Design with Subtle Cues:
Visual Expression of Connectedness and Its Downstream Effects

by

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To my mom and dad,

I owe you everything.

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ABSTRACT

This dissertation consists of three essays that investigate how social harmony is manifest in actual design practice (in the first essay) and how design promotes harmonious social interaction (in the second and third essays). The first essay examines cultural differences in how actual design practice reflects social harmony. It includes a content analysis and a survey to analyze Korean and US corporate logos. The results indicate that Korean logos are perceived as more harmonious in terms of design principles as well as connoted meaning. The second essay focuses on developing and testing visual cues that promote feelings of social connectedness. It identifies formal characteristics representing the concept of connectedness (i.e., connectedness cues) by conducting a logo design task, and tests the effect of connectedness cues on participants' self-descriptions. The results show that perceiving connectedness cues increases the extent to which one describes the self as socially interdependent. The third essay investigates the effect of connectedness cues on downstream behavior. In particular, it examines how connectedness cues and social norms interact to influence cooperative behavior in public goods games. The results suggest that connectedness cues enhance cooperation in situations when others are cooperative. This dissertation provides implications for persuasive design strategies that appeal to different cultures and promote prosocial behavior.

CHAPTER 1 Introduction

Just like the combination of musical chords produces a pleasing effect, harmonious social interaction among members of a social group is critical for their basic survival and subsistence or that of society. In their work to promote harmonious social interaction, previous design efforts have mainly focused on ecological or architectural variables to construct physical space in a way that people can easily mingle with one another. However, limited attention has been paid to design of small-scale artifacts in our surroundings. Although the well-known Chinese folk practice or philosophy of *Feng Shui* is concerned with the placement of objects in order to bring harmony in various aspects of life, little scientific research has tested the role of everyday artifacts in influencing social interaction.

This dissertation explores how objects can promote harmonious social interaction, with a particular focus on their communicative functions. The communicative view on objects has been studied across various fields and from diverse perspectives (e.g., Crilly, Good, Matravers, & Clarkson, 2008; Gros, 1984; Peirce, 1940; Vihma, 1995). For example, in semiotics (Peirce, 1940), objects are seen as symbols, signs, or language-like systems. Despite a diversity of perspectives on understanding the role of objects, there seems to be agreement that that objects convey meaning through their design and that manipulating the design of objects can be an effective way to communicate specific meanings. This process is important because the mental construct activated by (the design of) objects can in turn influence subsequent attitude and behavior through a priming process. That is, designed objects can serve as a cue that trigger judgments and actions.

Objective and scope

This dissertation aims to shed light on design that expresses social harmony and its downstream influence on social interaction. In doing so, this investigation contributes to the understanding of human response to visual form and meaning, and provides implications for promoting meaningful social interaction.

This research focuses on a specific aspect of design, visual form, but the broader term *design* is used throughout this dissertation. The visual form of an object is not only conceived as part of the Gestalt, referring to external coverage and surface of the object, but also taking part in the perception process as an object for interpretation (Vihma, 1995). The terms *visual form* and *visual appearance* are used interchangeably. Moreover, the terms *objects* and *artifacts* are also interchangeably used throughout the dissertation not only to refer to tangible products, but also to intangible products in a broad range of media.

In addition to visual form, this research focuses on employing the communicative power of design as a source of influence on particular human attitudes and behaviors, rather than understanding the nature of the communication process. Although this research (Chapter 2) examines perceivers' interpretation of form, it does not employ the semiotic approach or any other communication models considering design intent in evaluating or classifying form.

Lastly, since social harmony or harmonious social interaction is a broad and vague concept to measure, this research (Chapter 3 and 4) focuses on social connectedness and prosocial behavior that are established concepts in the literature. Prosocial behavior, defined as actions that benefit other people or society as a whole (Twenge, Baumeister, Ciarocco, & Bartels, 2007), is seen as key to promoting harmonious interpersonal or group interaction; the same is true for social connectedness. The term *social connectedness* and other related concepts such as *self-construal* and *collectivism (vs. individualism)* are defined in the following chapters as they are introduced.

Structure: Three essays

The first part of this dissertation investigates how visual form reflects meaning of social harmony, particularly by comparing design manifestation cross-culturally. It has been well documented that cultural differences exist in the extent to which social harmony matters to a group. This cultural difference influences various types of cultural practice, including visual practice such as art and design. Visual form reflecting local cultural values is more preferred by members of a culture and thus these forms are dominant in each culture (Zhang, Feick, & Price, 2006); In light of this relationship, comparing actual design practices from individualistic vs. collectivistic cultures can reveal formal qualities associated with social harmony as well as cultural preferences for aesthetics. Therefore, the first essay (Chapter 2) includes two studies that analyze form and perceived meaning of actual corporate logos from Korea and the US, and discusses implications for visual communication design for different cultures.

This dissertation then explores downstream consequences of visual expression, particularly investigating visual expression of connectedness and its influence on feeling of social connectedness and cooperative behavior. Specifically, the second essay (Chapter 3) explores the literature on communicative functions of products, mechanism of downstream effects, and social connectedness. It then presents two experiments conducted to identify design features that represent connectedness (i.e., connectedness cues) and to measure the effect of connectedness cues on one's self-construal (Markus & Kitayama, 1991). The third essay (Chapter 4) further examines the effect of connectedness cues on cooperative behavior. It includes two studies employing a public goods game to examine how connectedness cues influence monetary contribution decisions in different levels of contribution norms. These studies provide a unique technique to influence prosocial attitude and behavior through design characteristics of objects in our surroundings.

In the subsequent chapters, I elaborate on each of the three essays with details on theoretical background, empirical findings and discussions.

CHAPTER 2 Cultural Differences and Reflections of Harmony

2.1 INTRODUCTION

In our ever-shrinking world, physical borders have become more blurred and companies are becoming more global or multinational. Companies that have become truly global are not only moving their headquarters to other countries but also using branding strategies and marketing messages that appeal to a global market (Mueller, 2004). Therefore, it is important for marketers to understand local cultural values and deliberately reflect them in executing marketing communication messages in order to communicate their products or brands more effectively and persuasively (Aaker, 2000).

Understanding cultural differences may be the key to developing internationally accepted brands or products and communicating with global consumers. To understand and explain cultural similarities and differences, the dimension of individualism and collectivism (Triandis, 1995) has received the most attention by researchers specializing in cross-cultural research. The fundamental distinction between individualism and collectivism appears in their social orientation, that is, their relative emphasis on social connectedness with others. Individualistic cultures, such as those of the United States and Western Europe, stress the development and differentiation of a unique personality and identity, and autonomy. In contrast, in collectivistic cultures, such as those of China, Korea, and Japan, the impact of group membership on self-definition results in a desire to maintain in-group harmony.

The present study explores how cultural differences in social orientation can explain variances in visual communication (graphic design) practice, and chooses corporate logos as a target graphic

design for examining cultural differences. Prior literature indicates the importance of corporate visual identity specifically for multinational companies facing the choice between a standardized and a localized corporate identity. Despite its importance, empirical cross-cultural studies on corporate visual identity have been limited. Furthermore, prior cross-cultural studies on graphic design in general have mostly focused on examining differences in visual motifs and overall form such color and shape.

Thus, the current study compares Korean and US corporate logos particularly in communicating the sense of harmony. Prior cross-cultural research on aesthetic preference has demonstrated that people tend to prefer visual form congruent or associated with cultural values sought in each culture (e.g., June & Lee, 2007; Marcus & Gould, 2000; Zhang, Feick, & Price, 2006). Because people in collectivistic cultures tend to pursue harmony in a group than those in individualistic cultures, we hypothesize that Korean logos would reflect a greater sense of harmony in their visual syntax and semantics. This paper presents the results of two studies to support our hypothesis. In the first study, we examined cultural differences in formal qualities (syntax) by conducting a content analysis of actual corporate logos used in Korea and the US. In the second study, we conducted a survey to understand meaning (semantics) represented in logos.

2.2 LITERATURE REVIEW

2.2.1 Cultural differences in social orientation

A distinction between individualism and collectivism has been an important dimension of cultural knowledge and has generated a large body of research (e.g., Oyserman, Coon, & Kemmelmeier, 2002; Triandis, 1995). Cultural values of individualism and collectivism differ in their relative emphasis on social connectedness with one's group (Markus & Kitayama, 1991). In individualistic cultures, people are viewed as independent and possessing a unique pattern of traits that distinguish them from other people; they emphasize self-reliance, autonomy, competition, personal control, and individual goals. In contrast to such independence and uniqueness, people in collectivistic cultures view the self as inherently interdependent with the group to which they belong; they emphasize harmony, sociability, and a willingness to put aside personal needs for the good of one's social group (Markus & Kitayama, 1991). Cross-cultural

studies inspired by the dimension of individualism and collectivism have typically compared differences between East Asians and European North Americans (Lehman, Chiu, & Schaller, 2004) using nationality as a proxy for a person's underlying cultural values of individualism vs. collectivism (Brockner, 2003).

2.2.2 Cross-cultural studies

Researchers have studied cultural differences in design (e.g., Albers-Miller & Gelb, 1996; Cutler & Javalgi, 1992; June & Lee, 2007; Marcus & Gould, 2000), in attempt to suggest the most effective marketing methods and strategies to target people in different countries. They have found significant cultural differences in how products are presented to customers, many of them explaining the cultural difference through cultural models of individualism and collectivism. For example, American university websites showed a high degree of individualism throughout by way of frequent pictures of individuals, direct address (using "you" as opposed to "we"), personalization features, expression of private opinion, individual success stories, etc. In contrast, Indian sites displayed images of groups, used formal speech, included mission statements that impacted the larger group, and stated opinions on group behavior (Rajkumar, 2003).

Psychological studies have demonstrated cultural differences in aesthetic preference with emphasis on theorizing such cultural differences. For example, based on culturally different conflict resolution styles, Zhang and his colleagues (2006) examined cultural preference for angular vs. rounded shapes. The collectivistic tradition values harmonious relationship between self and environment and thus encourages conflict avoidance. On the other hand, the individualistic tradition values free will of individual agency and encourages conflicting will (Nisbett, Peng, Choi, & Norenzayan, 2001). Meanwhile, angular vs. rounded shapes evoke different perceptions; angular (rounded) shapes are regarded as a confrontation (compromise) between a focal stimulus and its surroundings (Arnheim, 1974). Moreover, as employed in design practice, angular shapes tend to induce associations with strength, toughness, and energy whereas rounded shapes tend to induce associations with harmony, friendliness, and approachableness (Berlyne, 1976). Consistent with the idea that the effect of physical features on

attractiveness perception depends on the qualities that are sought (Aronoff, Woike, & Hyman, 1992), they argued that collectivistic cultures where people seek harmony find rounded shapes more attractive; individualistic cultures where individuality and toughness are sought, angular features are more attractive. Consistent with their expectations, they found that rounded shapes are more preferred and prevalent in collectivistic cultures.

Taken together, the extant literature suggests that culture systematically influences visual form, such that cultural values or culturally influenced cognitive tendencies are manifest in the visual form. In other words, people find certain visual form more appealing when the qualities evoked by the form are congruent with their cultural value, thereby making the form more prevalent in each culture. For example, because people in collectivistic countries tend to maintain harmonious relationships between people to a greater extent than those in individualistic countries, it is reasonable to predict that visual form associated with the general concept of harmony would be the more dominant presentational form in collectivist cultures.

2.2.3 Corporate logos

Corporate identity (CI) is defined as strategic management tool used to present a company effectively to the public and to affect long-term public perceptions (Alessandri, 2001). The present research focuses on corporate visual identity which refers to visual components (i.e., graphic design) of CI. Corporate visual identity consists of a name, a brand logo, typography, color, a slogan or tagline. The brand logo is operationally defined as a symbol of CI. When the CI has additional pictorial elements, the pictorial elements represent the brand logo. When the CI only features typography, the typography represents the brand logo. From the design perspective, the form of brand logos can be classified into four categories: word-mark, letterforms, pictorial mark and abstract mark (Wheeler, 2003). Letterform logos are the single letter used as a distinctive graphic focal point for a logo. Pictorial logos use a literal and recognizable image. The image itself may allude to the name of the company or its mission, or it may be symbolic of a brand attribute. Abstract logos use visual form to convey a big idea or a brand attribute. These marks, by their nature, can provide strategic ambiguity, and work effectively for large companies with numerous and unrelated divisions (Wheeler, 2003; p. 84).

