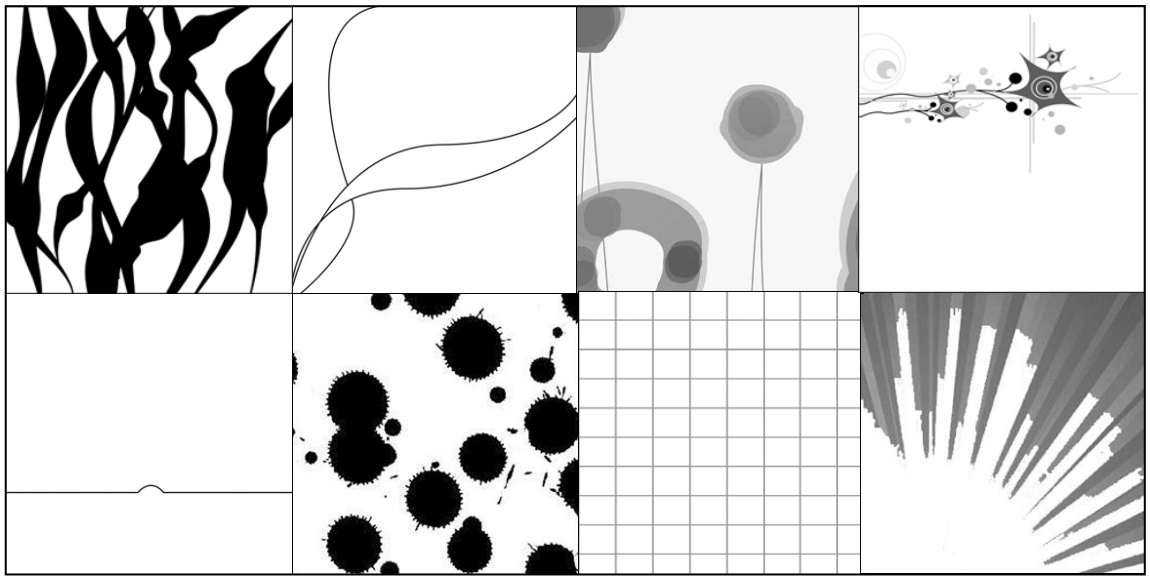

Figure 3. Study 1 Example Design Stimuli.

Phase 3: Consumer Ratings Of Design Stimuli

Phase 3 involved obtaining responses to the design stimuli created by the designers for this study. A fractional factorial experimental design generated 16 fractions out of the 256 stimuli, with each fraction comprising 16 designs. Three Qualtrics online surveys were conducted among college students from China and the U.S. The online surveys were translated and back translated twice between English and Chinese and pretested in both countries.

Affect

One survey was used to collect affective responses to design. A total of 224 (196 usable) college students from the U.S. and 237 (205 usable) college students from China

participated in this survey. Each respondent was presented with a fraction randomly selected from the 16 fractions. Each fraction started with an instruction describing the task and a short practice of an example question. After the instruction and practice, each respondent saw an image of a design followed by a question stated as “Please indicate how looking at the image above makes you feel using the sliders below” on a series of affective scales including “joyful”, “excited”, “peaceful”, “annoyed”, “nervous”, “contented”, “hopeful”, and “sad”. The left end of the scales stood for “clearly does not describe my feelings”, the mid-point for “somewhat describes my feelings”, and the right end for “clearly describes my feelings”. Consistent with the studies by Henderson and Cote (1998) and van der Lans et al. (2010), respondents were shown one stimulus per screen. The end of survey included questions to collect demographic information.

Attitude

A second survey was used to measure attitude toward design. A total of 246 (210 usable) college students from the U.S. and 236 (202 usable) college students from China participated in this survey. Each respondent was presented with a fraction randomly selected from the 16 fractions. Each fraction started with an instruction describing the task and a short practice of an example question. After the instruction and practice, each respondent saw an image of a design and was asked to evaluate the picture on five slider semantic scales anchored by “like/dislike”, “good/bad”, “high/low quality”, “distinctive/not distinctive”, and “interesting/uninteresting”, with a mid-point of “neither like nor dislike”, “neither good nor bad”, “neither high nor low quality”, “neither

distinctive nor not distinctive", and "neither interesting nor uninteresting" respectively. Similar to the affect survey, only one stimulus was shown per screen. The end of survey included questions to collect demographic information.

Meaning

A third survey was used to understand how well the design stimuli elicit the adjectives which designers were asked to convey with their design. A total of 492 (441 usable) college students from U.S. and 471 (430 usable) college students from China participated in this survey. Each respondent was presented with a fraction randomly selected from the 16 fractions. Each fraction started with an instruction describing the task and a short practice of an example question. After the instruction, each respondent saw an image of a design followed by a question stated as "Please indicate how strongly you agree or disagree that each word below describes the image above". Four adjectives for each design stimulus were provided on slider scales with the left end standing for "strongly disagree", the mid-point for "neither agree nor disagree", and the right end for "strongly agree". Only one of the four choices was correct. Similar to the attitude and the affect surveys, only one stimulus was shown on each screen. The end of survey included questions to collect demographic information.

Results

Affect

Factor analysis of the affective measures using principle components analysis revealed two dimensions, which explain 67.3% of the variance. The first factor, positive affect, included joyful, excited, peaceful, contented, and hopeful. The second factor, negative affect, included annoyed, worried, and sad. A reliability test of the five scales of joyful, excited, peaceful, contented, and hopeful came out statistically significant for each country (U.S. Cronbach's α = . 870; China Cronbach's α = .785) as well as the combined data of both countries (Cronbach's α = .842). This was also the case for annoyed, worried, and sad (U.S. Cronbach's α = . 817; China Cronbach's α = .808; combined Cronbach's α = .818).

Table 1. Factor Analysis of Items Measuring Affect Responses to Design

	Components	
Variable	Positive affect	Negative affect
joyful	.819	.345
excited	.624	.489
peaceful	.611	.011
contented	.790	.237
hopeful	.816	.284
annoyed	-.498	.696
worried	-.479	.734
sad	-.478	.658

Next, two new variables, positive affect and negative affect, were created by averaging the responses of the above mentioned measures included in each factor. The two new variables were used as the dependent variables (DVs) in a General Linear Model (GLM). The independent variables (IVs) in the model included designer country, viewer

country, match between designer country and viewer country, pairing of design adjectives, and two way interactions between match and pairing as well as between designer country and pairing.

As shown in Table 2, no statistically significant effect of match between designer country and viewer country was found for both positive and negative affect. For positive affect, the effect of viewer country was statistically significant ($p < .01$). However for negative affect, both designer country and viewer country were found to be statistically significant ($p < .001$). Chinese viewers tended to rate slightly but statistically significantly higher than U.S. viewers in both positive and negative affect. The main effect of pairing of design adjectives was statistically significant for both positive affect ($p < .001$) and negative affect ($p < .001$).

The interaction between pairing of design adjectives and match of designer country and consumer country was not significant for both positive and negative affect. However, the interaction between designer country and pairing of design adjectives came out statistically significant for both positive affect ($p < .001$) and negative affect ($p <.001$). Pairing of design adjectives did not influence U.S. designers as much as Chinese designers. When designed by pair, Chinese designers' design elicited more negative affect (see Figure 3). But when designed not by pair, Chinese designers' design brought forth more positive affective responses (see Figure 4).

Table 2. GLM for Affect and Attitude and Logistic Regression for Meaning

	Affect		Attitude	Correct meaning
Variable	Positive	Negative		
Intercept	-6.777***	-4.129*	5.634***	-.281
Designer country[a]	1.351	-.4.721***	-5.975***	-.178
Viewer country[a]	-2.506**	-7.369***	-4.939**	.071
Match between designer country and viewer country[b]	-1.784	.460	1.558	-.029
Pairing of design adjectives[d]	7.222***	-11.211***	5.371**	.096
Match between designer country and viewer country x Pairing of design adjectives	2.266	.313	-.595	
Designer country x Pairing of design adjectives	-10.820***	9.354***	-5.742*	

* $p < .05$
** $p < .01$
*** $p < .001$
a. Reference country is China.
b. Reference group is match.
c. Reference group is designed by pair.

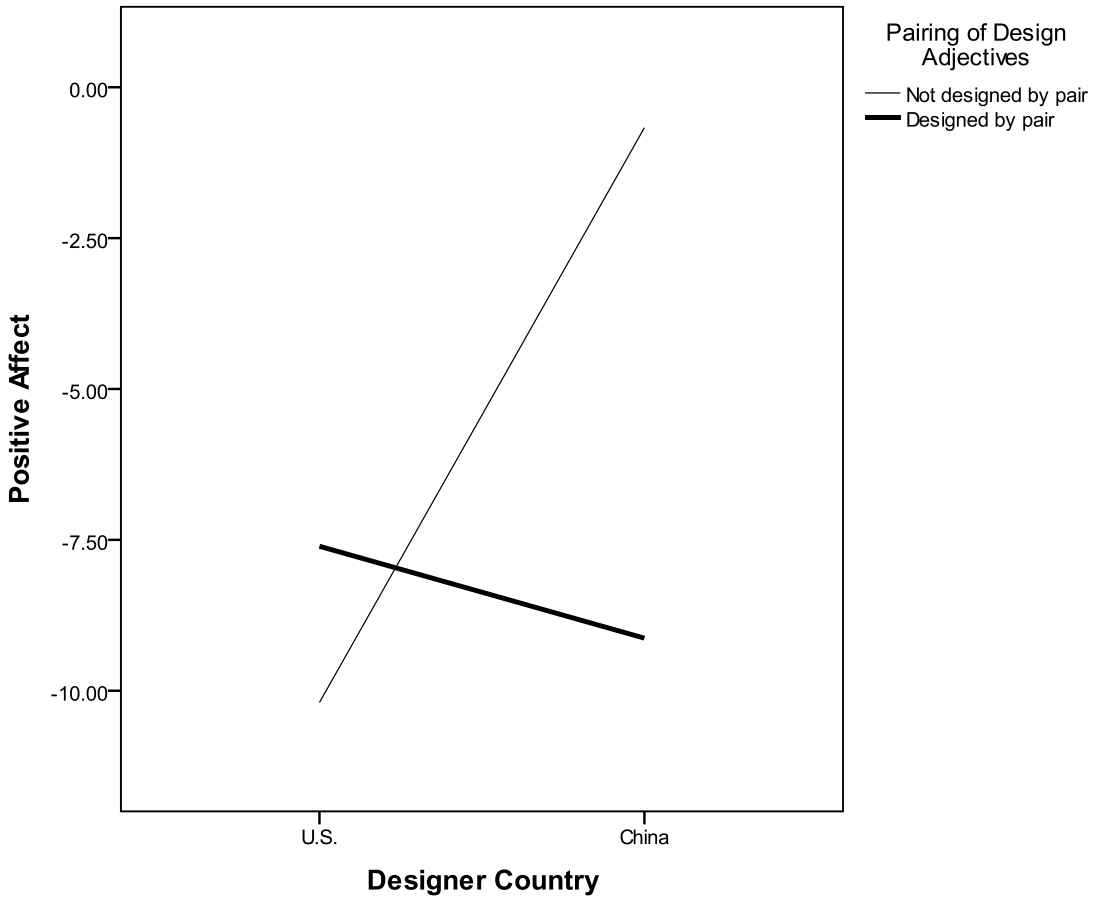

Figure 4. Positive Affect. Designer Country Difference by Pairing of Design Adjectives.

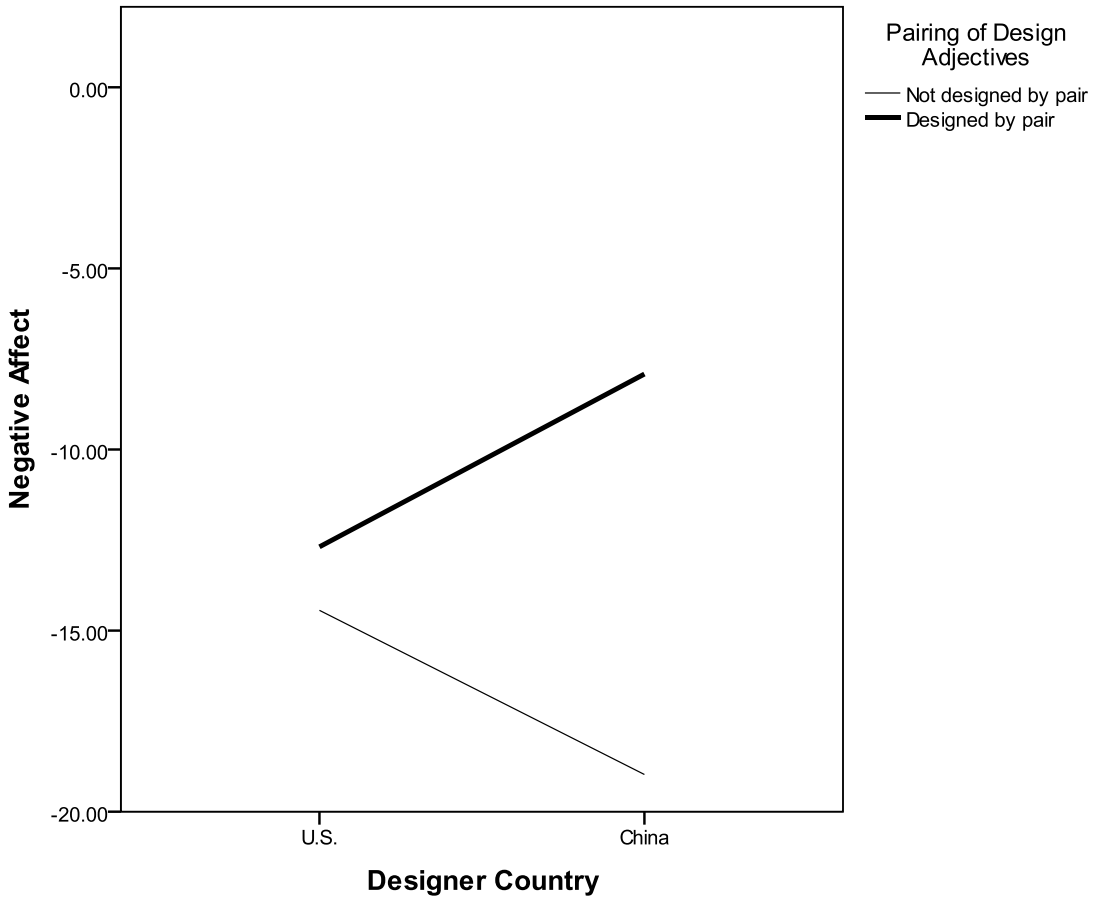

Figure 5. Negative Affect. Designer Country Difference by Pairing of Design Adjectives.