The present study explores the possibility of systematic cultural differences in visual communication of harmony manifest in corporate logos. Because actual logos from a culture should be a good reflection of its population's cognitive or aesthetic preference (Zhang, Feick, & Price, 2006), we propose that logos from collectivistic cultures would be perceived as more harmonious than those from individualistic cultures. To verify our hypothesis, we examined corporate logos in Korea and the US. We selected the US and Korea as representative countries of individualistic cultures and of collectivistic cultures, respectively. Previous research notes a large cultural difference between the two countries (Hall, 1989; Hofstede, 2001). For example, Hofstede (2001) reported that South Korea ranked 43rd in individualism, whereas the US was the most individualistic of the 50 countries.

In order to structure our analysis of corporate logos, we took a semiotic approach to visual communication. According to Morris (1971), a completed semiotic analysis of signs would take three distinct kinds of studies: Syntactics, semantics and pragmatics. Syntactics would study the formal relations of the sign. Semantics is the study of connotative meaning of a sign; what the image represents. Pragmatics on the other hand is the study of interactional meaning. It helps determine the origin of the meaning of a sign by understanding some of the factors such as codes, modality, sender, receiver and context. Using the semiotic approach, the present study looks at syntactics and semantics of logos in communicating harmony[1]. In other words, we examined the formal qualities (syntax) in Experiment 1 and meaning (semantics) of logos in Experiment 2.

2.3 EXPERIMENT 1: Analysis of formal qualities

Experiment 1 was designed to understand differences in formal qualities across Korean and US logos. Provided that harmony is about relationships among parts in a group, we are particularly interested in examining relationships of visual elements in logos. We propose that we would observe more harmonious compositions of elements in Korean logos than US logos. In order to define harmonious compositions, we employed standard design principles.

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[1] Pragmatic analysis may include the study of how logos are interpreted differently by context or perceiver, which is not within the scope of the present study.

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2.3.1 Design principles

Both construction and perception of any products involves certain design elements (e.g., line, plane, color, etc) and design principles (e.g., unity, contrast, balance, proportion, etc). Design elements are the parts marking up a product, and design principles refer to general rules of perception that involve the relationship between the parts of a visual display (Lauer, 1979). There are a large number of design principles that influence each other. And there is no fixed rule for the use of each principle, and there could be multiple ways to achieve the same principle. The design principle of unity, for instance, refers to a congruity among the elements of a design such that they look as though they belong together or as though there is some visual connection beyond mere chance that has caused them to come together (Lauer, 1979).

Table 1 Design principles of repetition, continuation, unity and harmony

Principles	Descriptions
Repetition	Element repeats itself in various parts of the design to relate parts to each other.
Continuation	The continuity in the form of a line, an edge, or a direction from one form to another creates a fluid connection among compositional parts.
Unity vs. Variety	The congruity or agreement among the elements in a design; it describes the feeling that all the elements in a work belong together and make up a coherent and harmonious whole. Variety, on the other hand, provides diversity. Variety acts to counter unity.
Harmony vs. Contrast	Harmony is another term for unity; harmony is achieved in a body of work by using similar elements throughout the work; it gives an uncomplicated look to a piece of artwork or sculpture. Contrast is created by using elements that conflict with one another. Contrast acts to counter harmony.

Among the many design principles, we are particularly interested in principles of repetition, continuation, unity and harmony. We chose to examine principles of unity and harmony, because they are directly relevant to visual perception of "harmony" by definition. In addition, given the principle of unity is achieved through principles of proximity, repetition, and continuation (Lauer, 1979), we decided to examine principles of repetition and continuation in order to examine the extent to which each principle supports the achievement of the final unity or harmony. We excluded the principle of proximity, because we assumed that proximity, which

involves placing elements together, would not be easy for coders to differentiate in small visual displays such as logos. Table 1 describes the four principles of interest. In our research, we define that better satisfying principles of repetition, continuation, and unity/harmony leads to more harmonious composition. We predict that Korean logos would better satisfy design principles of repetition, continuation, and unity or harmony. In other words, Korean logos would have more harmonious compositions than US logos. To verify our hypothesis, we conducted a content analysis of logos in terms of the aforementioned design principles. In addition to design principles, we examined general visual form, such as overall shape and color.

2.3.2 Method

Logo Samples

The sample corporate logos were collected from a business information database, OneSource Global Business Browser. Besides selecting parent corporations located either in Korea or the US, we limited our search to small and medium sized corporations having less than 500 employees. Small and medium corporations are more likely to reflect the local culture, thereby better serving our research goals of understanding cultural differences. We also limited the search to business-to-business (B2B) manufacturing industries (such as chemical, metal, construction, transportation, wood & forestry, and utility & energy). Then, we eliminated corporations that do not have websites, which resulted in 197 Korean and 3000 US corporations. Among 3000 US corporations, we randomly selected 197 US corporations while keeping their industry proportion same as the Korean samples'. For the final 197 Korean and 197 US samples, we collected their brand logos from the home pages of their websites typically showing their CI at the top of webpage. Then, we excluded logos consisting of word-marks (i.e., freestanding words of company names or acronym) because they may expose the corporations' nationality. We also excluded logos looking similar to well-known corporate logos to ensure low perceived familiarity. This yielded 83 Korean and 79 US logos for content analysis.

Coding Scheme

Two independent coders (mean age=19; both females; both Asians who have lived in the US over five years), who have no design background and also were blind to the hypothesis, analyzed logos in terms of their design elements (overall shape and main color) and principles (repetition,

and continuation, unity and harmony). The overall shape was measure as either (1) rounded or (2) angular. The color categories included (1) blue, (2) red, (3) yellow, (4) green, (5) gray, and (6) black. Following the general definitions of principles, in our study we instructed the coders about principles of repetition, continuation, unity and harmony as follows.

- *Repetition:* the use of the same or similar visual elements.
- *Continuation:* the continuation of line, edge or direction from one to another.
- *Unity/Variety:* the sense of oneness, of things belonging together and making up a coherent whole; the opposite concept of *variety*, defined as the elements with enough change or difference to enhance each other.
- *Harmony/Contrast:* the use of elements of the same type that go together; the opposite concept of *contrast,* defined as the use of elements that stand out because they are not alike.

Repetition and continuation were measured as either (1) low or (2) high. Unity was measured as either (1) variety or (2) unity, and harmony was measured as either (1) contrast or (2) harmony. In addition, the coders also classified logos by their logotype, following Wheeler's definition of brand-logo classification (Wheeler, 2003). The logotype was coded as either (1) letterform, (2) pictorial or (3) abstract.

2.3.3 Results

The average inter-coder agreement was 73%. Given that this study is exploratory in nature, the agreement rate over 70% can be used as acceptable criteria (Lombard, Snyder-Duch, & Bracken, 2002). Country and each of the individual variables were treated as categorical variables, and χ^2 tests were used to identify the difference between Korean and US logos.

Logotype (see Table 2) 70 percent of Korean logos were symbolic, while only 48 percent of the US logos were symbolic. The US logos were more pictorial logos (30 percent) than the Korean logos (13 percent). These differences in the logotype proportions were statistically significant (χ^2 = 9.82, p<.01), indicating that the Korean logos are more symbolic than pictorial.

Overall shape (see Table 2) An analysis on overall shape of logos revealed a significant relationship between country and overall shapes of logos, χ^2 =13.33, p<.001. A majority of the

Korean logos (76 percent) were perceived as rounded while most of the US logos (52 percent) were perceived as angular.

Main color (see Table 3) The most frequently used main color was blue for both countries. The second highest ranked color was red for Korean logos and black for US logos. Interestingly, only 6 percent of the Korean logos were black and none of the Korean logos was yellow. However, the US logos contained 22 percent of black and 10 percent of yellow as the main color.

Repetition (see Table 4) We found no difference between countries in terms of the repetition principle used in logo designs, χ^2 =.81, p=.37. The majority of the Korean logos contained a repetition of elements in their designs and this trend was the same for the US logos.

Continuation (see Table 4) The continuation principle was found to be significantly more frequent in the Korean logos (91 percent) than the US logos (66 percent), indicating that design elements in the Korean logos were arranged in a more visually connected way than were the US logos, χ^2 =4.61, p<.05.

Unity/Harmony (see Table 4) For the principle of unity, the Korean logos were perceived as having more unity and less variety than the US logos, and the difference was marginally significant, χ^2=3.42, p=.06. Similarly, the principle of harmony were found to be more frequent for the Korean logos than for the US logos (χ^2=6.79, p<.01), indicating that the Korean logos were perceived as more harmonious and less contrasting in their design principles.

2.3.4 Discussion

The results of Experiment 1 offered evidence that logos from a collectivist culture (i.e. Korea) have more harmonious compositions in their graphic design; they were perceived as better satisfying principles of harmony and unity. The Korean logos were also perceived as having higher continuation than the US logos, while we did not find cultural differences in repetition of visual elements. Although principle of unity (harmony) can be achieved through both repetition and continuation, our results show that the principle of continuation contributes more to the

observed cultural difference in perceived harmony or unity. In other words, the stronger visual sensation of harmony in the Korean logos may have resulted from the stronger visual continuity observed between visual elements in the logos. Furthermore, we found that the Korean logos were perceived as more rounded and abstract than the US logos. These findings about shape and logotype are consistent with the existing literature on cultural preference for aesthetic and communication strategies. Asian consumers have been found to prefer rounder shapes, whereas US consumers tend to prefer more angular shapes (e.g., Henderson, Cote, Leong, & Schmitt, 2003; Zhang, Feick, & Price, 2006). Advertising or brands in the diffusive Korean culture are more symbolic/abstract or high context than those in the specific US culture (e.g., June & Lee, 2007; Taylor, Miracle, & Wilson, 1997).

Table 2 Logotypes and overall shapes

	Logotype (%)			Overall shape (%)	
	Letterform	Pictorial	Symbolic	Angular	Rounded
Korea	16.7	13.3	71.1	24.1	75.9
U.S	21.5	30.4	48.1	51.9	48.1

Notes: Logotype: Inter-coder reliability = 85%; χ^2 = 9.82; df=2; p<.01, Overall shape: Inter-coder reliability=82%; χ^2 =13.33; df=1; p<.001

Table 3 Main color

	Main color (%)						
	Blue	Red	Yellow	Green	Gray	Black	Total
Korea	45.8	25.3	0	18.1	4.8	6.0	100
U.S	38.0	10.1	10.1	11.4	8.9	21.5	100

Notes: Inter-coder reliability = 74%, χ^2 =23.55; df=5; p<.001

Table 4 Repetition, continuation, unity and harmony

	Repetition (%)		Continuation (%)		Unity (%)		Harmony (%)	
	Low	High	Low	High	Variety	Unity	Contrast	Harmony
Korea	24.1	75.9	19.3	90.7	10.8	89.2	7.2	92.8
U.S	30.4	69.6	34.2	65.8	21.5	78.5	21.5	78.5

Notes: Repetition: Inter-coder reliability=75%; χ^2 =.81; df=1; p=.37, Continuation: Inter-coder reliability=54%; χ^2 =4.61; df=1; p<.05, Unity: Inter-coder reliability=71%; χ^2=3.42; df=1; p=.06, Harmony: Inter-coder reliability=72%; χ^2=6.79; df=1; p<.01

2.4 EXPERIMENT 2: Analysis of meaning

Although the results from Experiment 1 suggested that Korean logos have more formal qualities that contribute to perceived visual harmony than the US logos, it is still unclear whether Korean logos semantically communicate the greater sense of harmony. Therefore, Experiment 2 was designed to examine the semantic communication of harmony in logos. That is, it involved a direct measure of the sense of harmony in logos; with the same logo samples used in Experiment 1, we conducted a survey to ask participants to rate each logo on how effective it is in communicating a sense of harmony.

2.4.1 Method

A total of 255 subjects (69% male; age mean=28; SD=9.32) participated in an online survey on Amazon Mechanical Turk. Subjects were asked to look at logo designs proposed for a corporation whose slogan is "togetherness in harmony", and to evaluate how well each logo represents the corporate slogan. Among the 83 Korean and 79 US logo samples used in Experiment 1, each subject was presented with randomly selected 10 Korean logos and 10 US logos one by one, and rated how effectively each logo represents the concept of togetherness in harmony on a 7-point Likert scale from 1 – 'very ineffective' to 7 – 'very effective'. Each logo was seen by 31 subjects on average (mean=31.49; range=29~34; SD=1.19).