Attitude

A reliability analysis of the five attitude measures came out statistically significant for each country (U.S. Cronbach's α = . 893; China Cronbach's α = .932) as well as the combined data of both countries (Cronbach's α = 0.911). Therefore, the mean of five attitude measures was used as the DV in the analysis. A GLM was performed with IVs of designer country, viewer country, match between designer country and viewer country, pairing of design adjectives, and two way interactions between match and pairing as well as between designer country and pairing.

As shown in Table 2, four terms came out statistically significant. They were designer country, viewer country, paring of design adjectives, and the interaction between designer country and pairing of design adjectives. Designs by Chinese designers received more positive attitudinal responses than those by U.S. designers. Meanwhile, Chinese viewers tended to rate more positively than their U.S. counterparts. However, match between designer country and consumer country was not found statistically significant. This suggests that the attitude of viewers from both countries toward the designs were not influenced by the country of origin of the designers/designs. That is, Chinese and U.S. viewers responded similarly to Chinese and U.S. designs in terms of attitude. The only statistically significant interaction was the one between designer country and pairing of design adjectives ($p < .05$). Consistent with the results of affect, Chinese designers seemed to create better design when the adjectives were not paired than when paired. By contrast, whether or not the adjectives were paired did not make a difference to U.S. designers (see Figure 5).

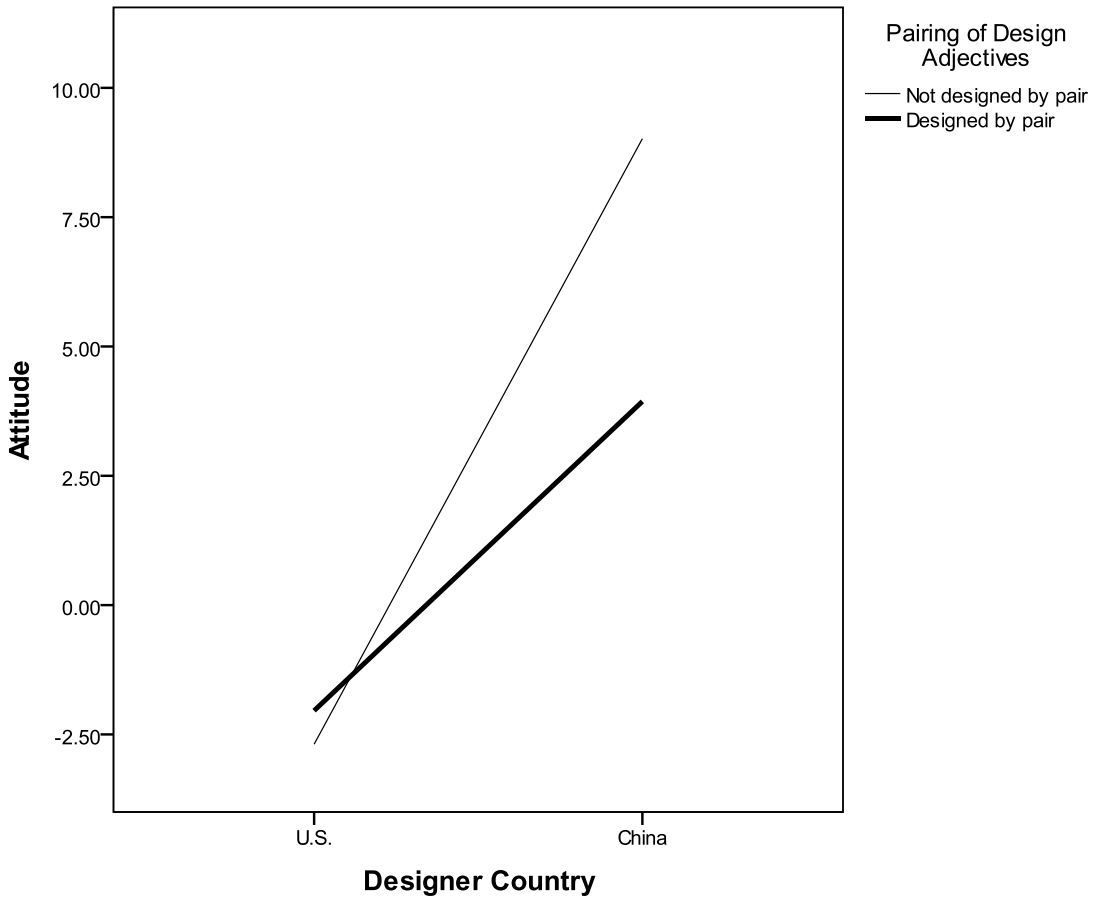

Figure 6. Attitude. Designer Country Difference by Pairing of Design Adjectives.

Meaning

In order to analyze the data, a new variable, "correct adjective" was created to record whether or not respondents got the correct design adjectives (i.e., the adjectives that designers were assigned to convey with their designs). If an adjective in a choice set of an image with the highest score was the correct adjective, the response was recorded as "correct". Otherwise, it was marked as "incorrect". After this new binary variable was created, a logistic regression was conducted with the binary variable "correct adjective" as the DV, and designer country, viewer country, match between designer country and viewer country, and pairing of design adjectives as the IVs. None of the IVs came out statistically significant (see Table 2). This means that there was no difference by country in terms of viewers' ability to recognize the intended meaning of design, regardless of whether the designer was Chinese or American.

Discussion

The findings of study 1 suggest a mixed understanding of universality of design. On the one hand, the match between designer country and viewer country was not statistically significant for all the three measures (affect, attitude, and meaning). This implies that viewers' design responses were not affected by the country of origin of the design/designers and provides some evidence of universality of design.

On the other hand, viewers from different countries sometimes responded to designs differently. For example, Chinese respondents were generally more positive than Americans in terms of attitude toward design although they tended to rate higher when a

design elicited negative affect. Also, Chinese designers' design received more positive attitudinal responses than those from American designers. These differences suggest that universality of design is complex and not all aspects of design may transfer across countries or cultures in the same way.

Being exploratory in nature, study 1 provides some initial insights into the universality of design and suggests that it is a complex phenomenon. Some aspects of design appear universal, while others (e.g., country differences in attitudinal responses) seem to show cultural differences. Nevertheless, these results may not be applicable to a greater extent because of the nature of the design task (i.e., abstract graphic design) and the sampling (college students who tend to be largely "globalized" and thus may not be representative of diverse consumers).

To better understand the culturally bound aspects, study 2 will further explore the universality of design in the context of product design with consumers participating in the survey. Study 2 will investigate how design expertise can be transferred cross-culturally.

One more interesting finding of study 1 is that Chinese designers did better when designing not by paired adjectives. But this was not the case for U.S. designers. Although this is not the main interest of this present research, it may suggest cultural influence on designers. In Chinese culture, or Confucianism, balance and harmony is very important. Chinese tend not to be polarized. Therefore, when being primed with polarized concepts (i.e., adjective pairs), Chinese designers might lose their natural focus on making good design and instead put more efforts on expressing or balancing the polarized concepts. Chinese designers executed more positive, and less negative, designs when they did not

feel constrained by having to balance adjective pairs, and can focus on the adjectives assigned. From practical point of view, this may suggest that it might be better to present design tasks in a less polarized manner to Chinese designers. But this would not be a problem for U.S. designers.

CHAPTER 5

STUDY 2

To test the hypotheses and further investigate the universality of design in a more practical context, study 2 involved product design. Designers were recruited from China and the U.S. to design products for consumers to respond to in a survey. Similar to Study 1 procedure, study 2 was also conducted in three phases.

Method

Phase 1. Design Task Development

The first phase of study 2 involved the development of design tasks for designers to create stimuli in the later phase. Two product categories, perfume bottles and desks, were selected because they are not culturally specific to either of the countries in this study. From the 16 pairs of adjectives in study 1, three pairs were selected, namely, old/young, modern/classic, and serious/playful. This generated eight combinations of adjectives and thus 16 design tasks (i.e., eight for perfume bottle design and eight for desk design). Twelve industrial designers from China and twelve industrial designers from the U.S., who worked in agencies and corporations, rated how hard/easy the 16 design tasks were on a 5-point scale (1 stands for "very easy" and 5 for "very hard"). The combination of modern/serious/younger was selected as the easy task and classic/playful/older was selected as the hard task ($Mean_{perfume\ bottle\ easy} = 2.14$, $Mean_{perfume}$

$_{\text{bottle hard}}$ = 3.29, $p < .001$; Mean $_{\text{desk easy}}$ = 2.00, Mean $_{\text{desk hard}}$ = 3.43, $p < .001$). A 2 x 2 x 2 fractional factorial experimental design generated two fractions of design tasks. The three factors were product category (a perfume bottle or a desk), difficulty of design tasks (hard or easy), and target market (China or the U.S.). Table 3 lists the design tasks which were assigned into two fractions (task group A and task group B).

Table 3. Design Task Groups

Task group A	Task group B
Easy perfume bottle for U.S. market	Easy perfume bottle for Chinese market
Hard perfume bottle for Chinese market	Hard perfume bottle for U.S. market
Easy desk for Chinese market	Easy desk for U.S. market
Hard desk for U.S. market	Hard desk for Chinese market

An example design task reads as follows:

> "Your client is a manufacturer of moderately priced perfumes and cosmetics. They are planning to launch two new perfume products:
> (1) One is targeted at the younger female mass market in the U.S. Your job is to design the bottle for this new perfume, which should look modern and serious.
> (2) The other one is targeted at the older female mass market in China. Your job is to design the bottle for this new perfume, which should look classic and playful.
>
> Please provide one design for each product. For both designs, please provide four views (front, top, side, and perspective) using any color as needed. Please use computer aid software for presentation of your designs. For the perspective view, please follow the style in the picture below in terms of the angle, the background, and the light"

In order to control possible confounds due to different presentation styles, a picture of an irrelevant product (a wood box) was provided in the design task instruction for designers to follow its presentation style.

Phase 2: Creation Of Design Stimuli

After the design tasks were developed. Eight industrial designers (designers for abbreviation in the remainder of the paper) from each country were recruited. This resulted in 16 designers in total. The designers were senior students of Industrial Design major from two equivalent universities in China and the U.S. The selection of designers was mainly based on their design expertise level. Three measures were used to decide the designers' expertise level.

GPA. GPA was used as one of the three measures of design expertise level. Chinese designers' average scores on 100-point scale were switched to be consistent with the U.S. 4-point GPA. High expertise designers (expert designers for abbreviation in the remainder of the paper) had an average of 3.54/4.00, and low expertise designers (non-expert designers for abbreviation in the remainder of the paper) had an average of 2.88/4.00. The difference is statistically significant ($p < 0.001$).

Real industrial design project experience. Designers were asked whether or not they had participated in any real industrial design projects, and if yes, how many domestic projects and international projects they had participated in. None of the designers had international design experience. Expert designers had participated in 1.63 real domestic design projects on average. This number for non-expert designers was .13. The difference is statistically significant ($p < 0.001$).

Industrial design competition participation. The third measure was design competition participation. Designers were asked whether or not they had participated in any domestic or international industrial design competitions, and if yes, how many of

each and how many awards they had received. Among the designers, only one Chinese designer participated in an international industrial design competition but had not received any award by the time of completing this design study. When it comes to domestic industrial design competitions, expert designers had participated in one competition and had received one award on average. These numbers for non-expert designers were .25 and 0 respectively. The differences are statistically significant for both dimensions ($p < 0.001$).

The selection process resulted in four expert designers and four non-expert designers from China and another four expert designers and four non-expert designers from the U.S. Next, each designer was assigned four design tasks from either task group A or B. This phase generated 64 product designs. Figure 7 presents six example design stimuli created by the designers in study 2.

After they finished the design tasks, the designers completed a self-evaluation survey. They were asked to predict consumer ratings of their designs at the target markets on a 5-point scale (1 stands for "poor" and 5 for "good"), to indicate how confident they were when completing each design task on a 7-point scale (1 stands for "not at all confident" and 7 for "very confident"), and to provide demographic information.

Figure 7. Study 2 Example Design Stimuli.

Phase 3: Consumer Ratings Of Design Stimuli

Phase 3 involved obtaining responses to the design stimuli. A fractional factorial experimental design generated eight fractions out of the 64 stimuli, with eight designs of each fraction. A Qualtrics online survey was designed and translated and back translated twice between English and Chinese. The survey included eight different versions based on the eight fractions generated by the fractional factorial experimental design. It was pretested twice among Chinese and U.S. consumers, with 16 Chinese and 16 Americans each time. In total, 295 (208 usable) U.S. consumers participated through Amazon Mechanical Turk and 304 (219 usable) Chinese consumers participated through a social network program in China. Each respondent was presented with one version of survey randomly selected from the eight versions. The survey included questions measuring affect, attitude, and meaning as well as demographic information at the end.

Affect. In order to assess consumers' affective responses to the design stimuli, four affect measures in previous research by Seva and Helander (2009) were used. They were "amazed", "contented", "cheerful", and "hopeful". Each respondent first saw an image of a design and was asked to indicate how looking at the product in the image made him/her feel on four slider scales, which were slightly adjusted based on the scales in the study by Seva and Helander (2009). The left end of the scales stood for "not feel at all", the mid-point for "somewhat feel", and the right end for "feel very much".

Attitude. Each respondent saw an image of a design and was asked to evaluate the product in the picture on five slider semantic scales anchored by measures including "like/dislike", "good/bad", "high/low quality", "distinctive/not distinctive", and "interesting/uninteresting", with a mid-point of "neither like nor dislike", "neither good nor bad", "neither high nor low quality", "neither distinctive nor not distinctive", and "neither interesting nor uninteresting" respectively.

Meaning. In order to measure how well designs convey the adjectives defined in the design tasks, two different conditions were applied: one was unprompted, the other was prompted. Under the unprompted condition, I applied the method in previous studies of logos (Henderson & Cote, 1998; van der Lans et al., 2010, etc.) and asked the respondents to provide any adjectives that come to mind when looking at the product.

Under the prompted condition, four bipolar semantic slider scales were applied. After seeing a product design picture, respondents were asked to indicate how well each pair of adjectives describes the product on four semantic scales anchored with "serious/playful", "modern/classic", "young/old", and "masculine/feminine".

Results

Design Expertise Transfer

In order to test the hypotheses about design expertise transfer with the measures of attitude and affect, a series of GLMs were conducted. The first GLM was focused on affect and attitude. Reliability analyses of the five attitude measures came out statistically significant for each country (U.S. Cronbach's $\alpha = 0.891$; China Cronbach's $\alpha = 0.943$) as well as the combined data of both countries (Cronbach's $\alpha = 0.917$). Reliability analyses of the four affect measures also showed statistical significance for each country (U.S. Cronbach's $\alpha = 0.942$; China Cronbach's $\alpha = 0.964$) as well as the combined data of both countries (Cronbach's $\alpha = 0.953$). Therefore, the mean of five attitude measures and the mean of four affect measures were used as two DVs in the first GLM. The IVs in this model included designer country, design expertise level, match between designer country and design target country (target country for abbreviation the remainder of the paper), match between consumer country and target country, and two-way and three-way interactions.

The second GLM was focused on the meaning measure under the prompted condition. Since the combination of design adjectives for hard design tasks was old, classic, and playful and the combination of design adjectives for easy tasks was young, modern, and serious, two new variables were created by averaging the responses to each adjective in each combination at the individual level. The two variables were the DVs in the model. Also, an ANOVA was tested on the mean responses to design adjectives between the easy task and the hard task.

Under the unprompted condition, respondents were asked to write down any adjectives coming to mind when they were looking at products in the survey. To analyze the qualitative data of unprompted adjectives, the first step was to code the qualitative data into quantitative data. Two U.S. college students and two Chinese college students performed the coding. The coding was conducted at individual respondent level. The coding mechanism was recording the counts of adjectives which were same (or close), opposite, or irrelevant to the adjectives supposed to be conveyed in each design as defined by design tasks. This coding process resulted in three numbers in total, with one for correct adjectives, one for opposite adjectives, and one for irrelevant adjectives. Next, I averaged the numbers of the two interpreters from each country for correct adjectives, opposite adjectives, and irrelevant adjectives respectively. The third step was creating a new variable called "correct rate" which equals to the number of correct adjectives divided by the sum of the numbers of correct, opposite, and irrelevant adjectives. Finally, a GLM was conducted with the new variable "correct rate" as the DV, and designer country, expertise level, and match between designer country and target country as the IVs.

The results are listed in Table 4.

Affect

The results did not show a statistically significant effect of match between designer country and target country. Therefore, H1 is supported. Likewise, the interaction between expertise level and match between designer country and target country was not

statistically significant. Thus H2 is also supported. Consumers' affective responses to design were not affected by the country of origin of designers/design. This did not differ between expert designers and non-expert designers.

The test found a statistically significant main effect of expertise level ($p < .001$). This implies that generally expert designers were better than non-expert designers in producing design which elicited more positive affective responses.

Besides the factors of interest in the hypotheses, the interaction between designer-consumer match and expertise level was found statistically significant ($p < .05$). For expert designers, the affective responses were slightly more positive when there was a match between designer country and consumer country. However, this relationship reversed in the case of non-expert designers (see Figure 8).

Designer country differences were found in interaction with expertise level and consumer-target match ($p < .01$). As shown in the Figure 9, the higher the expertise level, the more positive the affective responses, regardless of the country of origin of designers/design. This is consistent with the finding of the main effect of expertise level. Meanwhile, the increase in affective responses associated with design expertise level was greater when there was a mismatch between consumer country and target country. This difference was much greater for Chinese designed products than for American designed products.

Overall, Chinese consumers tended to have more positive affect for all designs ($p < .001$).

Table 4. GLM for Affect, Attitude and Meaning

			Correct meaning		
			Unprompted	Prompted	
Variable	Affect	Attitude		Hard	Easy
Intercept	11.889***	17.058***	.328***	2.570	7.852***
Designer-target match[a]	-1.706	-2.529	-.057**	-11.854***	.035
Designer-target match x Expertise	2.093	4.742**	.149***	16.229***	-5.494*
Designer country[b]	-4.737*	-3.915*	-.052*	-1.312	3.277
Consumer country[b]	-8.671***	3.778***	.075***	-2.525	.131
Expertise[c]	-11.175***	-10.105***	-.219***	-3.594	-1.310
Consumer-target match[a]	-.670	.133	-.044*	2.020	-.919
Designer-consumer match[a]	-1.732	-1.432	-.056***	1.075	-1.120
Consumer-target match x Expertise	-.654	-1.096	.059*	-7.148**	2.497
Designer-consumer match x Expertise	4.731*	2.924	.062*	-.935	4.171
Designer country x Designer-target match x Expertise	-1.755	-3.696	-.126***	-6.265*	-.512
Designer country x Consumer-target match x Expertise	10.302**	6.811*	.085*	2.599	-1.679
Designer country x Designer-consumer match x Expertise	-4.051	-.582	-.021	.064	-5.807

* $p < .05$
** $p < .01$
*** $p < .001$
a. Reference group is match.
b. Reference country is China.
c. Reference group is expert.

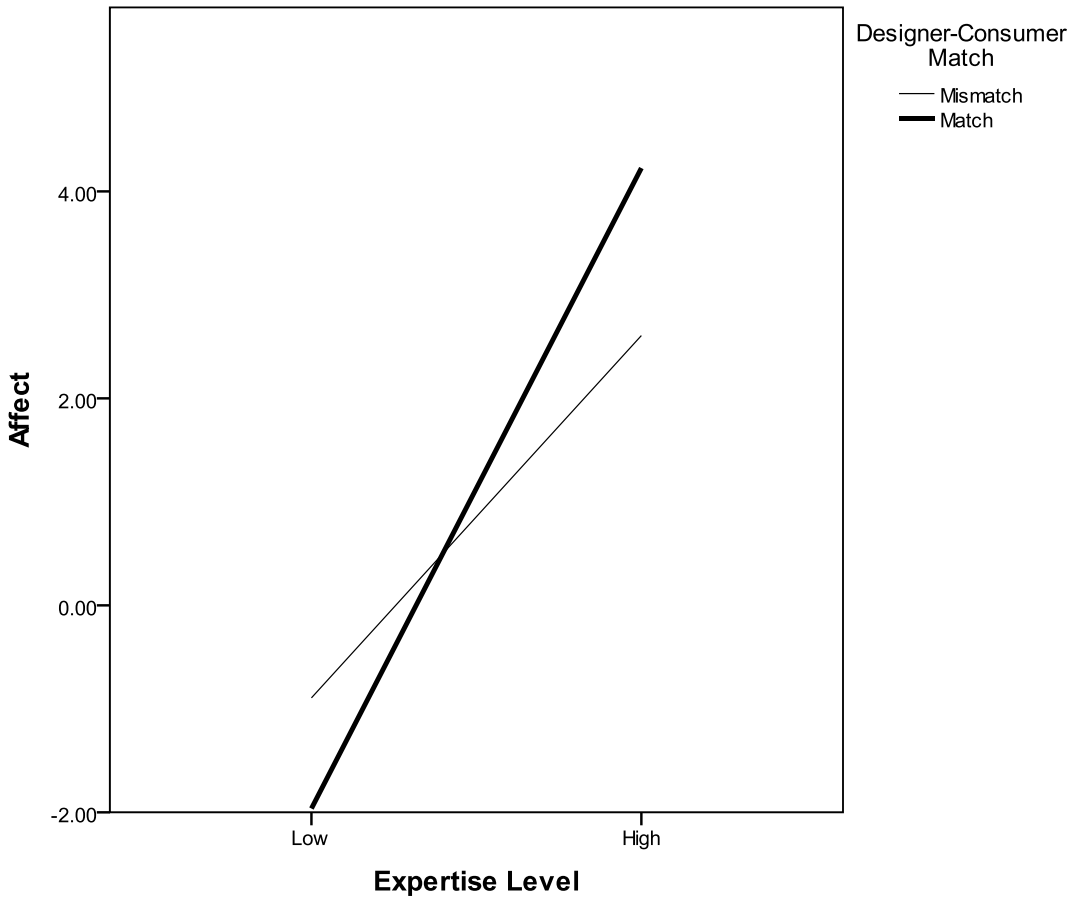

Figure 8. Affect. Interaction between Expertise Level and Designer-Consumer Match.

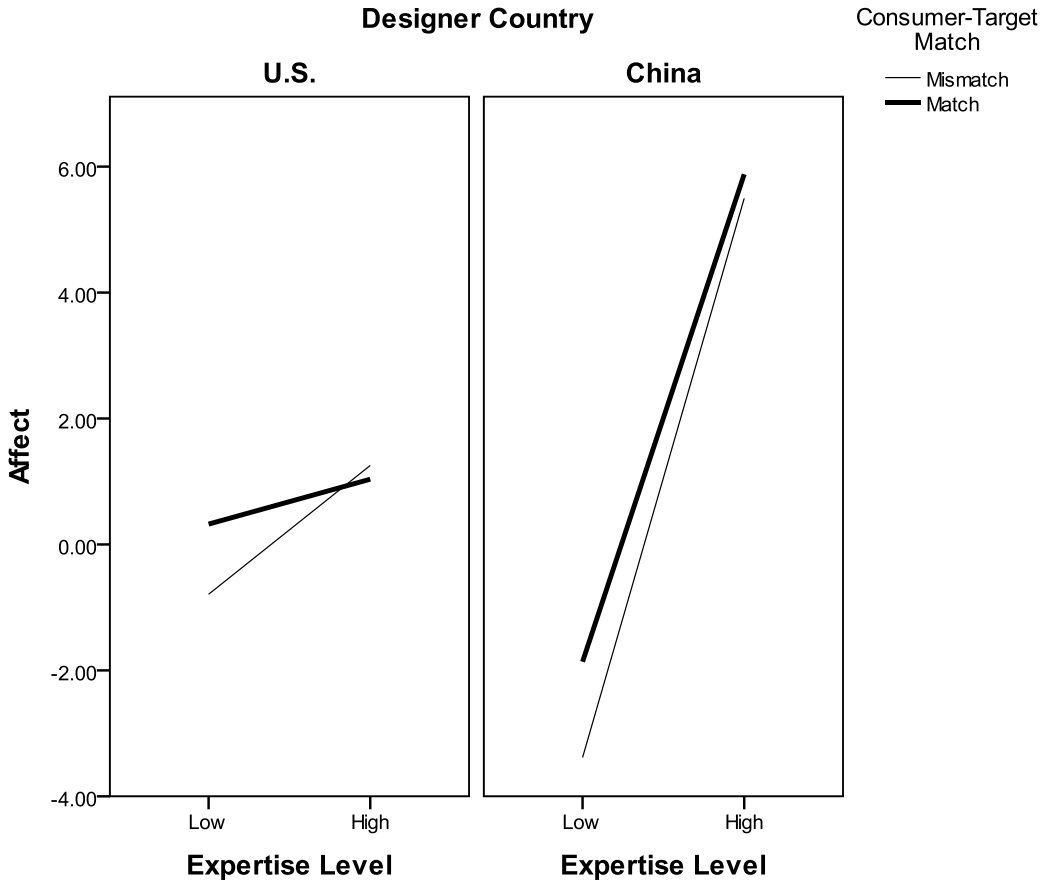

Figure 9. Affect. Designer Country Difference in Interaction with Expertise Level and Consumer-Target Match.

Attitude

Results show that there was a lack of statistically significant effect of match between designer country and target country. Therefore, H3 is not supported. However, the main effect of expertise level ($p < .001$) and the interaction between expert level and match between designer country and target country came out to be statistically significant ($p < .01$). This suggests more positive attitude toward expert designers' designs and the effect was stronger if there was a match between designer country and target country. That is, the increase in positive attitude for expert designers was greater if the design was targeted at the home market. Therefore, H4 is supported.

The analysis found a statistically significant three-way interaction between designer country, expertise level, and match between consumer country and target country ($p < .05$). As shown in Figure 10, the higher the expertise level, the more positive the attitude of consumers, regardless of which country the design was targeted. This is consistent with the finding of the main effect of expertise level. The increase in attitude associated with design expertise level was greater for Chinese designers than for U.S. designers.

Finally, U.S. consumers showed more positive attitude overall than Chinese consumers. This is a surprising finding because study 1 results anticipated more positive attitude among Chinese viewers than U.S. viewers. However the challenge was different as consumers were responding to abstract graphic designs in study 1 rather than products.

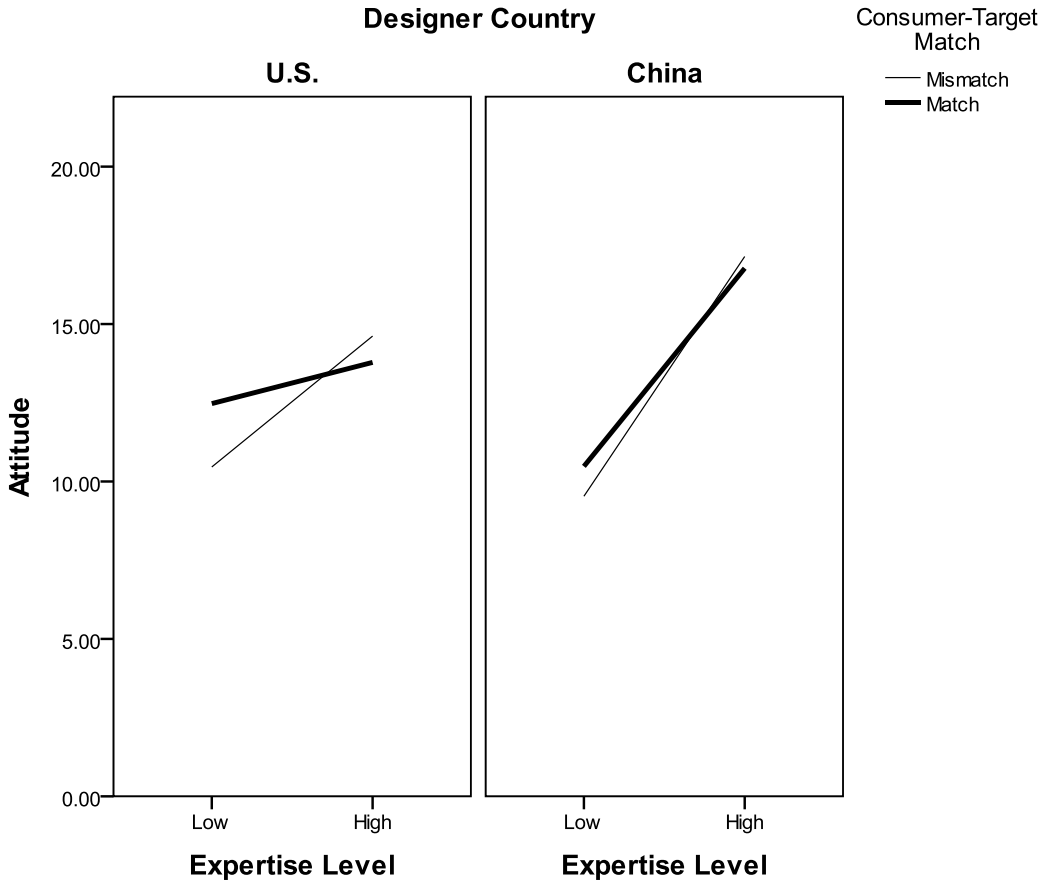

Figure 10. Attitude. Designer Country Difference in Interaction with Expertise Level and Consumer-Target Match.