2.4.2 Results

To statistically analyze how effectiveness scores differ by culture, we used a mixed effect model with logo as a random effect and random intercepts for subjects in order to account for the fact that each subject saw a different set of logos. The results showed that the effectiveness score is higher for Korean logos (mean=3.28; SD=0.78) than US logos (mean=2.98; SD=0.82), p=.02. This finding indicates that the concept of "togetherness in harmony" was better represented in Korean logos than in US logos. Figure 1 and Figure 2 present the top five Korean and US logos, and the bottom five Korean and US logos in terms of the effectiveness score, respectively.

2.4.3 Discussion

The results from Experiment 2 showed that Korean logos are more effective in representing the meaning of harmony. Consistent with the findings from Experiment 1, we found that Korean logos semantically represent the sense of harmony better than the US logos. As shown in Figure 2, the highest rated logos in their effectiveness score reflect repetition, continuation, unity and harmony in terms of formal qualities, suggesting that perceiving those design principles may contribute to the semantic interpretation of harmony.

KR logos					
Mean (SD)	5.45 (1.34)	4.90 (1.54)	4.84 (1.44)	4.67 (1.81)	4.48 (1.79)
US logos					
Mean (SD)	4.94 (1.90)	4.91 (1.63)	4.65 (1.41)	4.64 (1.78)	4.44 (1.52)

Figure 1 The top five Korean logos and the top five US logos

KR logos					
Mean (SD)	1.87 (1.52)	1.87 (1.09)	2.00 (1.50)	2.03 (1.10)	2.06 (1.55)
US logos					
Mean (SD)	1.53 (1.14)	1.70 (0.88)	1.79 (1.08)	1.85 (1.23)	1.94 (1.17)

Figure 2 The bottom five Korean logos and the bottom five US logos

To understand the relation between formal qualities and meanings, we ran a multiple regression analysis with having logos' formal qualities measured in Experiment 1 as predictor variables and logos' effectiveness scores measured in Experiment 2 as a criterion variable. The regression

model using a stepwise method (adjusted R^2 = .263; $F(3,158)$ = 20.143, $p<.0001$) shows that design principles of repetition and continuation, and overall shape significantly contribute to the effectiveness score (see Table 5). This indicates that repetition, continuation and roundedness positively influence the sense of harmony. Specifically, repetition has the biggest impact on the semantic interpretation of harmony, followed by roundedness and continuation.

Table 5 The significance of predictor variables

Predictor variable	Beta	*P* value
Repetition	.334	*p*<.0001
Overall shape (roundedness)	.297	*p*<.0001
Continuation	.195	*p*<.05

(Design principles of unity and harmony were not significant predictors in this model.)

2.5 GENERAL DISCUSSION

The present research investigated the impact of culture on the visual communication of harmony in corporate logos. Because a collectivistic culture emphasizes harmonious social relationships, we predicted that visual form communicating such qualities would be more frequently observed in a collectivistic culture. Our results are consistent with our expectations.

Our studies provide evidence that the collectivistic value of seeking harmonious relationships is formally and semantically better represented in logos from a collectivistic country. In Experiment 1, two coders analyzed formal compositions in corporate logos in two different countries, Korea and the US. We found that Korean logos compared to US logos better satisfy design principles of continuation, unity and harmony than the US logos. We also observed that Korean logos are more rounded and abstract than US logos. In Experiment 2, participants rated how well each logo represents the meaning of harmony. The result showed that Korean logos represent the meaning of harmony more effectively than US logos.

Taken together, this research demonstrates that visual form from a collectivistic culture where people seek social harmony better communicates the sense of harmony in terms of their formal qualities as well as semantics. Visual repetition, roundedness, and continuation seem to be key

formal qualities in communicating the semantic meaning of harmony. In particular, visual roundedness and continuity, which was more frequently observed in Korean logos (vs. US logos), are expected to contribute to achieving a greater sense of harmony.

These results make several contributions to the existing literature. Most importantly, the present study contributes to cross-cultural research on corporate visual identity. Even if verbal components in marketing communication have been broadly studied in the marketing and advertising field, research on visual components in communication remains limited. In particular, our findings provide implications for more effective and persuasive logo design by reflecting local cultural values. Moreover, although most prior research on corporate visual identity has focused on consumer businesses or brands, our study examined B2B industries and provided information about logo design of B2B corporations.

Second, in prior cross-cultural research on corporate logos (e.g., June & Lee, 2007), corporate samples tend to contain the largest corporations that run multinational businesses and international marketing communication (e.g., samples are collected from the Fortune Magazine's list of the largest corporations). However, such samples might not reflect the values of one single culture, thereby weakening their argument about not only cultural difference but also why cultural differences are observed. Here, our studies collected logo samples from small and medium sized corporations, which, we believe, provides a better test of design styles in each country and the differences between two countries.

Third, the current study contributes to existing empirical research on cultural differences in graphic design. Although prior research in the design field has focused on basic elements, layout, and general theme in visual display, to the best of our knowledge, our research is the first to examine cultural differences in compositional rules of visual elements, i.e., design principles. Although we focused on corporate logos in the present research, our findings are also applicable to a wide range of graphic design such as book, magazine, and package.

These contributions must be qualified in light of several important limitations of our research. First, although we assume that actual logos in each county reflect its population's aesthetic

preference, the content analysis does not show direct inference for cultural differences in corporate logos from the US and Korea, nor does it suggest what types of designs are preferred or effective in the two countries. Therefore, in future research, experimental studies or surveys are needed to directly access whether logo designs perceived as more harmonious are more preferable or effective in collectivistic cultures. Moreover, the present study only investigated Korean and US corporations, so the findings may not be applicable to other nations. Thus, future research is needed to analyze a large sample of countries in order to test external validity.

Second, the present study focused only on a particular visual component of corporate identity, that is, a logo. However, visual components of CI consist of other typographic elements such as names and taglines that could reflect the concept of harmony even more effectively. Korean taglines contain more additional values, like appeals to family, friend, neighbor, and emotion than American taglines, reflecting characteristics of diffusive culture (June & Lee, 2007). Therefore, it would be interesting to observe how logos reflect the concept of harmony in conjunction with taglines in future research.

Similarly, although we supposed that certain compositional rules might represent the concept of harmony, creative motifs (i.e., theme or metaphor) of logos might be more responsible for evoking the sense of harmony. For example, logos inspired by yin and yang, nodes, or a group of people might symbolically communicate a stronger sense of harmony regardless of their design principles and visual styles. Therefore, we may need to consider the influence of design principles only when the themes of logos do not overshadow the function of design elements and principles.

CHAPTER 3 Connected Shapes and Interdependent Self-Construal

3.1 INTRODUCTION

The relationship between environmental cues and human behavior has long been considered in both psychology and design. Ecological variables such as lighting, color, temperature, scent and spatial layout in a setting can influence people's behavior even without their awareness. Extant research has documented a number of such findings. For example, classical music leads customers to buy more expensive wine (Areni & Kim, 1993), and pleasant ambient scent in a store influences the perception of product quality as well as consumer spending (Chebat & Michon, 2003). Clean scent facilitates ethical behavior (Liljenquist, Zhong, & Galinsky, 2010) and bright lighting can reduce crime (Painter & Farrington, 1999). The color pink has been shown to have a calming effect, serving to reduce violent and aggressive behavior (Schauss, 1979; Snyder, 1981); thus some prison cells are painted pink to calm prisoners (e.g., Ben Hill County Jail).

Prior studies have considered how ecological features of the built environment such as interior or architectural design shape human behavior, but limited attention has focused on the extent to which physical objects or products can serve as situational cues to produce downstream consequences—e.g., engaging in prosocial behavior. It has been documented in the design and marketing literatures that modifying the form of a product and its associated meanings can significantly impact cognition, emotion and behavior in the context of product consumption. Moreover, the role of mundane objects in directing everyday interpersonal judgments and perceptions has been considered from an anthropological perspective, most notably that material objects hold meaning beyond their physical shapes and functions (Miller, 1998). Yet little is

known about how physical characteristics of objects affect social perceptions and behavioral outcomes. This is surprising given that man-made objects or products are expressive on their own insofar as they conveying meanings through their formal properties such as shape, size, color and texture.

In our present research, we examine how product expression can lead to meaningful downstream consequences. For example, can the design of a plate upon which food is served increase donations at a charity banquet? Can the design of coffee mugs used by people at a business meeting enhance cooperative behavior? Understanding the potential impact of product expression in everyday life settings may not only provide a practical technique for designers to influence human behavior, but may also contribute to design education and philosophy.

This paper focuses on the role of product expression as a situational cue that promotes interdependent self-construal, which in turn may be predictive of a variety of behaviors such as how close one sits to a new acquaintance, well-being and prosocial behavior. In particular, we propose and demonstrate that representation of connectedness in product form leads to a greater sense of social connectedness and thereby judgments of the self as an interdependent entity. We begin by reviewing the extant literature related to product expression, i.e., the communicative functions of product form. We also review the prior literature on priming and social connectedness. We then present two experiments that investigate the extent to which design features expressive of the theme of connectedness influence social connectedness (how one views oneself in relation to others).

3.2 LITERATURE REVIEW

3.2.1 Product expression

A product is defined as a bundle of benefits that a company offers to its consumers to meet their needs and wants (Webster, 1994), and the term "product" can be applied to a wide range of goods and services, both tangible and intangible. Product expression refers to how a product's form is communicative of function and represents a number of elements chosen and blended into a whole by the designer or design team to achieve a particular sensory effect (Hollins & Pugh,

1990; Lewalski, 1988). Product expression thus plays a critical role in determining consumer responses and market success. The form can attract consumers to a product, communicate information, and enhance product experience (Bloch, 1995).

Communicative functions of products

Designers started considering the communicative functions of products in reaction to the method of conception based on practical functions that was pervasive in the 1960s. Since then, semantic approaches for analyzing and improving symbolic qualities of a product form have been introduced in academia and practice. In the 1980s, for example, Krippendorff and Butter (1984) introduced product semantics – defined as the study of symbolic qualities of man-made forms in cognitive and social contexts, and their use and application in industrial design – to facilitate communications between a product and its user.

Gros' (1984) theory of product language, an example of applied product semantics, suggests a useful way to employ semantic concepts in design. In his conceptual model, Gros makes a distinction between the practical functions and language functions of products. The product language functions can be subdivided into two parts, the *formal aesthetic functions* and the *semantic functions*. The *formal aesthetic functions* (related to 'visceral level' in design; Norman, 2004) refer to formal aspects that can be observed regardless of the meaning, corresponding to syntax (or grammar) in a science of language. These aspects evoke aesthetic impressions among perceivers, that is, the sensation that stems from perceptions of attractiveness (or unattractiveness) in products (Crilly, Moultrie, & Clarkson, 2004).

Semantic functions are defined as the carriers of meaning and are further differentiated between indicating functions and symbol functions. The *indicating function* (related to 'behavioral level' in design; Norman, 2004) is related to 'self-explanation' of products, consistent with the concept of affordance (Gibson, 1979). In Gibson's ecological approach, affordances are defined as action possibilities latent in the environment, and artifacts are considered as bundles of affordances. For example, the grooves of a handle express how a product is to be grasped. Thus a product form describes the product's purpose and mode of use, expresses the product's utility and quality, exhorts the user to take appropriate actions and operations, and communicates the product's

origin and affiliation (Mono, 1997). The *symbolic functions* (related to 'reflective level' in design; Norman, 2004) provide information associated with what is imagined. Whereas the indicating function refers to what the product is seen to indicate about itself or the socio-cultural context, the symbolic function is about what is seen to symbolize about its user (Crilly et al., 2004). This is analogous to Langer's distinction between signs and symbols: "Signs announce their objects to him (the user), whereas symbols lead him to conceive their objects" (Langer, 1963: p. 61). The symbolic function is based on cultural and social convention and tradition; thus the message and meaning of a product is determined by cultural norms and context.