Meaning

Prompted condition. Under the prompted condition, the results of ANOVA of the mean responses to design adjectives for the hard task and the easy task showed that consumers agreed that the adjectives of the easy task (i.e., “young”, “modern”, “serious”) described the designs much better than those of the hard task (i.e., “old”, “classic”, and “playful”) ($Mean_{easy} = 6.90$, $Mean_{hard} = -3.99$, $p < .001$). GLM found a statistically significant effect of match between designer country and target country in the case of hard task but not in the case of easy task. Thus H5 is partially supported under the prompted condition.

For both the easy task and the hard task, there was a statistically significant effect of the interaction between expertise level and designer-target match (easy task $p < .05$; hard task $p < .001$). This is consistent with the prediction of H6. Therefore, H6 is supported under the prompted condition. For easy task, expert designers did much better than non-expert designers when there was no match between designer country and target country. However, when there was such a match, there was no difference between expert designers and non-expert designers. For hard task, non-expert designers were relatively stable whether there was match or mismatch between designer country and target country. By contrast, expert designers did much better under match than mismatch.

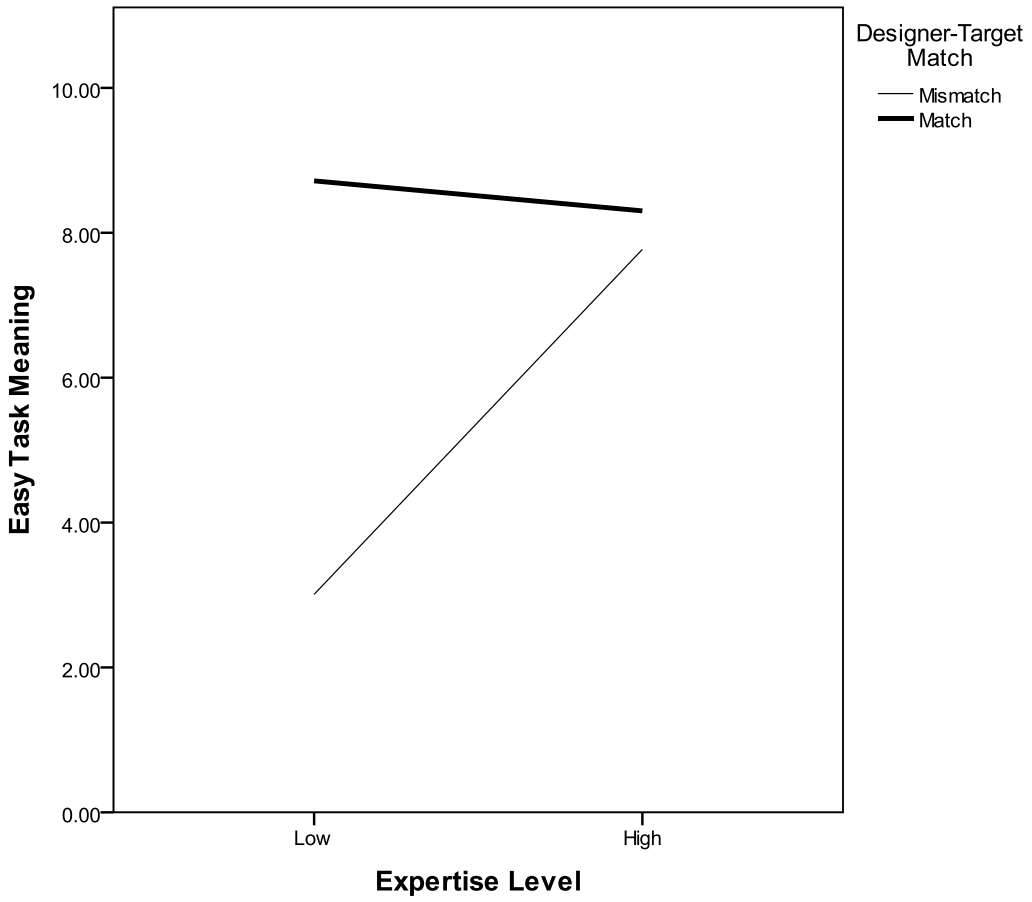

Figure 11. Prompted Meaning. Interaction between Expertise Level and Designer-Target Match in the Case of Easy Task.

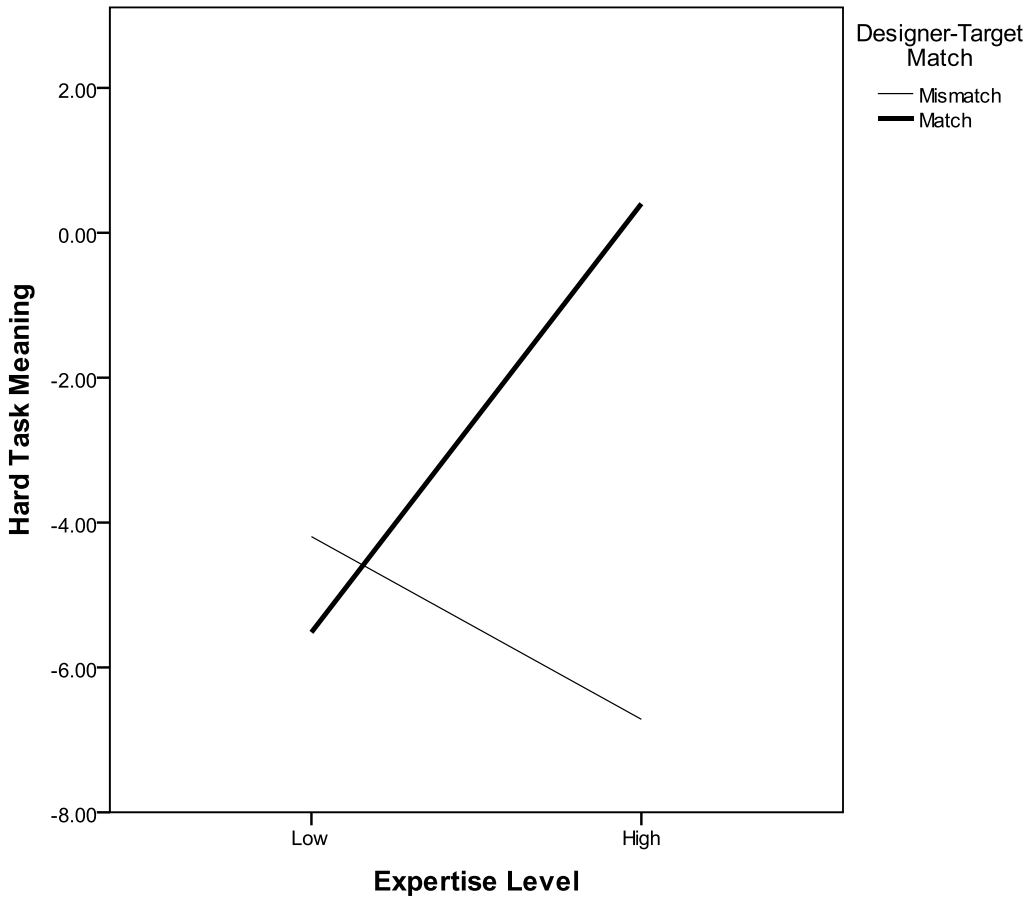

Figure 12. Prompted Meaning. Interaction between Expertise Level and Designer-Target Match in the Case of Hard Task.

Unprompted condition. Under the unprompted condition, GLM found it was statistically significant of the main term of designer-target match ($p < .01$) and the interaction term of expertise level and designer-target match ($p < .001$). Thus, both H5 and H6 are supported under this condition. Designers conveyed intended meaning better when designing for the home market than for a foreign market. Meanwhile, expert designers always did a better job conveying intended meaning than non-expert designers did. This difference was greater when there was match between designer country and target country than when there was no such a match (see Figure 13).

The analysis also uncovered a statistically significant main effect of consumer-target match and designer-consumer match. Consumers interpreted intended meaning of design for their home country slightly, yet significantly better than those for a foreign country ($p < .05$). Meanwhile, they seemed to be able to decode intended meaning of design by home country designers much better than those by foreign country designers ($p < .001$).

Expertise level was found to slightly, yet significantly, interact with the abovementioned two terms, i.e., consumer-target match ($p < .05$) and designer-consumer match ($p < .05$). Expert designers consistently did better than non-expert designers. The difference was greater when consumer-target match and designer-consumer match existed (see Figure 14 and Figure 15).

Country differences were also found in the analysis ($p < .001$). Expert designers from both countries consistently did better conveying intended meaning than non-expert designers. However, the difference between match and mismatch of consumer country

and target country was greater for Chinese designers than for U.S. designers (see Figure 16).

Taking in to account the prompted and the unprompted conditions jointly, H5 is only partial supported while H6 is fully supported.

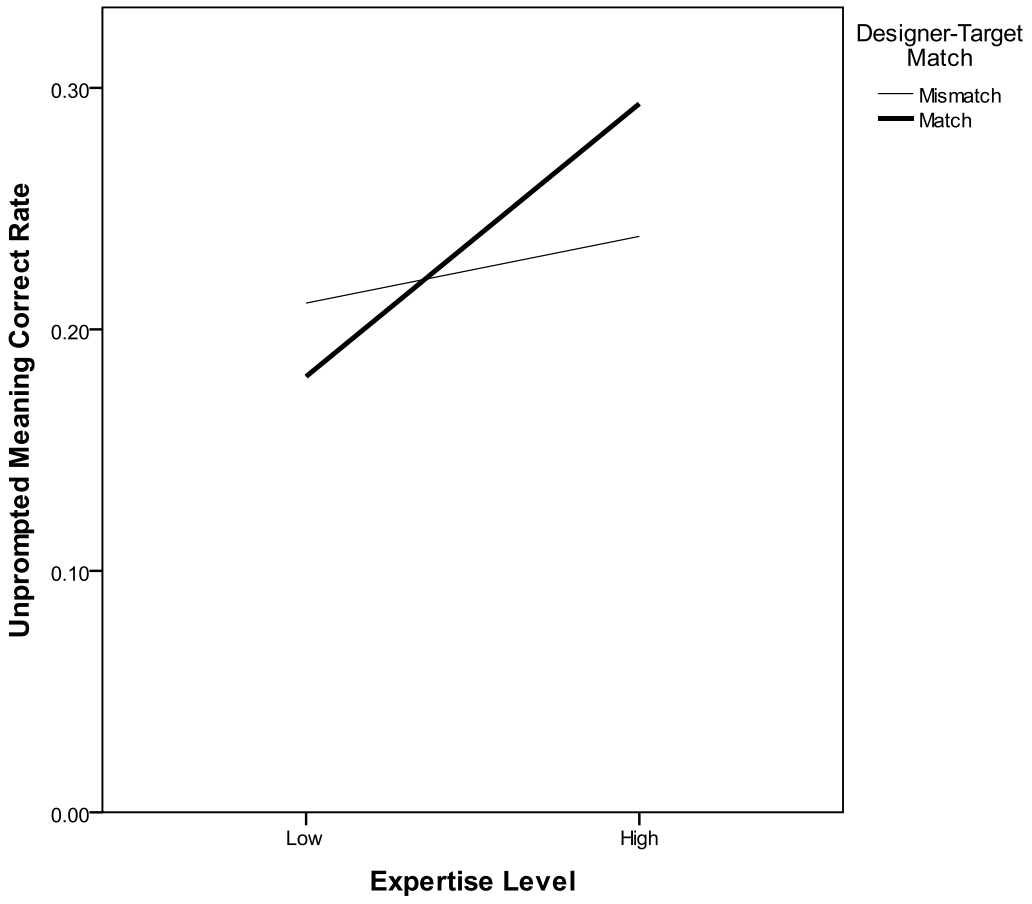

Figure 13. Unprompted Meaning. Interaction between Expertise Level and Designer-Target Match.

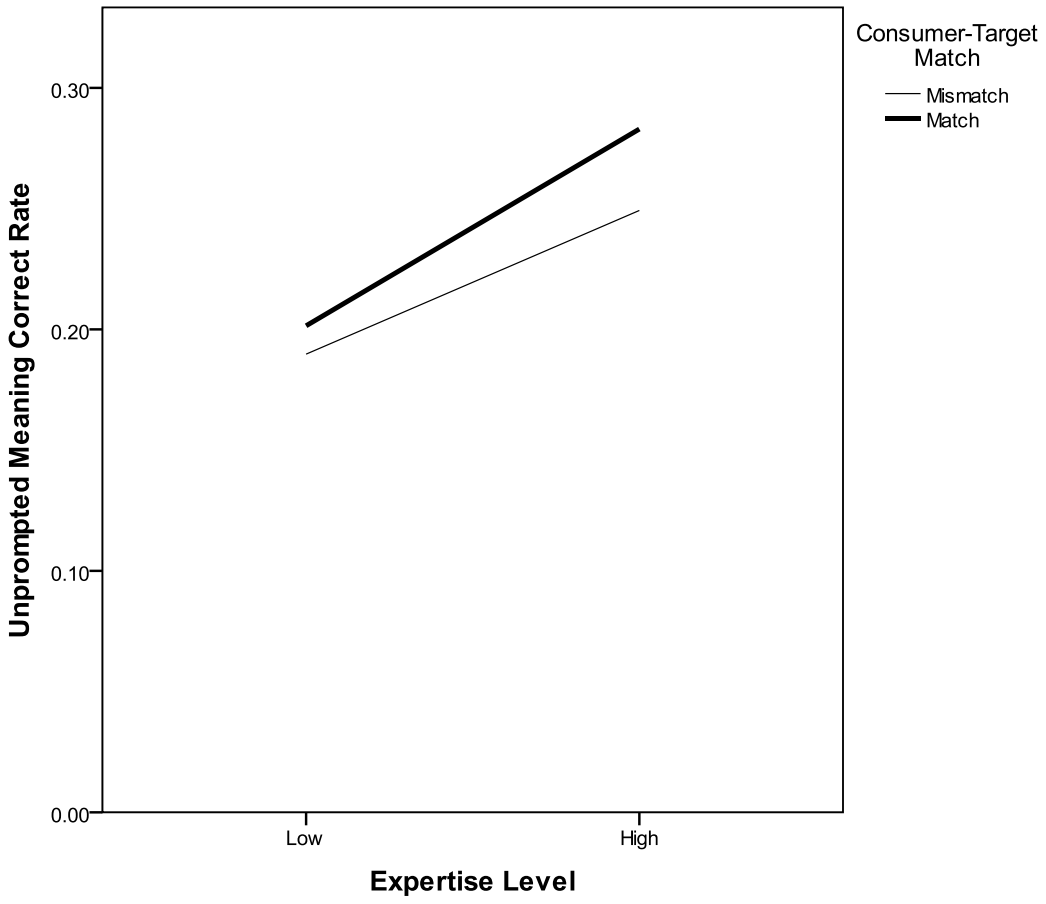

Figure 14. Unprompted Meaning. Interaction between Expertise Level and Consumer-Target Match.

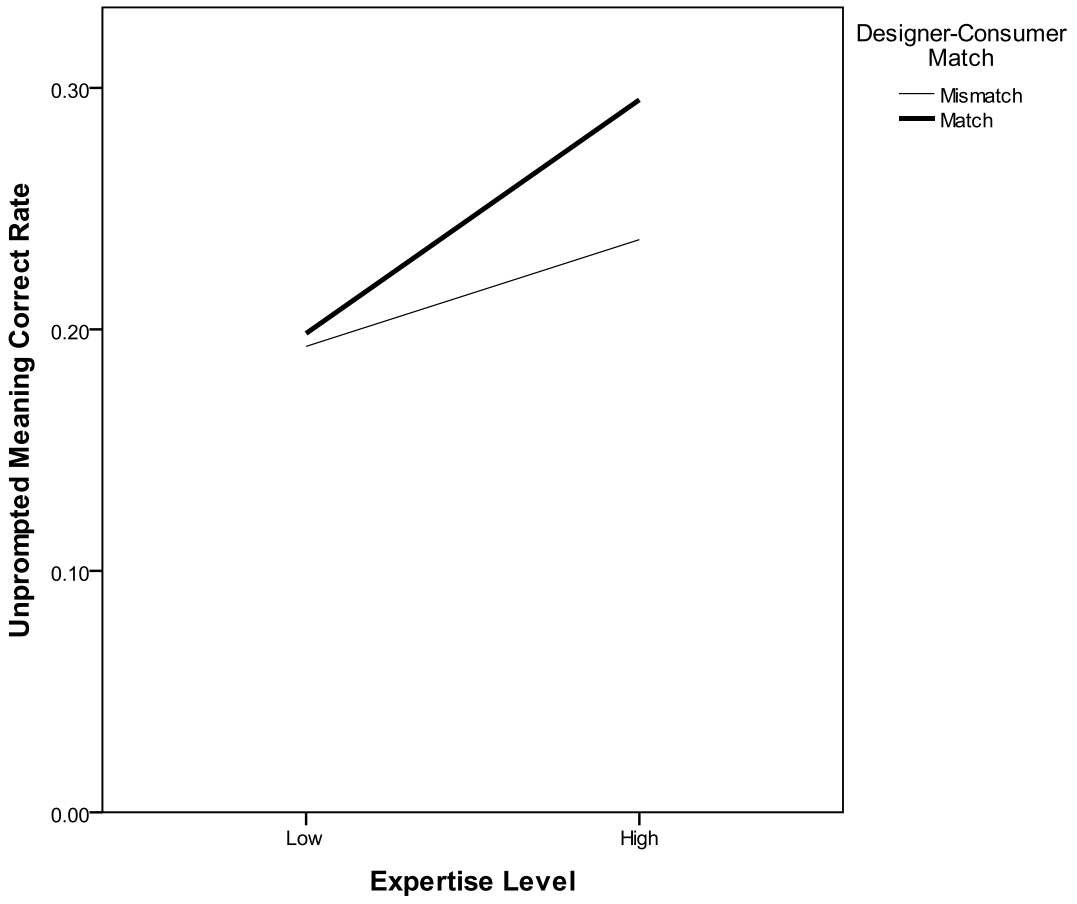

Figure 15. Unprompted Meaning. Interaction between Expertise Level and Designer-Consumer Match.

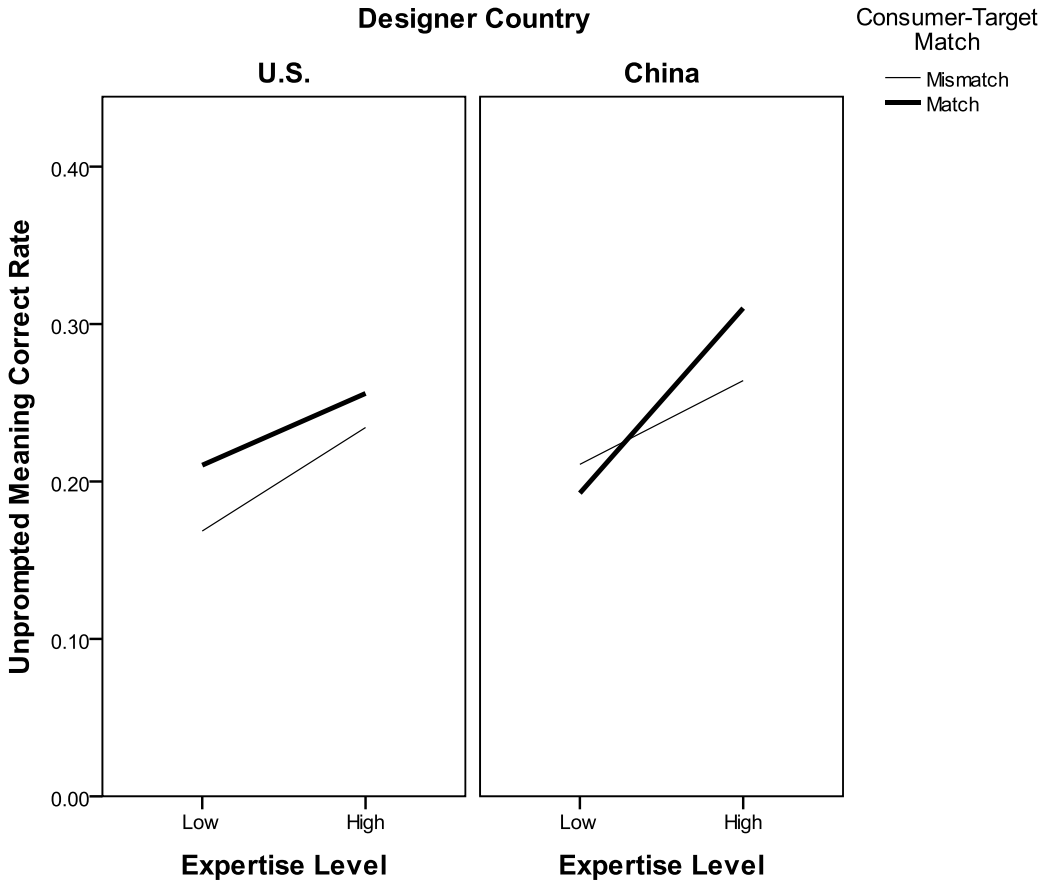

Figure 16. Unprompted Meaning. Designer Country Difference in Interaction with Expertise Level and Consumer-Target Match.

Design Calibration

Design Confidence

A GLM was tested with the DV of self-reported confidence by designers. The IVs included designer country, designer-target match, expertise, and interaction terms between the three factors. As shown in Table 5, the match between designer country and target country was found to be statistically significant ($p < .001$). Designers were more confident when designing for their home market. Therefore, H7 is supported. Results also uncovered a statistically significant main effect of expertise level ($p < .001$) and the interaction between expertise level and designer-target match ($p < .001$). As shown in Figure 17, expert designers were more confident when there was designer-target match than there was no such match. However, this was reversed for non-expert designers—non-expert designers were more confident designing for a foreign market than for the home market although they were generally less confident than expert designers in both situations. Also, while expert designers were much more confident than non-expert designers when designing for their home market, their confidence was at a similar level as non-expert designers' when designing for a foreign market. Therefore, both H8 and H9 are supported.

The analysis also uncovered statistically significant two-way interaction between designer country and designer-target match ($p < .001$) and three-way interaction between designer country, expertise level, and designer-target match ($p < .001$). U.S. designers were generally more confident than Chinese designers. This is consistent with the main effect of designer country on design confidence ($p < .001$). Expert designers from both

countries were more confident when designing for their home market than for a foreign market. However, this confidence difference was greater in the U.S. than in China. By contrast, non-expert designers from both countries were more confident when designing for a foreign market than for their home market. The difference was greater in China than in the U.S.

Design Prediction Accuracy

In order to test the hypotheses about design prediction accuracy, a GLM was conducted with prediction accuracy as the DV and designer country, expertise, designer-target match, consumer-target match, designer-consumer match, and interaction terms between them as IVs (see Table 5). The prediction accuracy was the sign-reversed absolute value of the difference between designers' prediction of consumer ratings and consumer real attitudinal ratings. The higher the value, the better the accuracy.

The analysis found a statistically significant effect of match between designer country and target country ($p < .05$). Therefore, H10 is not supported. This suggests that contextual knowledge about culture is important for designers to predict consumers' responses to their design.

Meanwhile, as hypothesized in H11, the interaction term of expertise level and designer-target match was not statistically significant. Also, the main effect of expertise level was not statistically significant, suggesting no difference between expert designers and non-expert designers in prediction accuracy. Therefore, H11 is supported.

However, the results revealed a statistically significant designer country difference ($p < .001$). Chinese designers were more accurate than U.S. designers in predicting consumers' evaluation of their design for their home country. However, when predicting for design targeted at a foreign market, there was no difference between Chinese designers and U.S. designers.

Table 5. GLM for Confidence and Prediction Accuracy

Variable	Confidence	Prediction Accuracy
Intercept	5.609**	-1.194**
Designer-target match[a]	-.370**	-.126*
Designer-target match x Expertise	.874**	.019
Designer country[b]	1.007**	-.185*
Expertise[c]	-1.377**	.067
Designer-consumer match[a]	-	.029
Consumer-target match[a]	-	.013
Designer-consumer match x Expertise	-	.134
Consumer-target match x Expertise	-	-.032
Designer country x Designer-target match	-.845 **	.289**
Designer country x Designer-consumer match	-	-.154
Designer country x Consumer-target match	-	-.052
Designer country x Designer-target match x Expertise	.593**	.030
Designer country x Designer-consumer match x Expertise	-	-.099
Designer country x Consumer-target match x Expertise	-	-.029

* $p < .05$
** $p < .001$
a. Reference group is match.
b. Reference country is China.
c. Reference group is expert.

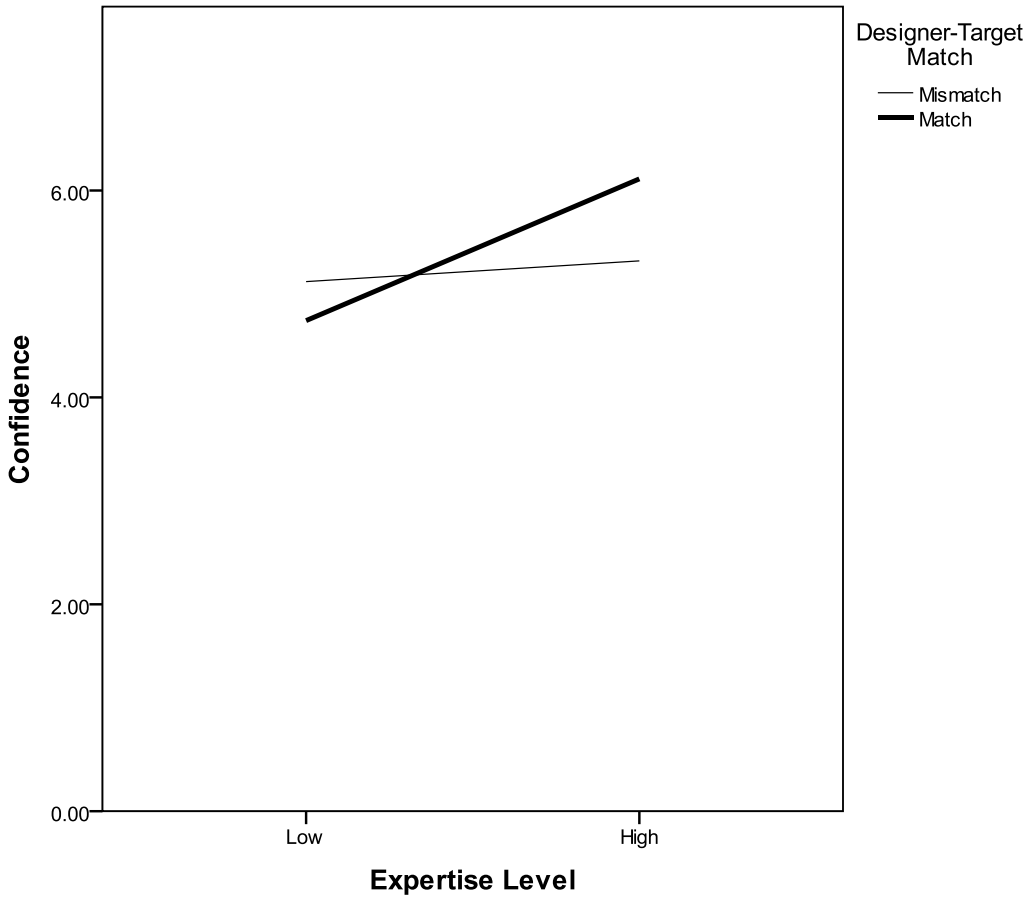

Figure 17. Confidence. Interaction between Expertise Level and Designer-Target Match.