Crilly and colleagues (2004) reviewed and integrated a number of existing models and frameworks from a wide range of disciplines, and developed a general framework to understand consumer responses to product form. This framework, in line with Gros' theory of product language, takes a semiotic perspective of product design by considering consumer responses to product appearance as one stage in a communication process. The process of communication eventually prompts cognitive, affective and behavioral responses to a product, which is moderated by a number of variables, including consumers' individual characteristics and cultural/situational factors (for a comprehensive review, see Crilly et al., 2004). In this model, aesthetic impression, semantic impression, and symbolic association of consumer responses correspond to formal aesthetic functions, indicating functions, and symbol functions (respectively) in Gros' theory. As Crilly et al. (2004) noted, the product language functions do not operate independently; they influence one another when consumers react to product design.

In sum, products have language functions; they are expressive of various types of meanings through their appearance (design). Since product meaning is interpreted as being a part of a product's appearance or expressive characteristics, we assert that people interpret meanings attached to a product that are consistent with the product's perceived expression. We suggest that product expression has a significant impact on consumer behavior especially in light of the increased emphasis placed on experiential or representational qualities of products by marketers and consumers alike.

The influence of product expression

Prior studies in marketing and in design have demonstrated the importance of product expression with respect to consumer decision-making (e.g., Creusen & Schooermans, 2005; Van Rompay, Pruyn, & Tieke, 2009), brand impression (e.g., Bloch, 1995; Childers & Jass, 2002; Karjalainen, 2007), self-expression (e.g., Belk 1988; Goffman, 1990; Richins, 1994) and identity formation (e.g., Belk 1988; Sirgy 1982; Solomon 1983). Consumer research on product expression or symbolism has primarily focused on consumer-product interaction in the context of consumption, with limited attention devoted to how product expression can influence behaviors beyond those relating to product purchase or use. Can the influence of product expression extend beyond the typical consumer-product interaction to other aspects of people's lives?

Psychological studies have found that representational qualities of products are capable of being situational cues that shape people's inner psyche or social activities. For example, mere exposure to a gun increased aggression among college students (Berkowitz & Lepage, 1967) and exposure to a briefcase elicited the concept of competition and made subjects perceive ambiguous social interactions as less cooperative (Kay, Wheeler, Bargh, & Ross, 2004). Further, green products were found to stimulate altruistic behavior (Mazar & Zhong, 2010), and exposure to the Apple company logo increased creativity (Fitzsimons, Chartrand, & Fitzsimons, 2008). Although these studies have demonstrated that product-associated meanings can influence behavior that is not directly related to product use, they have been limited to examining meanings that largely capture symbolic associations and depend less on product appearance. For example, symbolic meanings attached to a gun (i.e., aggression) are determined by cultural norms and values assigned to the general product category rather than the design form of the gun.

We sometimes encounter obvious relations between particular formal features and expressive qualities, although it is not always easy to verbalize the relationship. For example, angular and rounded shapes tend to generate different associations. Angular shapes tend to activate associations with traits that express energy, toughness, and strength. In contrast, rounded shapes tend to activate associations with traits that express approachabilty, friendliness, and harmony (Arnheim, 1974). People also generally perceive rounded logos as more *harmonious* and less *aggressive* than angular logos (Zhang, Feick, & Price, 2006).

The departure point for the present paper involves regarding products as actively conveying meaning through their own intrinsic, physical qualities rather than as passive reflection of values and norms that are assigned to them. We focus on meanings determined by the characteristics in product appearance and examine how those meanings can affect one's judgments of the self in relation to others. We suggest that when people perceive a certain form, associated meanings are activated, and this in turn triggers responses that are consistent with the meanings. In the next section, we discuss this process in greater detail.

3.2.2 Mechanism of meaning projection

A dominant theory of cognitive representation has been the semantic associative network (e.g., Collin & Loftus, 1975; Neely, 1977). Concepts are represented in memory as nodes, and relations are represented as associative pathways between the nodes. According to this theory, once a concept is activated, associated concepts are also triggered through a spreading activation. When a part of the memory network is activated, the activation spreads along associative pathways to related areas in memory. For example, activation of *nurse* would produce spreading activation to associates such as *doctor and hospital*. The spread of activation serves to make these associates available for further cognitive processing and thereby facilitates priming.

Priming refers to an implicit memory effect in which some previously activated information impacts the processing of subsequent information. For example, a word such as *dog* (the target word) is recognized more quickly when it is preceded by a related prime word (e.g., *cat*) than when it is preceded by an unrelated word (e.g., *computer*). Psychological research has long demonstrated that priming has consequences for judgments, emotions, and behavior even without our awareness, and a cue, such as an object, a word, or a symbol in the surrounding environment, can trigger the initial mental activation (Bargh, Chen, & Burrows, 1996).

A growing body of research in experimental psychology has suggested a more sophisticated type of priming, caused by metaphoric relations between concrete bodily concepts and abstract social concepts. Provided that people use metaphor to not only talk about but also understand abstract concepts in the world (Lakoff & Johnson, 1980), researchers have shown that manipulating

sensations and other psychological states related to concrete bodily concepts can produce transfer effects in a wide range of social psychological phenomena in metaphorically consistent ways. For example, people who simply held a warm beverage described a target individual as having a warmer personality (Williams & Bargh, 2008). Similarly, Ackerman, Nocera, and Bargh (2010) showed that tactile features of products such as hardness, weight, and texture influence impressions during social interactions. For example, people sitting on hard chairs were more rigid in negotiating the sale price of a new car, and people evaluated job candidates more seriously when reviewing resumes on a heavy rather than a light clipboard. People who completed a difficult puzzle tended to view a subsequent social interaction as being more difficult, harsh and argumentative.

These prior studies illustrate that conceptual metaphors operate to influence diverse cognitive processes that shape social attitudes and behavior. Moreover, they suggest how physical features of objects may trigger initial mental constructs that generate downstream effects across multiple conceptual domains. This prior line of research has focused on the existence and nature of the responses rather than the source of influence (i.e., the material objects). Hence, how visual sensory aspects of a product, which make up the core aspect of a product form, play a role remains unclear. It is likely that visual appearance of products provides a powerful source of influence because the product form can provide a shortcut to meaning.

Pilot study: Demonstration that form impacts social meaning
Although Chapter 2 demonstrated that design features impact the meaning of objects, it remains unclear whether design features could generate downstream effects on meanings in different conceptual domains. To empirically test this idea, we conducted a small-scale pilot study. Given that i) particular design features represent meanings, and ii) judgments and perceptions can be affected by product meaning via cognitive accessibility, we predict that design-generated priming effects will obtain. That is, exposure to particular design features may communicate meanings and associated mental constructs, which in turn systematically influence subsequent responses. Participants (*n*=153) were recruited from Amazon Mturk (mean age = 32; 51% female) and asked to rate on a 7-point scale as to how each of seven personality adjectives (flexible, cooperative, sympathetic, friendly, giving, warm, and considerate) describes a person

shown in either a rounded or an angular picture frame (see Figure 3a). The results (see Figure 3b) showed that people perceive an image of a person in a *rounded* picture frame as having a more *flexible and cooperative* personality than the same person in an *angular* picture frame (flexible: $t(151)=2.09$, $p<.05$; cooperative: $t(151)=1.97$, $p<.05$; no other difference reached statistical significance). Meanings associated with a rounded shape (e.g., harmony, friendliness, approachability) generated downstream influence on personality perceptions, suggesting a metaphorical relation between the concrete concept of visual roundedness and the abstract concept of social friendliness.
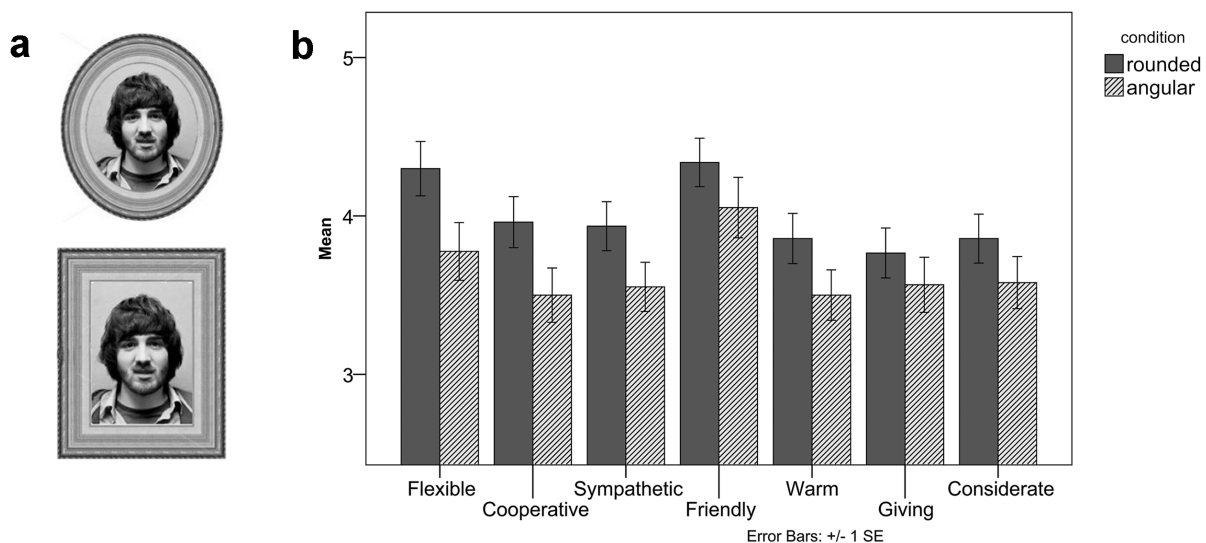
Figure 3 Visual stimuli and results of the picture frame pilot study: (a) A person in a rounded picture frame (top) and the same person in an angular picture frame (bottom); (b) Results

3.2.3 Social connectedness

A basic human need is to feel connected or related to other human beings (Baumeister & Leary, 1995; Deci & Ryan, 2000). Prior research has shown that feeling connected to others enhances psychological and physical well-being (Brown, Nesse, Vinokur, & Smith, 2003), and leads to a greater sense of empathy (Cialdini, Brown, Lewis, Luce, & Neuberg, 1997) as well as trust and cooperation (Glaeser, Laibson, Scheinkman, & Soutter, 2000).

Although human relationships appear to be important for all human beings, there are differences in the degree to which these relationships influence an individual's sense of self. The difference

in whether one views the self either as independent (or individualistic) or interdependent (or collectivistic) has been referred to as one's self-construal (Markus & Kitayama, 1991). Individuals with an independent self-construal tend to see the self as detached from their social context, and value autonomy and uniqueness. Those with an interdependent self-construal, on the other hand, see the self as more intertwined with the social context, and value maintaining group harmony and fitting in. Which type of self-construal is dominant is known to be highly influenced by culture (Markus & Kitayama, 1991), with Westerners being more independent than interdependent and East Asians being more interdependent than independent.

A number of researchers in cultural psychology have shown that self-construal influences cognitive styles, aesthetic preference (Zhang, Feick, & Price, 2006), motivation, and social behaviors (Van Baaren, Horgan, Chartand, & Dijkmans, 2004). For example, individuals who are highly interdependent have been found to report higher self-confidence when thinking of a close friend (Gabriel, Reaud, & Tippin, 2007), and sit closer to a new acquaintance (Holland, Roeder, Van Baaren, Brandt, & Hannover, 2003) than those who are relatively less interdependent. Overall, those with a highly interdependent self-construal put more effort into being close to others and derive more personal satisfaction from their close relationships than individuals who perceive themselves as less interdependent (Markus & Kitayaman, 1991). Previous research has also shown that interdependence predicts health and well-being (Kitayama, Karasawa, Curhan, Ryff, & Markus, 2010), and fosters prosocial behavior (Ashton-James, Baaren, Chartrand, Decety, & Karremans, 2007; Karremans, Van Lange, & Holland, 2005; Van Lange, 1999).

Although there are two distinct types of self-construal, people do not always fall into either one or the other (Oyserman, 2011). In fact, all of us have both independent and interdependent self-concepts. However, the relative accessibility of these self-concepts can be influenced by situational cues such as cultural icons (e.g., the Statue of Liberty vs. The Great Wall; Hong, Chiu, & Kung, 1997) and collective pronouns (e.g., I vs. We; Gardner, Gabriel, & Lee, 1999). For example, one's self–construal becomes more interdependent after being asked to circle all pronouns in a passage that includes instances of "we" and "us" compared to a passage containing instances of "I" and "me".