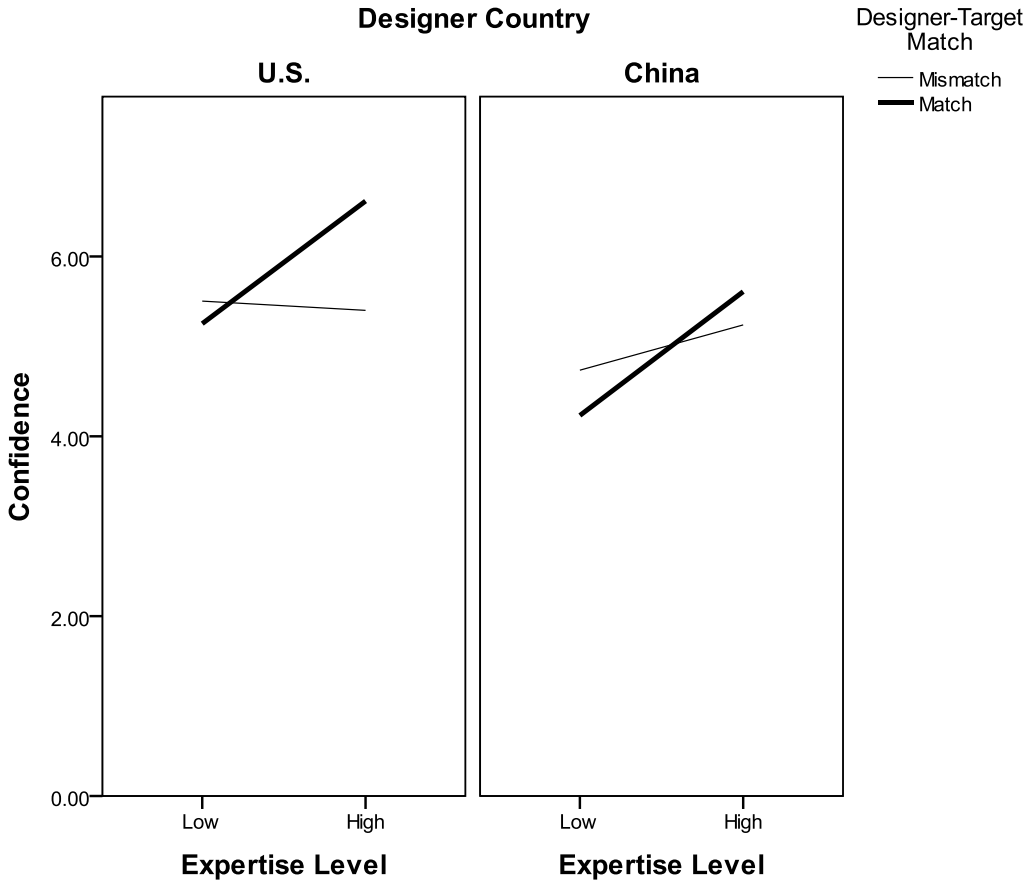

Figure 18. Confidence. Designer Country Difference in Interaction with Expertise Level and Designer-Target Match.

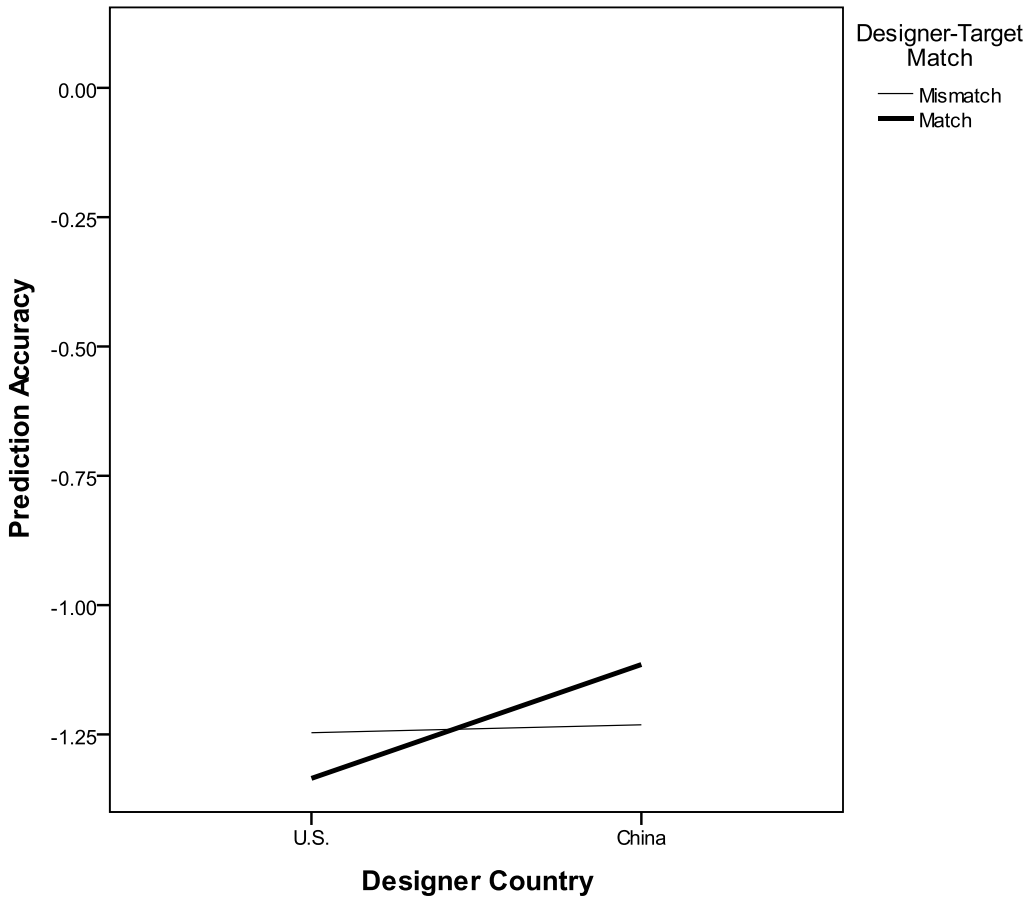

Figure 19. Prediction Accuracy. Designer Country Difference in Interaction with Designer-Target Match.

Discussion

Design Expertise Transfer

Affect

The results from study 2 suggest that designer country background does not influence consumers' affective responses to design. However, design expertise level is crucial. Compared with non-expert designers, expert designers tend to create designs which elicit more positive affect and this is not moderated by designers' contextual knowledge about culture. In other words, there is no difference in consumers' affective responses to design due to different cultural background. Both Chinese and Americans recognize designs which elicit more positive affect. This to some extent may imply the existence of universality of design on the affect level. It seems design expertise may be easily transferred between cultures, at least between China and the U.S., without decrease due to a lack of contextual knowledge of cultures.

While no main designer-consumer match effect is found, the results do uncover a statistically significant interaction between designer-consumer match and expertise level. Although generally expert designers are better at eliciting more positive affect among consumers than non-expert designers, the difference is slightly greater when the raters are consumers from the same country as the designers', rather than those from a foreign country.

The results also uncover designer country differences in the increase in affect due to design expertise. The difference between expert and non-expert designers is significantly greater for Chinese designed products. The results show that Chinese expert

designers design products with more positive affect responses than U.S. expert designers. However, U.S. non-expert designers' products receive more positive affect responses than Chinese non-expert designers' products.

Attitude

While differences in attitudinal responses due to cultural background are expected based on the reasoning suggested by the extant literature, the results indicate that cultural background alone does not make a difference on consumers' attitude toward design. It seems consumers from China and the U.S. are similar in their attitudinal responses of design—they always like designs created by expert designers better. This may also suggests the existence of universal visual design on the attitude level. Because the design tasks were selected to avoid innate cultural "mark", it may be speculated that globalization has resulted in a shared taste of products, at least for products which are not culturally specific.

Meanwhile, the significant interaction between designer-target match and expertise may imply that design expertise transfer at this level is harder than the affect level in the sense that, although expert designers generally do better than non-expert designers, the difference between them is smaller when designing for a foreign market than for the home market.

Based on the results, this study may suggest that: (1) consistent with later findings about design confidence (i.e., expert designers are more confident than non-expert designers), designers create better designs when they are confident; (2) consumers

recognize good designs regardless of designers' country of origin; (3) designers appear to do better when designing for their home market. Therefore, this may imply that, when giving out design tasks, rather than having designers guess about culture differences, it would be better to just ask them to do best design they can. Best designs always win.

Meaning

With regard to conveying intended meaning of design, the results are relatively more complicated. The results reveal that culture match between designers and target market matters for the unprompted condition and for the hard task under the prompted condition, but there is no difference between non-expert designers and expert designers when the design task is easy. This may suggest that conveying intended meaning of design is more difficult than creating design which will elicit more positive affective responses and more positive attitude among consumers.

Design codability relies on shared knowledge in a culture. For a same design, different cultures may have different understandings in terms of the meaning the design conveys. Using red color as an example, it carries a largely positive connotation, being associated with courage, loyalty, honor, success, fortune, fertility, happiness, and passion (Cullen, 2000). Because red is seen as a lucky color, many international companies draped their brands in red during the Beijing 2008 Olympics, including Pepsi, which changed its iconic blue can into a red can for this occasion (Kotabe & Helsen, 2010; Schmitt, 1995). In some parts of Africa, however, red is a color of mourning, representing death (Bradley, 2001). Because red is associated with death in many parts of

Africa, the Red Cross has changed its colors to green and white in parts of the continent (Austin & Pinkleton, 2006).

Given that design codability is tightly connected with culture, it is possible that although a consumer feels happy about a product design and likes it, he may not be able to interpret what the designer intends to convey with the design without knowing the culture within which the designer resides. Therefore, design seems less universal at this level.

This speculation may be further strengthened with the fact that design expertise tends to be diminished when cultural boundary changes—while expert designers can better convey intended meaning than non-expert designers in their home country, this difference is smaller when they design for a foreign market. In other words, design expertise transfer across cultures at the meaning level is difficult.

Design Calibration

Design Confidence

The results from study 2 suggest that designers from both countries are more confident to design for their home market. Meanwhile, expert designers are more confident than non-expert designers regardless of the target market although the difference is greater when designing for their home market than for a foreign market.

Interestingly, while expert designers are less confident at designing for a foreign market, non-expert designers show higher confidence when designing for a foreign market than for the home market. It is speculated that non-experts may underestimate

how difficult it is to design for a foreign market with substantial cultural differences, aesthetic preferences, and so on. These are errors that experts are less likely to make. With more experience, designers gain a greater understanding of these differences and are better able to adjust for them.

Consistent with findings about cultural difference of confidence in the literature of psychology (Mann et al., 1998), U.S. designers are found to be generally more confident than Chinese designers. Compared with their Chinese counterparts, U.S. expert designers are much more confident when designing for their home market than for a foreign market.

Prediction Accuracy

In terms of design prediction accuracy, both expert designers and non-expert designers are poor at predicting consumers' ratings of their designs. There is no difference between expert designers and non-expert designers, whether the target market is in their home country or a foreign country. However, given a certain expertise level, designers tend to predict more accurately for design targeted at their home market than those at a foreign market. This may suggest that culture as a context of design is important. It may be speculated that designers better understand their home country culture and thus preferences, beliefs, etc. shaped by the culture as suggested by McCracken (1986), or it may be because they learn from previous design experience and understand local consumers better. This is consistent with what Lawson and Doris (2009) point out about the importance of contextual and experiential knowledge in design.

Designer country also matters in terms of prediction accuracy: Chinese designers' prediction of consumers' ratings is more accurate than U.S. designers' for design targeted at their home market; and there is no such a difference when they estimate consumers' ratings of design for a foreign market.

Design Calibration

According to previous studies on knowledge calibration (e.g., Alba & Hutchinson 2000; Hutchinson & Eisenstein, 2008; Wright, 2002), people are well calibrated if they are high in confidence when their knowledge is accurate and low in confidence when it is inaccurate.

The results of design confidence and prediction accuracy in study 2 indicate that both expert designers and non-expert designers are poorly calibrated. Expert designers are generally more confident than non-expert designers. The difference is significantly greater when designing for their home market than for a foreign market. When it comes to prediction accuracy, both expert and non-expert designers are inaccurate regardless of whether they design for their home market or for a foreign market. This may suggest that, contrary to common speculation, expert designers are better calibrated when designing for a foreign market than for their home market.

With regard to specific country differences, compared with U.S. designers, Chinese designers are relatively better calibrated, and this is especially true when they are designing for their home market.

CHAPTER 6

GENERAL DISCUSSION

Theoretical Implications

The present research broadens the extant literature of aesthetics, design, and expertise by (1) exploring the universality and cross-cultural differences of design responses; (2) investigating the transfer of design expertise across cultures; and (3) examining design knowledge calibration across cultures.

Universality Of Design

Specifically, this research provides insights into the universality of aesthetic design. The extant literature on aesthetics/design focuses on universal design principles and properties in terms of perception of design (e.g., Berlyne, 1971; van Damme, 2000). The present study explores universality of aesthetic design from multi-aspects including affect, attitude, and meaning. Rather than claiming aesthetic design is universal or not universal, the results suggest that universality of design is a complex, multi-faceted phenomenon—there are at least three levels of design universality. First, affect seems to be the lowest level and is the most universal. Consumers from both countries in the study share similar affective responses to design regardless of the country of origin of the designers/design. Second, while attitude involves more cultural influence, the results of cross-cultural difference indicate that universality of design may also exist at this level, at least for products which are not culturally marked. It may be speculated that globalization may have led to a globalized/universal aesthetic preference in some product categories.

Finally, meaning codability of design seems to be the most difficult to be transferred cross-culturally. In other words, design at this level is the least universal among the three aspects.

Design Expertise

Expertise Transfer

This research fills the void of research on design expertise regarding expertise transfer and knowledge calibration. The results suggest the existence of design expertise in that expert designers generally do better than non-expert designers. Cultural boundaries may or may not moderate this expertise. To elicit positive affect, designers can transfer their expertise to another culture without decrease. Although culture alone does not have an effect on consumers' attitude toward design made by designers of different cultural backgrounds, expertise transfer across cultures may not as easy as in the case of affect. Expert designers' designs tend to receive less positive attitudinal responses in a foreign market than in their home market. When it comes to conveying intended meaning of design, it is the most difficult. Cultural background/knowledge of designers is associated with how well intended meaning can be conveyed. Generally designers can better express intended meaning of design when designing for their home market than for a foreign market in the premise of hard tasks. For easy tasks, culture alone does not account for the quality of design meaning convey. If taking expertise level into consideration, expert designers convey intended meaning much better in their home market than in a foreign market. In other words, cultural boundaries may diminish design expertise.

Design Knowledge Calibration

In terms of design knowledge calibration, the literature on knowledge calibration suggests that, except that experts in meteorology and bridge playing show better calibration, experts and novices in other domains are both poorly calibrated (e.g., Hutchinson & Eisenstein, 2008; Lichtenstein, Fischoff, & Phillips, 1992; Shanteau & Stewart, 1992). The results of the present research suggest that design domain is not different from most fields because both expert designers and non-expert designers are poorly calibrated and overconfident.