We suggest that one's feeling of connectedness is situationally malleable such that it can be influenced by relevant words or images. In particular, we examine how "product expression" can affect one's sense of interdependence. We propose that once a product form activates meanings relevant to the concept of connectedness, this leads to a self-construal that is more interdependent. This poses a twofold question: first, what type of visual form evokes the concept of connectedness; and second, can the visual form of the product lead to a greater sense of interdependence?

3.3 HYPOTHESIS

What forms are expressive of the concept of interdependence or connectedness? The word *connect* ("Connect", 2012) was originally from Latin, *connectere* which means "to fasten together, to tie, join together (from con- "together" + nectere "to bind/tie/fasten"). According to Oxford English Dictionary, meaning of *connection* ("Connection", 2012) is the condition of being related to something else by a bond of interdependence, causality, logical sequence, coherence, or the like; interdependence is defined as the condition of depending on one other. Thus, we propose that forms having parts or elements joined together by a mutual dependence can represent the concept of connectedness. Synonyms of the words *connect* and *interdependent* ("Interdependent", 2012) could provide further insights on various embodiments of the mutual dependence. Synonyms include the following: affix, attach, bridge, fasten, get into, hook, plug into, tie in, yoke, intertwined, interwoven, joint, knit together, linked, mutual, parallel, reciprocal, relevant, similar, tied up, matched, completing, and complementary.

We hypothesize that perceiving these characteristics in a joining relationship among formal visual elements in products communicate the general concept of being connected. We further hypothesize that the concept activates the related construct of social connectedness; and as such, one's feeling of being socially connected is likely to become more salient. In Experiment 1, we investigate visual characteristics of forms that represent the concept of connectedness (i.e., connectedness cues). In Experiment 2, we test whether the connectedness cues lead to greater judgments of interdependence.

3.4 EXPERIMENT 1: Design Task

The goal of this study was to understand design features that represent the concept of connectedness. The meaning of connectedness can be represented in various ways, but we were interested in how the theme of connectedness is physically embedded in product forms through design features, especially in terms of joint relationships between design elements. We sought to identify design dimensions contributing to the meaning of connectedness and to understand the characteristics of each dimension.

3.4.1 Method

Experiment 1 involved a task in which participants were asked to design visual images expressive of connectedness. A total of 39 undergraduates (29 females, mean age=19) from an introductory psychology class at the University of Michigan participated in the design task. They were informed that a company was about to launch a new product and needed a logo/trademark that visually communicates the new brand slogan, *connectedness*. They were told to imagine that they were designers who had to create a brand logo and to design a logo/trademark that visually communicates the concept of connectedness. They were then asked to draw the visual images on sheets of paper that were provided to them. They were instructed not to communicate the concept through words (e.g., the word *connectedness*) but rather to communicate the concept abstractly through geometric or organic shapes. They were asked to generate as many design ideas as they could for 15 minutes and to indicate the final design (or designs) that they wished to present to the company.

Among all 49 logos that participants indicated as final designs, we removed 26 logos that included typographies (e.g., the word 'connectedness') and pictorial representations of people and real-world items (e.g., images of people holding hands, people talking on the phone, globes, and power buttons). We reasoned that such typographic or pictorial representations would not be informative with respect to the formal elements and design principles. After excluding 26 logos, a total of 23 logos were used in the subsequent analysis.

3.4.2 Results and discussion
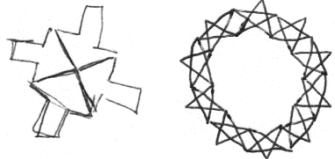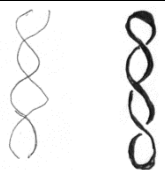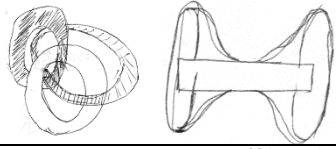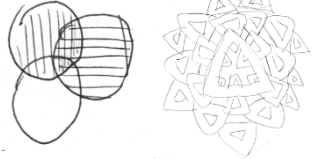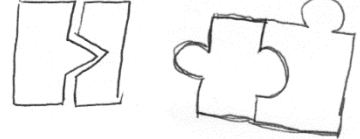
Two independent coders with an industrial design background who were blind to the study hypotheses rated each logo on seven dimensions using bipolar adjectives in a dichotomous format. The dimensions included overall shape, number of shape elements, similarity among shape elements, proximity, balance, symmetry, and repetition (see Table 6). The coders also sorted logos by six types of joint relationship (no joint, joint on a common edge, intertwined, linked, superimposed, complementarity) and evaluated each logo on a 5-point scale as to how well it represented the theme of connectedness.

Inter-coder agreement was relatively high (80%). When disagreements between the coders arose, a third coder reconciled them. We used frequencies to identify common characteristics in each dimension. The majority of the logos were perceived as having *multiple* and *homogenous* shape elements: they used the same elements *repetitively* arranged in *close* proximity. The overall shapes of the logos were generally perceived as *symmetrical*, *rounded* and *balanced.* In terms of joint relationships between the individual elements, 78% of the logos had shape elements either locked in complementary relationships (e.g., concavity and convexity; 39%), superimposed/overlapped on each other (22%), or linked (17%). Figure 4 shows four logos that had the highest ratings (mean = 4.5) on effective representation of the connectedness theme.
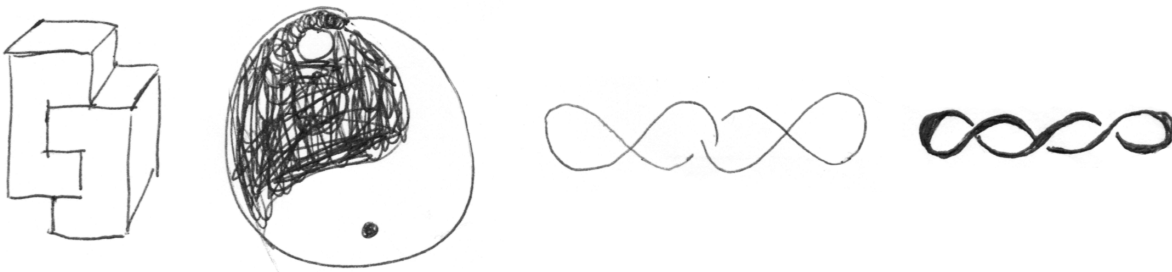
Figure 4 Logos representing connectedness

Table 6 Coding scheme and results

Dimensions	Frequency results
The number of elements	Singular (0%) vs. **Multiple** (100%)
Similarity	Heterogeneous (22%) vs. **Homogeneous** (78%)
Repetition	Not repetitive (13%) vs. **Repetitive** (87%)
Proximity	Distant (4%) vs. **Close** (96%)
Overall symmetry	Asymmetrical (35%) vs. **Symmetrical** (65%)
Overall shape	Angular (39%) vs. **Rounded** (61%)
Overall balance	Instable (0%) vs. **Balanced** (100%)

A type of joint relationship		Examples
	No joint (4%)	
	Joint on a common edge (9%)	
	Intertwined (9%)	
	Linked (17%)	
	Superimposed/overlapped (22%)	
	Complementarity/ concavity & convexity (39%)	

In sum, the majority of participants visually expressed the concept of connectedness through specific types of physical continuity or joints between multiple, similar shape elements. The types of joint relationships included complementarity (i.e., concave-convex relations), link, and intertwinement. Thus joint relationships in design features seem to be a key characteristic that people invoke to visually communicate the concept of connectedness. Building on the priming literature reviewed above (i.e., spreading activation tends to be symmetric) we make the reverse inference relative to the finding in Experiment 1 and hypothesize that designs that feature joint relationships may prime connectedness and self-construal.

3.5 EXPERIMENT 2: Connectedness design cues prime self-construal

We next examined the effect of connectedness design cues on interdependent self-construal. In particular, Experiment 2 investigated whether particular design features (i.e., connectedness cues) as implemented in common products generate greater interdependent self-construal.

3.5.1 Method

Stimuli

Based on design characteristics of connectedness that were identified in Experiment 1, we adopted images of real products with design characteristics of connectedness: three "connected" objects and three counterpart objects (i.e., control) as shown in Figure 5. The connected objects were a set of products having a complementary relationship to complete a form or function, whereas the control objects lacked the cues for complementarity but were otherwise matched to the connected objects in terms of standard design features such as the number of elements, function, similarity and proximity.

These objects were pretested to ensure that they were perceived as different in the design dimensions of interest. One hundred and fifty-seven participants were recruited via Amazon Mturk (60% female, mean age=30). Participants evaluated each object on 7-point rating scales (1=not at all; 7=very much) on the following dimensions: interlocking, fitting together, complementary, novelty, and liking. The first three rating scales were averaged to form an

aggregate measure of connectedness (r=.78). The connected objects (*M*=5.52, *SD*=0.95) were rated significantly higher in connectedness than the control objects (*M*=4.90, *SD*=1.08; *t*(155)=3.82*, p*<.001). The connected objects (*M*=5.15, *SD*=0.92) were also perceived to be more novel than the control objects (*M*=3.14, *SD*=0.78; *t*(155)=14.87, *p*<.001). There was no difference in liking between the connected and control objects (*p*=.37) which indicates that any significant differences on main dependent measures we obtain are unlikely to be due to differences in liking.
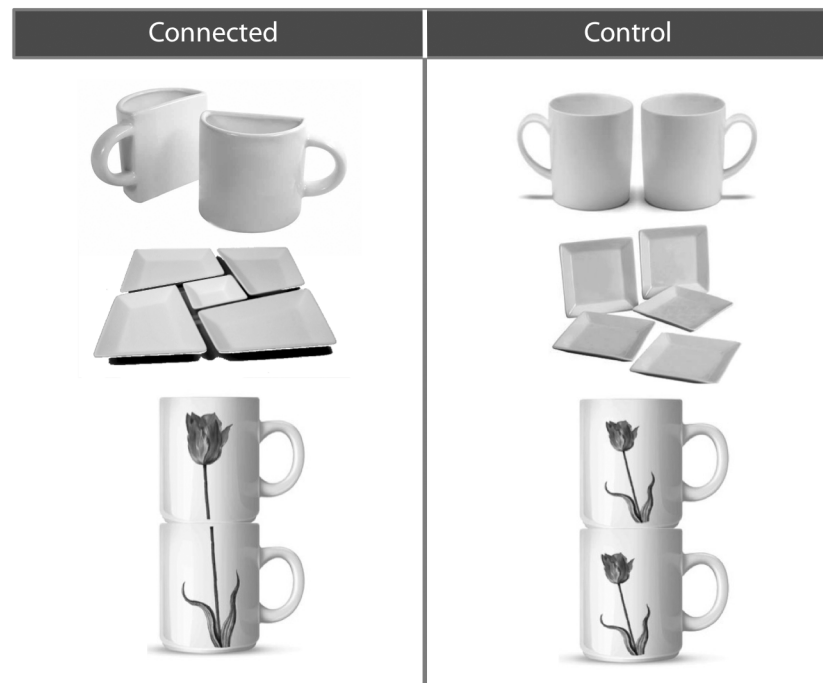
Figure 5 Experimental stimuli: connected (left) and control (right) objects

Procedure

Two hundred and thirteen participants (55% female, mean age=30) recruited on Amazon Mturk completed an online questionnaire. They were told that the purpose of the study was to examine the relation between different kinds of cognitive processes and that they would be participating in two simple tasks intended to assess different kinds of thinking. They were further informed that the first task involved the assessment of product design and the second involved a sentence completion task. Half the participants were randomly assigned to the connected condition in which participants viewed images of "connected" objects, and the other half were assigned to the control condition. All participants were presented with a set of three images in a counterbalanced

order. For each object they viewed, participants were asked to describe it with three adjectives. After participants viewed the objects, they completed a modified Twenty Statement Test (TST; Kuhn & McPartland, 1954) in which they completed ten statements that begin with "I am."

Coding scheme

TST is a standard self-construal measure that allows participants to define themselves or construe their identity in reference to their social roles, groups, status, and relationships. The content of self-description in the TST was coded as independent, interdependent, or not relevant by using a standard TST coding scheme (Gardner et al., 1999). Descriptions about personal traits, ability and attitudes (e.g., "I am smart," "I am tall") were coded as independent self-description, whereas descriptions about social roles or membership (e.g., "I am a mother," "I am a student of the University of Michigan") were coded as interdependent self-descriptions. Descriptions that referred to neither personal attributes nor social membership, such as statements referring to their situation (e.g., "I am doing this survey"), and other miscellaneous statements (e.g., "I am a penguin,") were coded as 'not relevant.'

3.5.2 Results and discussion

Two independent coders, who were blind to the hypotheses and experimental conditions, coded the first five of ten statements. We analyzed the first five statements as they tend to be the most salient for respondents (Carpenter & Meade-Pruitt, 2008). We also reasoned that the subtle and momentary priming effect of connectedness cues would be more likely to be captured in those initial statements. Past studies have similarly analyzed a subset of TST responses (Cousins, 1989; Gray, Ishii, & Ambady, 2011; Jones, Sensenig, & Haley, 1974; Watkins, Yau, Dahlin, & Wondimu, 1997). Inter-coder reliability was 0.70. A two-way repeated-measures ANOVA was conducted to examine the effect of experimental manipulation (connected vs. control objects) on types of self-descriptions. The primary dependent variable of interest was the number of interdependent and independent self-descriptions. We obtained a significant interaction between the type of object and the type of self-descriptions, $F(1,211)=3.77$, $p<.05$. Participants in the connected objects condition expressed more interdependent descriptions ($M=0.87$, $SD=1.22$) than did those in the control objects condition ($M=0.55$, $SD=1.01$; $t(211)=2.09$, $p<.05$, while

those in the connected objects condition produced marginally fewer independent descriptions (M= 4.07, SD= 1.26) than did those in the control objects condition (M=4.35, SD=1.11; t(211)=1.75, p=.08) (see Figure 6).

Exposure to connected objects resulted in more interdependent descriptions than was found with control objects. In other words, viewing objects that were connected (compared to those were not connected) shifted one's self-construal towards greater interdependence. It is noteworthy that viewing three product images can systematically affect one's self-concept in relation to others. The results importantly provide support for our prediction that product form communicates meaning which in turn influences judgments in a manner congruent with the activated meaning.
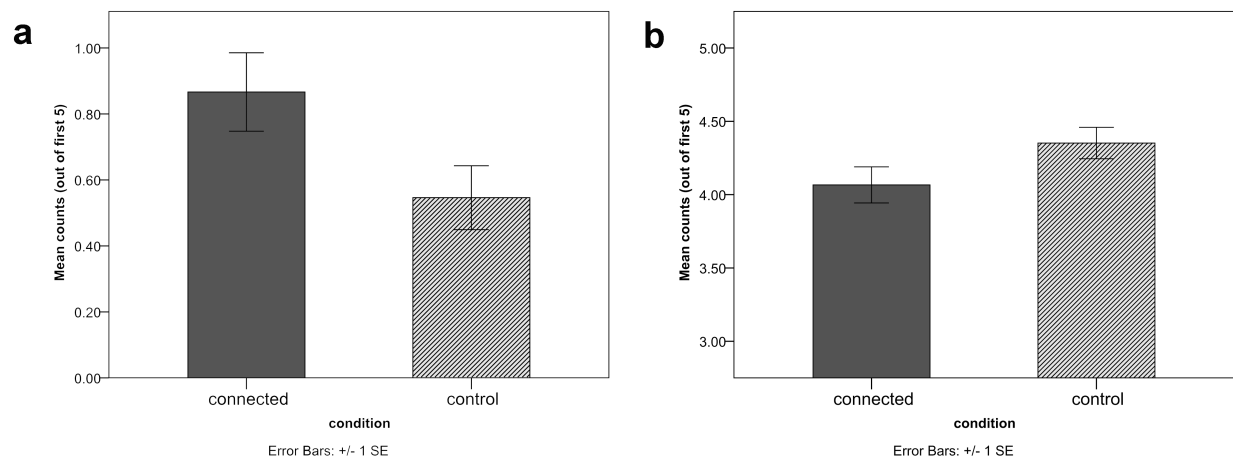
Figure 6 Counts of interdependent descriptions (a) and independent descriptions (b)

3.6 GENERAL DISCUSSION

The results of our experiments provided evidence consistent with the notion that we "are" what we surround ourselves by. We demonstrated that exposure to particular design features (i.e., connectedness cues) implemented in common products influences one's perception of self in a way that is congruent with their associated meanings (i.e., generate greater interdependent self-construal). We identified particular design characteristics representing the theme of connectedness (e.g., complementary joint relationships) (Experiment 1), manipulated connectedness by varying the joint relationships in products, and found that participants listed

more interdependent than self-descriptions after viewing connected mugs and a connected set of dinner plates compared to control objects (Experiment 2).

3.6.1 Theoretical and practical implications

This research demonstrates the value of attending to the design properties of objects and their messages in delivering subtle cues to influence human perception, cognition and behavior. We suggest that the results may apply beyond product design to broader domains associated with visual communications. Understanding the potential impact of product expression may yield novel insights regarding designers' roles and their design philosophies. An awareness of this influence will inform designers about their role in potentially having more far-reaching influence that extends beyond pleasing users and provide them with practical techniques on how to realize such influence.

The present findings also contribute to a better understanding of product meaning or symbolism as an environmental influence. The assertion that product meaning is used for expressing one's self-concept or identity has been well documented in design and consumer research. It has long been acknowledged that product meaning can serve the consumer's goal for satisfying a need or for impression management, and also play a role in generating situational self-concept and behavior (e.g., clothing symbolism influences role performance). The current paper explores the role of product meaning in terms of design features and suggests that product meaning can also exert an influence on self-construal even without possession or consumption of the product. It, therefore, contributes to extensive ongoing efforts to promote desirable behavior by using design features of products as situational cues that influence one's internal state. We hope that this research encourages an active sharing of ideas among researchers in related disciplines, especially between behavioral scientists who concentrate on the effect of environmental cues on human behavior and designers who are interested in behavior change.

In addition, although our findings provide a demonstration that design-evoked meanings can lead to meaningful variations in judgments of the self and in relations to others, we expect that the influence of connectedness cues would go beyond the demonstrated effects in the present study

and have downstream behavioral consequences. These insights have implications for the promotion of healthy, prosocial behavior. For instance, previous studies have shown that an interdependent self-construal leads to more prosocial behavior (Ashton-James, Baaren, Chartrand, Decety, & Karremans, 2007). Drawing on this prior evidence, we expect that perceiving the connectedness cues will result in greater likelihood of prosocial behavior, potentially mediated by interdependent self-construal. These hypotheses about the relation between connectedness cues, products, self-construal, and prosocial behavior await empirical testing in future studies.

3.6.2 Limitations and future research

Despite the theoretical and practical implications of our findings, there are potential limitations that we wish to acknowledge. First, in Experiment 2 images of products were presented to participants in a product evaluation format. This controlled setting might have exaggerated the priming effect of product expression by having participants pay overt attention to the products. Given that human actions are situated and influenced by various contextual factors, future research should consider more realistic settings in which products are situated and investigate the circumstances under which product forms serve as situational primes. Moreover, the present studies primarily focused on the impact of connected shapes on one particular type of judgment: interdependent self-construal. It remains an open question whether contextually relevant, meaningful downstream effects can be demonstrated with other types of meanings and in other domains. Future studies will have to test the robustness of the present findings by demonstrating the range of meanings that are associated with different product forms, and the types of contexts and judgments that may be susceptible to such influences.

Second, it should be noted that our studies focused on meanings of formal characteristics of shapes in isolation. However, meanings around products are usually more complicated. Not only are products complex stimuli that comprise multiple visual elements beside shapes, but various factors besides product appearance can also imbue products with meaning that can overshadow representational qualities associated with product appearance. For example, certain products will always activate specific meanings characterized by their brands or marketing activities regardless

of their design details, especially when the brand has a stable brand image. We may need to consider the influence of design-associated meanings only when associations evoked by other factors are less salient. Therefore, the relative strength or congruency between meanings of products as a function of a range of variables should be considered by designers when seeking to harness the influence of product expression.

Third, although we reason that the connected objects influence cognitive accessibility of the general concept of connectedness or interdependence, the current research is silent on how that comes about. Indeed, there are likely to be multiple possible pathways in activating the general concept. For example, perceiving the connected objects and making sense of the multiple pieces that need to be physically together for visual completion, participants may need to project themselves onto the products to understand product expression. This process of empathetic or bodily experience may be responsible for corresponding changes in one's self-concept. In addition, unlike in visual arts or graphics, products hold additional meanings associated with product use. Therefore, the connected objects in our study may have simply afforded an action possibility of connecting pieces or/and communicated such meanings more symbolically, that is, meanings of mentally connecting owners/users who share the set. Future research should seek to further elucidate the mechanisms underlying the effects observed in the present research.

Lastly, our studies focused primarily on consequences of meanings associated with product form. Yet understanding relations between formal features and symbolic meanings or knowing how to design to represent meaning is also important. Attempts to account for structural relations between visual elements and expressive qualities often do not extend beyond global attributions such as size or color (Van Rompay, 2008). Therefore, continuous empirical effort to identify relations between form and meaning is warranted.

CHAPTER 4 Connected Shapes and Cooperative Behavior

4.1 INTRODUCTION

We often face social dilemmas in which individuals' personal interests are at odds with group benefits. Situations such as voting, paying taxes, teamwork, and environmental protection demonstrate the tension between individual and collective rationality. Researchers from social psychology and experimental economics have long been examining the nature of psychological mechanisms that may foster cooperation and bring about behavior change through both explicit and implicit interventions.

It is widely recognized that communications that make social norms (i.e., information about what others do) salient can be effective in influencing prosocial behavior. In addition to activating social norms, rather subtle interventions, such as framing and priming, have been found to significantly impact prosocial behavior in social dilemmas. For example, simply labeling a psychological game as a "community game" (vs. "wall street game") significantly increases cooperation rates (Liberman, Samuels, & Ross, 2004). Moreover, contributions to the public good tend to increase when people make contributions in an environment that includes the subtle hint of "watching eyes" - a configuration of three dots suggestive of a schematic face (Ridgon, Ishii, Watabe, & Kitayama, 2009). These studies illustrate how sensitive prosocial behavior can be to the presence of situational cues; choice behaviors become more generous with the help of proper cues.

In this article, we focus on other subtle cues, i.e., "connectedness cues" and how the cues influence cooperative behavior in the presence of social norms. Connectedness cues are known to activate the feeling of being socially connected or interdependent (Kim, Yoon, & Gonzalez, 2012). Given that people with interdependent self-construals tend to conform to social norms

(Kim & Markus, 1999), we argue that the effect of connectedness cues on cooperation would be dependent on the level of social norms to the extent that connectedness cues would lead to greater cooperative behavior in a situation with a high cooperation norm. Across two experiments employing a public goods game, we tested the relationship between connectedness cues, contribution norms, and contribution decisions.

4.2 LITERATURE REVIEW

4.2.1 Social connectedness and prosocial behavior

Prior research has shown that feeling connected to others enhances a sense of empathy (Cialdini, Brown, Lewis, Luce, & Neuberg, 1997), trust and cooperation (Glaeser, Laibson, Scheinkman, & Soutter, 2000), and volunteering behavior (Pavey, Greitemeyer, & Sparks, 2011). Consistent with this idea, viewing the self as interdependent has been associated with an enhanced tendency to conform to social norms (Kim & Markus, 1999), to the decisions of others (Iyengar & Lepper, 1999), to be fundamentally connected to others (Van Baaren, Horgan, Chartand, & Dijkmans, 2004) and to engage in prosocial behavior (Ashton-James, Baaren, Chartrand, Decety, & Karremans, 2007; Karremans, Van Lange, & Holland, 2005; Van Lange, 1999).

Although social relationships appear to be important for all people, there are differences in the extent to which these relationships influence an individual's perception of self. The difference in whether one views the self either as independent or interdependent has been referred to as one's self-construal (Markus & Kitayama, 1991). Recent research has established two distinct types of self-construal: Independent self-construal and interdependent self-construal. The independent self-construal involves viewing oneself as autonomous, distinct from others, and self-reliant. In contrast, the interdependent self-construal involves viewing oneself as intertwined with the social context and maintaining group harmony and fitting-in. Therefore, it is, perhaps, not surprising to see that people with interdependent self-construals are more attentive to social context in general, maintaining cooperative relationships with others.