With regard to design calibration in different cultural contexts, the results imply that both expert and non-expert designers are more confident to design for their home market than for a foreign market. Expert designers are generally more confident than non-expert designers, but the difference is significantly greater when designing for their home market than for a foreign market. When it comes to prediction accuracy, both expert and non-expert designers are inaccurate regardless of the target market. The findings may suggest that, contrary to common speculations, expert designers are better calibrated when designing for a foreign market than for their home market.

Managerial Implications

Besides theoretical contributions, this research provides implications for managers and designers.

Generally expert designers create better designs than non-expert designers and expert designers do much better when designing for their home market than for a foreign market. The results suggest that good designs, executed by expert designers, always "win", regardless of their country of origin. Nevertheless, the present research also uncovers the evidence that there are many interactions complicating universality of

design and design expertise transfer. While design expertise to elicit positive affective response is not moderated by culture, it seems to be impacted by culture in attitudinal responses and intended meaning recognition. This suggests that, although expert designers can generally generate better design, it would be unwise to hire any expert designers to make any design for any markets. For companies which target a foreign market, it would be better to hire the best designers from that market, and this is especially true if the design task is to build brand impressions with design, i.e., to convey intended meaning through design.

The results find that expert designers are more confident when designing for their home market. However for non-experts, it finds the reverse. It appears that non-experts are overconfident in their abilities to design for a foreign market. We could speculate that non-expert designers may underestimate how difficult it is to design for a foreign market with substantial cultural differences, aesthetic preferences, and so on. These are errors that experts are less likely to make. With more experience, designers gain a greater understanding of these differences and are better able to adjust for them. Companies may consider providing non-expert designers with experiences that increase their sensitivity to cultural differences and to incorporate those differences into products they design for the global market.

Additionally, it is found that both expert designers and non-expert designers are poorly calibrated. This suggests it would be wise to include other functions in a product development team, such as marketing, in the design selection process. This also suggests that integration of various functions, such as marketing and design, is important. Managers should encourage cross-functional integration to improve product design success.

Limitations And Future Research

General Limitations And Future Research Directions

This research suggests that universality of design is a complex, multi-faceted phenomenon and can be explained at different levels including affect, attitude, and meaning. However, this study is an initial exploration from this perspective. This may suggest much opportunity for future research to better understand the culturally-bound aspects of design transfer. Conveying intended meaning seems the most difficult or the least universal. It would be interesting to explore the reasons behind this phenomenon in future research.

This research uncovers some cultural differences in design responses and the effect of culture on design expertise transfer. Design expertise transfer is moderated by culture when designers use design to elicit positive attitude and to convey intended meaning. It would be interesting to explore how to use short-term training to improve design expertise for a foreign market. For example, future research can study whether showing design preferred in a foreign market to designers with different cultural backgrounds can improve those designers' design ability for the foreign market.

Beside expertise level, expertise domain has an important role in expertise transfer. Future research should explore how expertise domain affects design expertise transfer. Moreover, this research focuses on the aesthetic aspect of design. It would be interesting to investigate design expertise from other aspects of design, such as manufacturability, material, cost, etc.

Finally, this research only looks into two countries. It is possible that the findings are not representative of other countries and thus they are not generalizable in a broader sphere. Future research should extend cultural context and embrace more countries.

Specific Limitations And Future Research Directions By Study

Although it is not the focus of the present research, the results of Study 1 suggest that pairing of design adjectives makes a difference for Chinese designers but not for U.S. designers. It would be interesting to investigate the mechanism behind this phenomenon and to further explore how pairing of design adjectives may influence design outcome in the context of product design.

Opposite to the prediction, study 2 does not find a statistically significant main effect of culture on attitude toward design. It might be due to the design tasks I selected in the study, which teased out cultural specific products. It would be interesting to repeat the study with cultural specific products and investigate how much impact designers' cultural background can have on their design outcome of cultural specific products.

REFERENCES

Aaker, D. A. (1991). *Managing Brand Equity*. New York: The Free Press.

Adams, F. M. & Osgood, C. E. (1973). A cross-cultural study of the affective meanings of color. *Journal of Cross-Cultural Psychology, 2,* 135-156.

Ahmed, S., Wallace, K. M., & Blessing, L. (2003). Understanding the differences between how novice and experienced designers approach design tasks. *Research in Engineering Design, 1*, 1–11.

Ajzen, I. (2008). Consumer attitudes and behavior. In C. P. Haugtvedt, P. M. Herr, & F. R. Kardes (Ed.), *Handbook of Consumer Psychology* (p.p.525-548). New York: Psychology Press.

Alba, J. W. & Hutchinson, J. W. (1987). Dimensions of consumer expertise. *Journal of Consumer Research*, *4*, 411–454.

Alba, J. W. & Hutchinson, J. W. (2000). Knowledge calibration: What consumers know and what they think they know. *Journal of Consumer Research*, *2*, 123-156.

Alberti, L. B. (1988). *Renaissance Architectural Theoretician: On the Art of Building in Ten Books*. Joseph Rykwert, Neil Leach, and Robert Tavernor, trans. Cambridge, MA: MIT Press. (Originally published in 1485, *De re Aedificatoria*, Florence: Nicolaus Laurentii.)

Alexander, C. (1979). *The Timeless Way of Building.* New York: Oxford University Press.

Allard, F. & Starkes, J.t L. (1991). Motor-skill experts in sports, dance, and other domains. In K. A. Ericsson & J. Smith (Ed.), *Toward A General Theory of Expertise* (p.p.126-152). New York: Cambridge University Press.

Alsleben, R. (1962). *Ästhetiche Redundanz*. Quickborn: Schnelle.

Anderson, J. R. (1990). *Cognitive psychology and its implications*. New York: Freeman.

Anzai, Y. (1991). Learning and use of representations for physics expertise. In K. A. Ericsson & J. Smith (Ed.), *Toward A General Theory of Expertise* (p.p.64-93). New York: Cambridge University Press.

Arnheim, R. (1974). *Art and Visual Perception*. Berkeley and Los Angeles, California: University of California Press.

Austin, E. & Pinkleton, B. (2006). *Strategic Public Relations Management: Planning and Managing Effective Communication Programs*. Hillsdale: Lawrence Erlbaum Associates.

Batra, R. & Homer, P. M. (2004). The situational impact on brand image beliefs. *Journal of Consumer Psychology*, *3*, 318–30.

Bagozzi, R. P. (1978). The construct validity of the affective, behavioral, and cognitive components of attitude by analysis of covariance structures. *Multivariate Behavioral Research, 13*, 9-31.

Bartlett, F. C. (1958). *Thinking*. London: George Allen and Unwin.

Bense, M. (1965). *Aesthetica: Einführung in die neue Ästhetik*. Baden-Baden: Agis.

Berkowitz, M. (1987). Product shape as a design innovation strategy. *Journal of Product Innovation Management, December*, 274-283.

Berlyne, D. E. (1965). *Structure and Direction in Thinking*. New York: Wiley.

Berlyne, D. E. (1971). *Aesthetics and Psychology*. New York: Meredith Corporation.

Blattberg, R. C. & Hoch, S. J. (1990). Database models and managerial intuition: 50% model + 50% manager. *Management Science, 8*, 887–899.

Blier, S. P. (1987). *The Anatomy of Architecture, Ontology and Metaphor in Batammaliba Architectural Expression*. Cambridge: Cambridge University Press.

Bloch, P. H. (1995). Seeking the ideal form: Product design and consumer response. *Journal of Marketing*, *3*, 16–29.

Borja de Mozota, B. (1990). Design as a strategic management tool. In M. Oakley, B. Borja de Mozota, & C. Clipson (Ed.), *Design Management: A Handbook of Issues and Methods* (p.p.73–84). Oxford: Blackwell.

Borja de Mozota, B. (2003). *Design Management: Using Design to Build Brand Value and Corporate Innovation*. New York: Allworth Press.

Bradley, C. (2001). *Western World Costume*. New York: Dover Publications.

Breckler, S. J. (1989). Affect versus evaluation in the structure of attitudes. *Journal of Experimental Social Psychology, 3*, 253-271.

Brillouin, L. (2004). *Science & Information Theory*. New York: Dover.

Butterfield, G. B. & Butterfield, E. C. (1977). Lexical codability and age. *Journal of Verbal Learning and Verbal Behavior, February*, 113-18.

Camerer, C. F., & Johnson, E. J. (1991). The process-performance paradox in expert judgment: How can experts know so much and predict so badly? In K. A. Ericsson & J. Smith (Ed.), *Toward a general theory of expertise: Prospects and limits*. Cambridge, UK: Cambridge University Press.

Charness, N. (1981). Search in chess: Age and skill differences. *Journal of Experimental Psychology: Human Perception and Performance, 7,* 467–476.

Child, I. L. & Siroto, L. (1971). Bakwele and American aesthetic evaluations compared. In C. F. Jopling (Ed.), *Art and Aesthetics in Primitive Societies* (p.p.271-289). New York: Dutton.

Cho, H.& Schwarz, N. (2010). I like those glasses on you, but not in the mirror: Fluency, preference, and virtual mirrors. *Journal of Consumer Psychology, 4*, 471-475.

Christensen-Szalanski, J. J. J. & Bushyhead, J. B. (1981). Physician's use of probabilistic information in a real clinical setting. *Journal of Experimental Psychology: Human Perception and Performance, 7*, 928-935.

Cohen, J. B., Pham, M. T., & Andrad, E. B. (2008). The nature and role of affect in consumer behavior. In C. P. Haugtvedt, P. M. Herr, & F. R. Kardes (Ed.), *Handbook of Consumer Psychology* (p.p. 297-348). New York: Psychology Press.

Collingwood, R. G. (1938). *The Principles of Art*. London: Oxford University Press.

Crilly, N., Moultrie, J., & Clarkson, P. J. (2004). Seeing things: Consumer response to the visual domain in product design. *Design Studies, 6*, 547-577.

Cross, N. (2004). Expertise in design: An overview. *Design Studies, 5*, 427-441.

Cross, N. (2010). Design expertise. *Design Studies, 2*, 203-205.

Cullen, C. (2000). *Global Graphics*. Gloucester: Rockport Publishers.

Daniel, T. C. & Ellis, H. C. (1972). Stimulus codability and long-term recognition memory for visual form. *Journal of Experimental Psychology, 1*, 83-89.

Davis, S. M. (1987). *Future Perfect*. Reading, MA: Addison-Wesley.

Deng, X., Hui, S. K., & Hutchinson, J. W. (2010). Consumer preferences for color combinations: An empirical analysis of similarity-based color relationships. *Journal of Consumer Psychology, 4*, 476-484.

Dreyfus, H. L. & Dreyfus, S. (2005). Expertise in real world contexts. *Organization Studies*, *5*, 779-792.

Dumaine, B. (1991). Design that sells and sells and ... *Fortune, March II*, 86-94.

Ericsson, K. A. & Kintsch, W. (1995). Long term working memory. *Psychological Review*, *2*, 211–245.

Faimon, P. & Weigand, J. (2004). *The Nature of Design*. Cincinnati, Ohio: HOW Design Books.

Fechner, G. T. (1871). *Zur Experimentalen Aesthetik*. Leipzig, Germany: Hirzl.

Fechner, G. T. (1876). *Vorschule der Aesthetik*. Leipzig, Germany: Breitkopf und Hartel.

Fechner, G. T. (1997). Various attempts to establish a basic form of beauty: Experimental, aesthetics, golden Section, and square. *Empirical Studies of the Arts*, *2*, 115-130. (A translation by Monika Niemann, Julia Quehl, Holger Höge, and Carl von Ossietzky of "VerschiedeneVersuche, eine Grundform der Schönheit Aufzustellen. Experimentale Ästhetik, Goldner Schnittund Quadrat," *Vorschule der Äesthetik*, Ch. 14. Leipzig: Breitkopf und Härtl.)

Fischer, E. (1959). *Von der Notwendigkeit der Kunst*. Dresden: Verlag der Kunst.

Fishbein, M. & Ajzen, I. (1975). *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research*. Reading, MA: Addison-Wesley.

Garner, W. R. (1962). *Uncertainty and Structure as Psycholgical Concepts*. New York: Wiley.

Gemser, G. & Leenders, M. A. (2001). How integrating industrial design in the product development process impacts on company performance. *Journal of Product Innovation Management, 1,* 28–38.

Gentner, D. R. (1988). Expertise in typewriting. In Michelene T. H., Robert G. & Marshall J. F. (Ed.), *The Nature of Expertise* (p.p.1-22). New Jersey: Lawrence Erlbaum Associates.

Gero, J. S. & Rosenman, M. A. (1990). A conceptual framework for knowledge-based design research at Sydney University. *Artificial Intelligence in Engineering, 2,* 65-77.

Glaser, R & Chi, M. T. H. (1988). Overview. In M. T. H. Chi, R. Glaser, & M. F. Farr (Ed.), *The Nature of Expertise* (p.p.XV-XXVIII). Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Götz, K. O., Borisy, A. R., Lynn, R. & Eysenk, H. J. (1979). A new aesthetic sensitivity test I: Construction and psychometric properties. *Perceptual and Motor Skills*, 3, 795-802.

Green, C. D. (1995). All that glitters: A review of psychological research on the aesthetics of the golden section. *Perception, 8*, 937–68.

Gunzenhäuser, R. (1962). *Asthetisches Mass und Ästhetische Information*. Quickborn: Schnelle.

Haugtvedt, C. P. & Kasmer, J. A. (2008). Attitude change and persuasion. In C. P. Haugtvedt, P. M. Herr, &and F. R. Kardes (Ed.), *Handbook of Consumer Psychology* (p.p.419-435). New York: Psychology Press.

Henderson, P. W. & Cote, J. A. (1998). Guidelines for selecting or modifying logos. *Journal of Marketing, April*, 14–30.

Henderson, P. W., Cote, J. A. Leong, S. M., & Schmitt, B. (2003). Building strong brands in Asia: Selecting the visual components of image to maximize brand strength. *International Journal of Research in Marketing, 4*, 297-313.

Henderson, P. W., Giese, J. L., & Cote, J. A. (2004). Impression management using typeface design. *Journal of Marketing, October*, 60–72.

Hise, R. T., O'Neal, L., McNeal, J. U. & Parasuraman, A. (1989). The effect of product design activities on commercial success levels of new industrial products. *Journal of Product Innovation Management, 1,* 43–50.

Ho, C. H. (2001). Some phenomena of problem decomposition strategy for design thinking: Differences between novices and experts. *Design Studies, 1*, 27-45.

Hoch, S. J., & Schkade, D. A. (1996). A psychological approach to decision support systems. *Management Science, 1*, 51–64.

Hoegg, J., Alba, J. W., & Dahl, D. W. (2010). The good, the bad, and the ugly: Influence of aesthetics on product feature judgments. *Journal of Consumer Psychology*, *4*, 419-430.

Huntley, H. E. (1970). *The Divine Proportion: A Study in Mathematical Beauty*. New York: Dover.

Hutchinson, J. W., & Alba, J. W. (1991). Ignoring irrelevant information: Situational determinants of consumer learning. *Journal of Consumer Research, December*, 325–346.

Hutchinson, J. W. & Eisenstein, E. M. (2008). Consumer learning and expertise. In C. P. Haugtvedt, P. M. Herr, and F. R. Kardes (Ed.), *Handbook of Consumer Psychology* (p.p.103–131). New York: Lawrence Erlbaum Associates.

Ihara, S. (1993). *Information Theory for Continuous Systems*. New Jersey: World Scientific.

Kavolis, V. (1968). *Artistic Expression—A Sociological Analysis*. Ithaca, New York: Cornell University Press.

Kiemle, M. (1967). *Äesthetische Probleme der Architektur*. Quickborn: Schelle.

Klayman, J. (1988). On the how and why (not) of learning from outcomes. In Berndt Brehmer & C. R. B. Joyce (Eds.), *Human judgment: The SJT view*. North Holland: Elsevier.

Koehler, D. J., Brenner, L. A., & Griffin, D. (2002). The calibration of expert judgment: Heuristics and biases beyond the laboratory. In T. Gilovich, D. Griffin, & D. Kahneman (Ed.), *Heuristics and biases: The psychology of intuitive judgment*. Cambridge: Cambridge University Press.

Koffka, K. (1935). *Principles of Gestalt psychology*. New York: Harcourt Brace.

Kotabe, M & Helsen, K. (2010). *Global Marketing Management*. New Jersey: Wiley.

Kothandapani, V. (1971). Validation of feeling, belief, and intention to act as three components of attitude and their contribution to prediction of contraceptive behavior. *Journal of Personality and Social Psychology, 19*, 321-333.

Krippendorff, K. (1989). On the essential contexts of artifacts or on the proposition that design is making sense (of things). *Design Issues, 2*, 9–38.

Kumar, M. & Garg, N. (2010). Aesthetic principles and cognitive emotion appraisals: How much of the beauty lies in the eye of the beholder? *Journal of Consumer Psychology, 4*, 485-494.

Lachman, R., Shaffer, J. P., & Hennrikus, D. (1974). Language and cognition: Effects of stimulus codability name-word frequency and age of acquisition on lexical reaction time. *Journal of Verbal learning and Verbal Behavior, December*, 613-625.

Lalo, C. (1908). *L'Esthetique Experimentale Contemporaine*. Paris: Alcan.

Landa, R. (2011). *Graphic Design Solutions*. Boston, MA: Wadaworth.

Lauer, D. A. (1990). *Design Basics.* New York: The Dryden Press.

Lloyd, P. & Scott, P. (1994). Discovering the design problem. *Design Studies, 2*, 125-140.

Lawlor, R. (1982). *Sacred Geometry: Philosophy and Practice*. London: Thames & Hudson.

Lawrence, P. & McAllister, L. (2005). Marketing meets design: Core necessities for successful new product development. *Journal of Product Innovation Management, 2*, 107–108.

Lawson, B. (1983). *How Designers Think*. Westfield, NJ: East-view Editions.

Lawson, B. (1997). *How Designers Think*. Oxford: Architectural Press.

Lawson, B. (2004a). Schemata, gambits and precedent: Some factors in design expertise. *Design Studies, 5,* 443-463.

Lawson, B. (2004b). *What Designers Know*. Oxford, UK: Architectural Press.

Lawson, B. & Dorst, K. (2009). *Design Expertise*. Oxford, UK: Architectural Press.

Lewalski, Z. M. (1988). *Product Eutectics: An Interpretation for Designers.* Carson City, NV: Design and Development Engineering Press.

Lichtenstein, S., Fischhoff, B., & Phillips, L. D. (1982). Calibration of probabilities: The state of the art to 1980. In D. Kahneman, P. Slavic, & A. Tversky (Ed.), *Judgment under Uncertainty: Heuristics and Biases.* Cambridge, UK: Cambridge University Press.

Luck, R., Haenlein, H., & Bright, K. (2001). Project briefing for accessible design. *Design Studies*, *3*, 297-315.

Mace, R, Hardie, G., & Place, J. (1991). Accessible Environments: Toward Universal Design. Retrieved July 11, 2012 from http://www.accessiblesociety.org/topics/universaldesign/

Madzharov, A. V. & Block, L. G. (2010). Effects of product unit image on consumption of snack foods. *Journal of Consumer Psychology, 4*, 398-409.

Malhotra, N. K. (2005). Attitude and affect: New frontiers of research in the 21st century. *Journal of Business Research, 4*, 477-482.

Mann, L., Radford, M., Burnett, P., Ford, S., Bond, M., Leung, K., et al. (1998). Cross-cultural differences in self-reported decision-making style and confidence. *International Journal of Psychology, 5*, 325-335.

McCracken, G. (1986). Culture and consumption: A theoretical account of the structure and movement of cultural meaning of consumer goods. *Journal of Consumer Research, June*, 71-84.

McGill, W. J. (1954). Multivariate information transmission. *Psychometrika, 2*, 97-116

Meyers-Levy, J. & Zhu, R. (2010). Gender differences in the meanings consumers infer from music and other aesthetic stimuli. *Journal of Consumer Psychology, 4*, 495-507.

Miller, M. & Adler, J. (2003). Isaac hits his target. *Newsweek, 17*, 74–77.

Moles, A. (1958). *Théorie de l'information et perception ésthetique*. Paris: Flammarion. (Information theory and esthetic perception. Urbana, IL: University of Illinois Press.)

Monö, R. (1997). *Design for Product Understanding*. Sweden: Liber, Stockholm.

Orth, U. R. & Malkewitz, K. (2008). Holistic package design and consumer brand impressions. *Journal of Marketing, 3*, 64–81.

Ostrom, T. M. (1969). The relationship between the affective, behavioral and cognitive components of attitude. *Journal of Experimental Social Psychology, 5*, 12-30.

Page, C., & Herr, P. M. (2002). An investigation of the processes by which product design and brand strength interact to determine initial affect and quality judgments. *Journal of Consumer Psychology, 12*, 133−147.

Palmer, S. E. (1990). Modern theories of gestalt perception. *Mind and Language, 5*, 289-323.

Pandelaere, M., Millet, K., den Bergh, B. V. (2010). Madonna or Don McLean? The effect of order of exposure on relative liking. *Journal of Consumer Psychology, 4*, 442-451.

Patrick, V. M. & Peracchio, L. A. (2010). "Curating" the JCP special issue on aesthetics in consumer psychology: An introduction to the aesthetics issue. *Journal of Consumer Psychology, 4*, 393-397.

Perussia, F. (1988). Semiotic Frame: A method for the experimental analysis of images. *Psychological Reports, 63*, 524-26.

Petty, R. E. & Cacioppo, J. T. (1981). *Attitude and Persuasion: Classic and Peripheral Approaches*. Dubuque, IA: Wm. C. Bown.

Petty, R. E., J. T. Cacioppo, & R. Goldman. (1981). Personal involvement as a determinant of argument based persuasion. *Journal of Personality and Social Psychology*, *41*, 847–855.

Raghubir, P. & Greenleaf, E. A. (2006). Ratios in proportion: What should the shape of the package be? *Journal of Marketing, 2,* 95–107.

Ratcliff. C.D., Czuchry, M., Scarberry, N. C., Thomas, J. C, Dansereau, D. F., & Lord, C. G. (1999). Effects of directed thinking on intentions to engage in beneficial activities: actions versus reason. *Journal of Applied Social Psychololgy, 5*, 994–1009.

Reimann, M., Zaichkowsky, J., Neuhaus, C., Bender, T., Weber, B. (2010). Aesthetic package design: A behavioral, neural, and psychological investigation. *Journal of Consumer Psychology, 4,* 431-441.

Rodewald, H. K. & Bosma, L. F. (1972). Information transmission in brief exposures as a function of association value. *Perceptual Motor Skill, 2,* 420-422.

Sangelkar, S., Cowen, N., & McAdams, D. (2012). User activity –product function association based design rules for universal products. *Design Studies, 1,* 85-110.

Schön, D. A. (1983). *Dynamic Memory*. Cambridge: Cambridge University Press.

Schmitt, B. H. (1995). Language and visual imaginary: Issues in corporate identity in East Asia. *Journal of World Business, winter,* 28-36

Schmitt, B. H. & Simonson, A. (1995). Managing corporate image and identity. *Long Range Planning, 5,* 82–92.

Schneider, D. M. (1971).The interpretation of Pakot visual art. In C. F. Jopling (Ed.), *Art and aesthetics in primitive societies* (p.p.55-63). New York: Dutton.

Schön, D. A. (1988). Designing: Rules, types and worlds. *Design Studies, 3,* 181–190

Seitamaa-Hakkarainen, P. & Hakkarainen, K. (2001). Composition and construction in experts' and novices' weaving design. *Design Studies, 1,* 44–66.

Seva, R. R. & Helander, M. G. (2009). The influence of cellular phone attributes on users' affective experiences: A cultural comparison. *International Journal of Industrial Ergonomics, 2,* 341-346.

Shannon, C. E. (1948). A mathematical theory of communication. *Bell System Technical Journal, 3*, 379–423.

Shanteau, J. (1988). Psychological characteristics and strategies of expert decision makers. *Acta Psychologica, 68,* 203–215.

Shanteau, J. (1992a). Competence in experts: The role of task characteristics. *Organizational Behavior and Human Decision Processes, 2*, 252–266.

Shanteau, J. (1992b). How much information does an expert use? Is it relevant? *Acta Psychologica, 1*, 75–86.

Shanteau, J., & Stewart, T. R. (1992). Why study expert decision making? Some historical perspectives and comments. *Organizational Behavior and Human Decision Processes, 2,* 95-106.

Singh, D. (1993). Adaptive significance of female physical attractiveness: Role of waist-to-hip ratio. *Journal of Personality and Social Psychology*, *2*, 293-307.

Singh, D. & Suwardi, L. (1995). Ethnic and gender consensus for the effect of waist-to-hip ratio on judgment of women's attractiveness. *Human Nature, 6,* 51-65.

Sloboda, J. (1991). Musical expertise. In K. A. Ericsson & J. Smith (Ed.), *Toward A General Theory of Expertise* (p.p.153-171). New York: Cambridge University Press.

Soloway, E., Adelson, B., & Ehrlich, K. (1988). Knowledge and processes in the comprehension of computer programs. In Michelene T. H. CHI, Robert G. & Marshall J. Farr (Ed.), *The Nature of Expertise* (p.p.129–152). New Jersey: Lawrence Erlbaum Associates.

Symons, D. (1995). Beauty is in the adaptations of the beholder: The evolutionary psychology of human female sexual attractiveness. In P. R. Abramson & S. D. Pinkerton (Ed.), *Sexual Nature, Sexual Culture* (p.p.80-118). Chicago: University of Chicago Press.

Swan, K. S., Kotabe, M. & Allred, B. B. (2005). Exploring robust design capabilities, their role in creating global products, and their relationship to firm performance. *Journal of Product Innovation Management, 2,* 144–164.

Tham, K, W., Lee, H. S., et al. (1990). Building envelope design using design prototypes. *ASHRAE Trans, 96,* 508-520.

Thorndike, E. L. (1917). Individual differences in judgments of the beauty of simple forms. *Psychological Review, 24,* 147–153.

Titchener, E. B. (1909). *A Text-Book of Psychology*. Part I. New York: Macmillan.

Townsend, C. & Shu, S. B. (2010). When and how aesthetics influences financial decisions. *Journal of Consumer Psychology, 4*, 452-458.

Ulrich, K.T. & Eppinger, S.D. (2008). *Product Design and Development*. Boston: McGraw-Hill.

van Damme, W. (2000). Universality and cultural particularity in visual aesthetics. In N. Roughley (Ed.), *Being Humans* (p.p.258-283). Berlin; New York: de Gruyter.

van der Lans, Ralf, Cote, J. A., Cole, C. A., Leong, S. M., Smidts, A., Henderson, P. W., et al. (2009). Cross-national logo evaluation analysis: An individual-level approach. *Marketing Science, 5*, 968-985.

Venkatesh, A., Joy, A., Sherry Jr, J. F., & Deschenes, J. (2010). The aesthetics of luxury fashion, body and identify formation. *Journal of Consumer Psychology, 4*, 459-470.

Vermaas, P. E. & Dorst, C. H. (2007). On the conceptual framework of John Gero's FBS model of designing and the prescriptive aims of design methodology. *Design Studies, 22*, 133-159.

Veryzer, R. W. (1993). Aesthetic response and the influence of design principles on product preferences research. In F. Kardes & M. Sujan (Ed.), *Advances in Consumer Research*, vol. 22 (p.p.641-645). Provo, UT: Association for Consumer Research.

Veryzer, R. W. (1995). The place of product design and aesthetics in consumer research. In L. McAlister and M.L. Rothschild (Ed.), *Advances in Consumer Research*, vol. 20 (p.p.224-228). Provo, UT: Association for Consumer Research.

Veryzer, R. W. (1998). Key factors affecting customer evaluation of discontinuous new products. *Journal of Product Innovation Management*, *2*, 136–150.

Veryzer, R. W., Jr., & Hutchinson, J. W. (1998). The influence of unity and prototypicality on aesthetic response to new product designs. *Journal of Consumer Research*, *24*, 374–394.

Webster's (1979). *New Collegiate Dictionary*. Springfield, MA: G & C Merriam Co.

Wright, P. (2002). Marketplace metacognition and social intelligence. *Journal of Consumer Researc, March*, 677–682.

Yamamoto, M. & Lambert, D. R. (1994). The impact of product aesthetics on the evaluation of industrial products. *Journal of Product Innovation Management*, *29,* 309-324.

Yang, X., Zhang, J. & Peracchio, L. A. (2010). Understanding the impact of self-concept on the stylistic properties of images. *Journal of Consumer Psychology*, *4*, 508-520.

Zelanski, P. & Fisher, M. P. (1984). *Design Principles and Problems*. New York: The Dryden Press.