Which type of self-construal is dominant is known to be highly influenced by culture (Markus & Kitayama, 1991), with Westerners being more independent than interdependent and East Asians

being more interdependent than independent. However, the relative accessibility of these self-concepts can be influenced by situational cues; researchers have been manipulating the salience of independent vs. interdependent self-construals by subtle situational primes (e.g., Gardner, Gabriel, & Lee, 1999; Kuhnen & Hannover, 2000; Trafimow, Triandis, & Goto, 1991). For example, Kim, Yoon, & Gonzalez (2012) have recently demonstrated that "connectedness cues" could promote the interdependence of one's self-construal. Connectedness cues refer to visual stimuli representing the concept of connectedness through complementary joint relationships of visual elements. In their study, they found that perceiving three products that have complementary joint relationships in their form resulted in more descriptions of the self as an interdependent entity. Adopting the idea of connectedness cues to temporarily activate one's internal state of being interdependent, one of our goals is to validate and extend the effect of connectedness cues to social interaction, more specifically, cooperative behavior in social dilemmas.

4.2.2 Social norms and prosocial behavior

Researchers in various fields have long documented the powerful influence of observed social behavior on prompting subsequent similar behavior in the observers (e.g., Cialdini, Reno, & Kallgren, 1990; Festinger, 1954; Milgram, Bickman, & Berkowitz, 1969). Studies have well demonstrated that descriptive social norms, which refer to the perception of what is commonly done in a situation, can increase the likelihood that an individual will behave consistently with them. For example, researchers have found that emphasizing the prosocial descriptive norm that few people litter on the street has the effect of reducing littering (Cialdini et al., 1990).

Moreover, manipulating the level of social norms can systematically influence the level of prosocial behavior. That is, people are more willing to contribute the more others contribute, which is consistent with the idea of "conditional cooperators" (Fishbacher, Gaechter, & Fehr, 2001) from the literature in behavioral economics. For example, researchers have found that telling public radio donors how much a more generous donor has contributed increased their contributions and renewal rates. In contrast, they decreased their contributions when provided

with information about another donor who contributed less than their previous contributions (Shang & Croson, 2006).

4.2.3 The present research

Although previous research has considered interdependent self-construals and social norms separately to promote cooperative behavior, it would be interesting to examine how those two factors would work together to influence cooperation in social dilemmas. Although individuals with interdependent self-construals tend to pursue collective interest (vs. self interest) in social dilemmas (Utz, 2004), knowing how much others contribute (i.e., contribution norms) might create a greater challenge for interdependent people to follow their desire to conform the contribution norms.

The present research aims to look at both connectedness cues (i.e., activated interdependent self-construals) and social norms in social dilemmas. In other words, this research involves the possible interplay among connectedness cues and contribution norms, and resulting contribution decisions to the public good. In our experiments, after presented with either connectedness cues or control cues, subjects make their contributions to the public fund under different levels of contribution norms. The level of contribution norms would positively influence the level of people's contributions in general such that people contribute more under a higher contribution norm. However, we expect that the impact of contribution norms would be more prominent after the exposure to connectedness cues, because such an exposure would activate interdependent self-construals, and in turn, increase conformity to contribution norms. Therefore, after exposed to connectedness cues, we argue that people would be more attentive to contribution norms, which may bring out significantly more contributions in a situation with a high contribution norm. However, we predict weaker effect of connectedness cues when people make contributions under a low contribution norm, because people are naturally more conforming to a lower contribution norm.

4.3 EXPERIMENT 1

To test our hypothesis, we first developed four connected symbols (i.e., connectedness cues) and four control counterparts by manipulating joint relationships of visual elements. We then presented subjects with the connected symbols (vs. control symbols) before making contribution decisions in a money game, which is an adapted linear public goods game. We also manipulated the level of contribution norms in the money game.

4.3.1 Method

Connectedness cues

The manipulation of connectedness involves presenting a set of connected vs. control symbols that we developed based on the design characteristics representing connectedness (Kim, Yoon, & Gonzalez, 2012). The connected symbols include two intertwined semi-circle rings, two intertwined sinusoidal curves, three interlinked rings, and two u-shaped blocks with openings facing toward each other and interlocking. The control counterparts lack intertwined or interlinked relationships between elements but are otherwise identical to connected symbols (see Figure 7). These pairs of symbols were pretested with 90 people (mean age=32, 40% male) who did not participate in the main study to ensure that the connected symbols (M $_{four\ connected\ symbols}$=4.92, SD=1.01) are perceived as more connected than control symbols (M $_{four\ control\ symbols}$=2.66, SD=1.16), ($F(1, 88)$=97.91, p<.001)[2].

Participants and procedure

One hundred fifty-nine students who enrolled in the introductory marketing course at the University of Michigan Ann Arbor (mean age=19, SD=1.40; 37% male) participated in the experiment. Participants were randomly assigned to one of six conditions in a 2 (cue: connectedness vs. control) x 3 (contribution norm (CN): high vs. low vs. control) between-subjects design. On arrival at a computer lab, participants were seated at computer screens to complete an online questionnaire and asked to follow instructions on the screen. They were

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[2] Participants evaluated each symbol on 7-point rating scales (1=not at all; 7=very much) on the following dimensions: interlocking, fitting together, complementary, and intertwined. These four rating scales were averaged to form an aggregate measure of connectedness for each symbol.

informed that they would be playing a money game that requires a total of 10 players, and that they would start testing their visual perception while waiting until all 10 players are available to join the game.

Visual perception task

The visual perception task was designed to expose participants to connectedness cues. Participants were randomly allocated to either the connectedness or the control cue condition. In the connectedness cue condition, they were exposed to four connected symbols while those assigned in the control cue condition saw four control symbols. They were asked to answer a few simple questions regarding each symbol that was presented in random order (e.g., "which (black vs. white) element looks curvier to you?" and "how many times do the surfaces of the elements touch each other?").
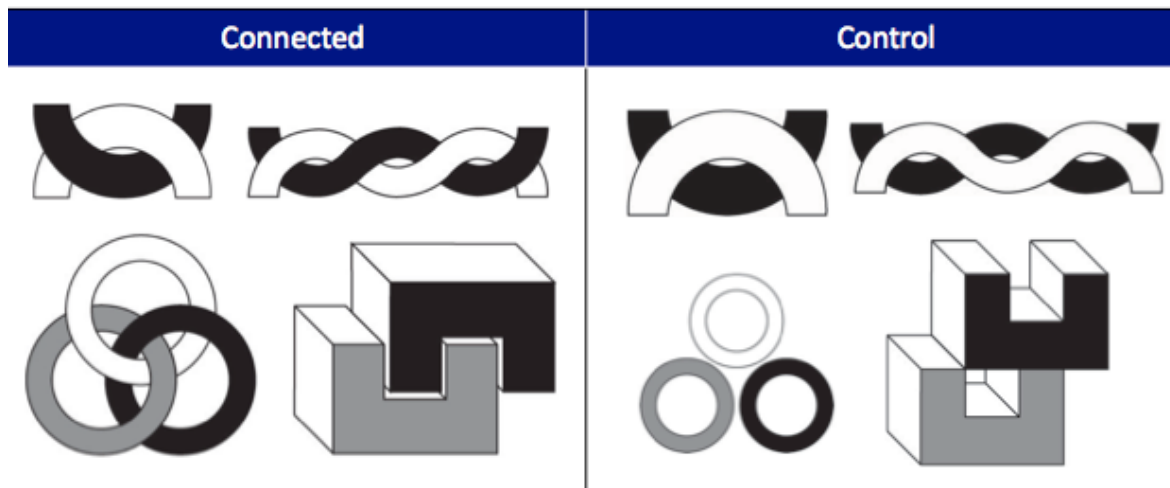
Figure 7 Connected symbols (left) and control symbols (right)

Money game

After the visual perception task, participants were provided with an instruction for a "money game". Although the money game has the nature of the standard linear public goods game in essence, it provided players with information about other players' contributions in the previous round instead of information about individual payoffs or the total amount in the public account. The instructions informed them that each participant would be playing 10 rounds of a money game with 10 total players including him/herself, that each round they would be given a

hypothetical endowment of $10 in the personal account and then asked to how much of that $10 they want to contribute to the public account, and that the amount in the public account would be doubled and divided evenly among all the players at the end of each round. At the end of the general instruction, participants were provided with different instructions depending on their assigned condition.

In the high and low CN conditions, participants were told that they would be able to see how much other players had contributed and that their contributions would be seen to other players as well. In each round (except the very first round), each participant saw a distribution of nine pre-programmed values (ranging from 0 to 10) pretending to be other players' individual contributions in the previous round. The distribution of the values in each round was averaged to become $7.5 (Mean SD of ten rounds=2.3) for the high CN condition and $2.5 (Mean SD of ten rounds=1.8) for the low CN condition.

In the control CN condition, participants were told that they would not be able to see how much other players had contributed and that their contributions would not be seen by other players. They played ten rounds of the public goods game without any information about contribution norms.

4.3.2 Results

To examine the impact of connectedness cues and contribution norms on contribution decisions, a 2 (cue: connected vs. control) x 3 (CN: high vs. low vs. control) ANOVA was performed. We omitted the first (where players did not get contribution norms) and the last rounds (end-game effect; Selten & Stoecker, 1986). Thus, the dependent variable was the amount of money that participants contributed to the public account on the average of the remaining eight rounds. We used an alpha level of 0.05 for all significant tests. Figure 8 presents contribution decisions by cue and contribution norm.

The ANOVA revealed a marginal main effect of cue, $F(1, 153)=3.44$, p=.07, with higher contributions in the connectedness cue condition (M=4.75, SD=0.25) than in the control cue

condition (M=4.04, SD=0.29). A main effect of the contribution norm was also significant, $F(2, 153)=31.60$, p<.001, indicating that the level of the contribution norm positively influences the contribution amount. That is, when provided with a high CN, participants contributed $6.40 (SD=0.32), whereas when provided with a low CN, participants' average contribution was $2.66 (SD=0.35). These amounts significantly differed from average contribution in the control CN condition (M=4.14, SD=0.32).

The results of greatest interest in the analysis are those examining an interaction effect between cue and CN, which was also proved to be significant, $F(2, 153)=4.85$, p<.01. To interpret this interaction, we first examined contribution differences between cue conditions in each level of CN conditions. The only significant difference between cue conditions was found in the high CN condition. A review of group means indicated that being exposed to connected symbols significantly increased the amount of contribution ($M_{connected}$=7.58, SD=0.41 vs. $M_{control}$=5.21, SD=0.49), $F(1, 153)=9.64$, p<.01.
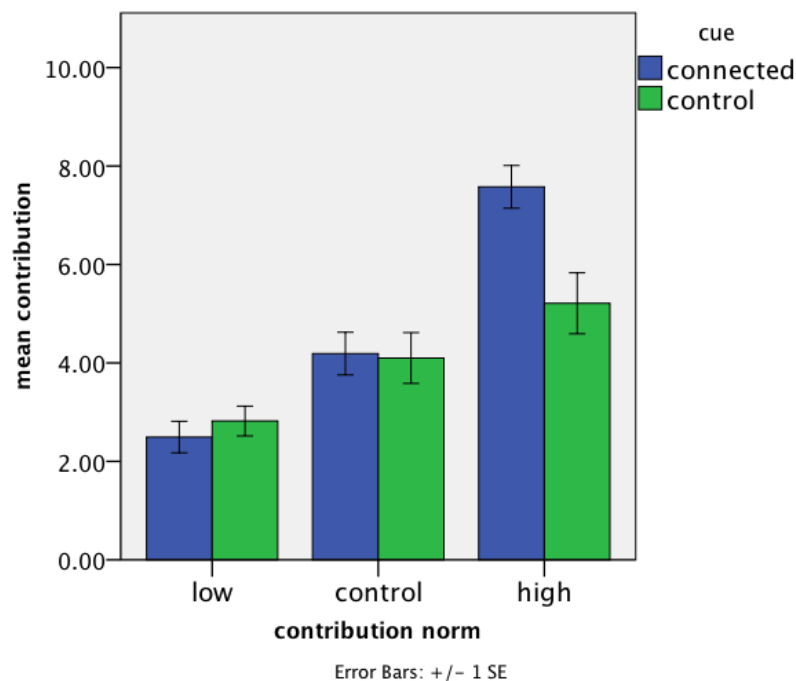
Figure 8 Contribution decisions by cue and contribution norm

Looking at differences among three CN conditions with each cue condition, all pair-wise comparisons in the connectedness cue condition were significant; the contribution amount in the

high CN condition was significantly higher than in the control CN condition (Tukey adjusted p<.001), and the contribution amount in the low CN condition was significantly less than in the control CN condition (Tukey adjusted p<.05). Furthermore, participants' contributions in the high CN condition were $7.58 (95% CI [6.77, 8.39]), which is not significantly different from the given contribution norms (i.e., the average of others' contributions, $7.5). Similarly, participants in the low CN condition contributed $2.49 (95% CI [1.53, 3.46]), which is almost identical to the given contribution norm ($2.5). Instead, in the control cue condition, participants in the high CN condition contributed significantly more than those in the low CN condition (Tukey adjusted p<.01), but no other comparisons were significant.

4.3.3 Discussion

These results from Experiment 1 show that the effect of connectedness cues on contribution decisions is dependent on the level of contribution norms. We found that participants exposed to connectedness cues (vs. control cues) contributed significantly more only when they make contributions in a situation with a high contribution norm. In other words, connectedness cues were effective to promote peoples' contributions only when they knew others' contributions were as high as 75% of their endowment.

The results support our hypothesis that exposure to connectedness cues enhances cooperation in a situation with a high contribution norm. The exposure to connected symbols yielded greater impact on the degree to which participant respond to the presence of contribution norms, as indicated by contributions significantly different from those in the baseline (control CN condition). Furthermore, it is surprising to see that their average contributions almost identically mimic provided contribution norms; when exposed to connectedness cues, people contribute just as much as others contribute. These results also indicate that for those exposed to connectedness cues, the positive effect of the high contribution norm was shown to be bigger than the negative effect of the low contribution norm. This observation is, perhaps, counterintuitive when we consider that the negative effect of the downward social information tends to be lager than the positive effect of upward social information (Croson & Shang, 2008). It is also worth noticing that we did not explicitly present participants with either $7.5 or $2.5 as a contribution norm.

Instead, in each round they saw a list of other players' individual contributions that range from 0 to 10 but average either approx. 7.5 for the high CN condition, and approx. 2.5 for the low CN condition. Thus, this might support that the contribution norm manipulation served as social influence rather than as anchoring effect.

To summarize, connectedness cues (vs. control cues) seem to make people more attentive to what others do and behave more consistently with contribution norms, significantly enhancing people's contributions when they are under a high contribution norm. In other words, we argue that connectedness cues make people more attentive to what "generous" others do. To provide further evidence for this idea, we conducted Experiment 2 that employs changing contribution norms across rounds in the money game. This manipulation would allow us to better observe how attentive people are to contribution norms. Moreover, it provides us an opportunity to rule out the floor effect which we suspected to observe in the low CN condition.

4.4 EXPERIMENT 2

In Experiment 2, we designed the money game by varying the level of contribution norms across rounds rather than keeping the consistent contribution norm throughout all rounds as in Experiment 1. In other word, we added two odd rounds that have irregular contribution norms either significantly higher or lower than the contribution norm in any other rounds.

4.4.1 Method

Participants and design
One hundred fifty participants from a paid subject pool at the University of Michigan (mean age=25, SD=10.5; 35% male) participated in Experiment 2. Participants were randomly assigned to one of six conditions in a 2 (cue: connected vs. control) x 3 (contribution norm (CN): high to low vs. low to high vs. control) between-subjects design.

Procedure

The materials were identical to Experiment 1, except for a few changes in manipulating contribution norms in the money game. As in Experiment 1, after completing the visual perception task where participants were primed with either connectedness or control symbols that we used in Experiment 1, they were randomly assigned to one of three CN conditions in the money game: High to Low (HL), Low to High (LH), and control conditions.

In the HL and LH conditions, participants played a total of 12 rounds including two odd rounds, the sixth (R6) and tenth rounds (R10). In the HL condition, participants were provided with a high contribution norm (the average of others' contributions; $7.5) in each round except R6 and R10; they started with the high contribution norm ($7.5) and then received a low contribution norm ($2.5) in R6 and R10. The same logic applied for the LH condition but in the reversed direction. In other words, participants saw an irregularly high contribution norm, $7.5 at R6 and R10, while presented with a low contribution norm, $2.5 at any other rounds. In the control CN condition, participants repeated 12 rounds without any contribution norms.

(a) Control	(b) Low to High (LH)	(c) High to Low (HL)
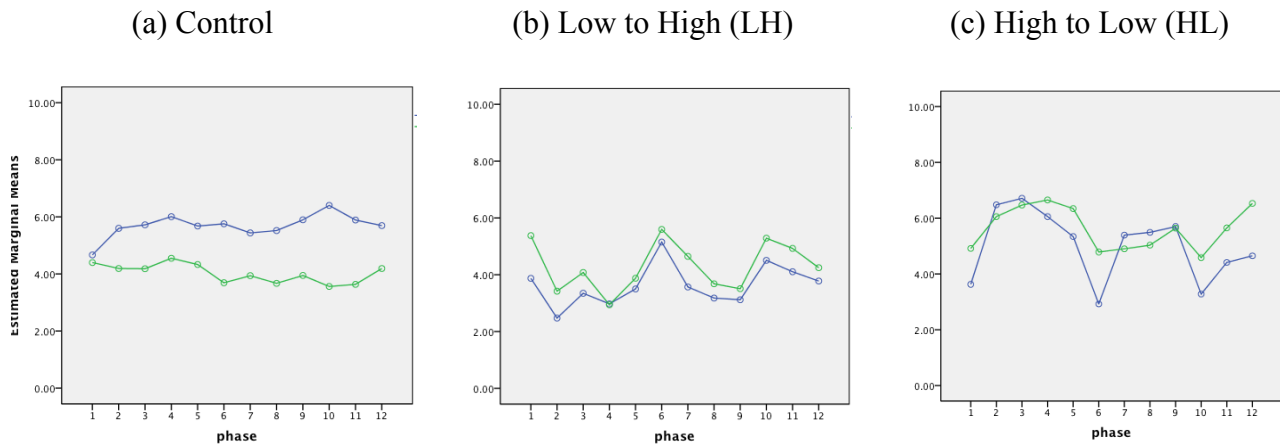
Note: X-axis: round; Y-axis: mean contribution ($); Cluster: cue condition (Blue: connected, Green: control)

Figure 9 Mean contributions over time by contribution norm conditions: (a) control, (b) low to high, and (c) high to low conditions

4.4.2 Results

Figure 9 presents a first look at mean contributions over time by CN conditions. We omitted the first and last rounds in the same way as in Experiment 1 and used the remaining ten rounds for further analysis. For simplicity, we further grouped the ten rounds into five phases according to their order relative to R6 and R10: Phase 1 (R2, R3, R4, and R5), Phase 2 (R6), Phase 3 (R7, R8, and R9), Phase 4 (R10), and Phase 5 (R11). Rounds in each phase were collapsed to form the average phase contribution. Table 7 reports the average amount of contribution in each phase by cue and CN conditions.

A 2 (cue: connected vs. control) x 3 (contribution norm (CN): HL, LH, and control) x 5 (Phase: 1, 2, 3, 4, and 5) ANOVA was performed with phase as a repeated measure. The dependent variable was the average contributions ($) that participants contributed to the public account. The 3-way ANOVA revealed that a three-way interaction between cue, CN and phase was significant, $F(8, 576)= 1.99$, $p<.05$, indicating that interaction effects between cue and phase differ in different levels of CN. Breaking this interaction down, contribution decisions were examined separately in each CN condition.

LH condition (higher social norms in Phase 2 and 4)
As seen in the graph (b) in Figure 9, participants' behavior in two cue conditions appeared almost identical. The interaction effect between cue and phase, and the main effect of cue were non-significant, indicating that there is no difference in the pattern of contribution decisions across cue conditions. However, the main effect of phase was shown significant, $F(4, 192)=9.70$, $p<.001$, indicating that participants' contribution differed by phase. Of interest were contribution differences between odd rounds and other rounds. Thus, we performed planned contrasts to compare contribution in each of Phase 2 and 4 (R6 and R10; rounds with a suddenly high contribution norm of $7.5) with contributions in other phases (rounds with a low contribution norm of $2.5). The contribution amount in Phase 2 was significantly higher than the mean contributions in Phase 1 and Phase 3, $F(1, 48)=23.92$, $p<.001$ for Phase 1, $F(1, 48)=14.12$, $p<.001$ for Phase 3. Similarly, the contribution in Phase 4 was significantly greater than contributions in Phase 1 and Phase 3, $F(1, 48)=17.00$, $p<.001$ for Phase 1 and $F(1, 48)=11.59$,

$p<.001$ for Phase 2. There was no significant difference between contributions in Phase 2 and 4. The mean contribution of Phase 2 and 4 (M=5.13, SD=2.72) was significantly different from the contribution on the average of all other phases (M=3.58, SD=2.55), $F(1, 48)=26.81$, $p<.001$. Overall, these results basically indicate that the level of contribution norm positively influenced the level of contributions; exposure to a higher contribution norm increased the amount that participants contributed to the public account.

HL condition (lower social norms in Phase 2 and 4)

As the graph (c) in Figure 9 presents different contribution patterns across cue conditions, a 2-way interaction between cue and phase was significant, $F(4, 188)=2.53$, $p<.05$, revealing that contribution differences between cue conditions varied by phase. In Phase 2, participants exposed to connected symbols (M=2.92, SD=3.06) contributed less than did those exposed to control symbols (M=4.79; SD=3.80), and this difference was marginally significant, $F(1, 47)=3.56$, $p=.065$. This difference was also significantly different from differences at Phase 1 and Phase 3 ($F(1,47)=5.04$, $p<.05$ for Phase 1, and $F(1,47)=6.46$, $p<.05$ for Phase 3). These results indicates that people primed with connectedness cues contributed less than those in the control condition when the contribution norm was suddenly dropped to $2.5 for the first time. When we consider the average contribution of Phase 2 and 4 where they had a a significantly lower contribution norm of $2.5, their contribution was $3.10 (SD=2.66; 95% CI [1.76-4.45]), which was not significantly different from the given contribution norm, $2.5, but significantly different from the control counterpart (M=4.69, SD=3.76), $F(1, 47)=2.88$, $p=.09$. Contribution differences between cue conditions were not statistically significant in all other phases.

Within the connectedness cue condition, the average contribution in Phase 2 was significantly less than average contributions in Phase 1, $F(1, 23)=38.79$, $p<.001$, and Phase 3, $F(1, 23)=23.48$, $p<.001$. Similarly, the average contribution in Phase 4 was also significantly less compared to Phase 1, $F(1, 23)=18.82$, $p<.001$ and Phase 3, $F(1, 23)=12.07$, $p<.01$. There were no significant differences between Phase 2, Phase 4, and Phase 5, at a Bonferroni adjusted alpha level of 0.0125. For those exposed to control symbols, the average contribution in Phase 1 was significantly higher than contributions in Phase 2, $F(1, 24)=9.77$, $p<.001$, and Phase 4, $F(1, 24)=7.73$, $p<.01$, respectively. Contributions in Phase 2, Phase 3, Phase 4, and Phase 5 were not

significantly different from one another. Taken together, these results indicate that changes of contribution norms across rounds caused more significant changes in the level of contributions for participants primed with connectedness cues.

Control condition

There was a significant interaction effect between cue and phase, $F(4, 196)=2.44$, $p<.05$. No main effect of phase was found, but the main effect of cue was found marginally significant, $F(1, 49)=3.53$, $p=.07$. Participants in the connectedness cue condition (M=5.79, SD=3.97) contributed more than did those in the control symbols condition (M=3.97, SD=3.84).

Table 7 Average contribution in each phase by cue and contribution norm conditions

Phase	1	2	3	4	5
Round	R2, R3, R4, R5	R6	R7, R8, R9	R10	R11
	Avg. contribution in dollar (SD)				
High to Low	CN=7.5	CN=2.5	CN=7.5	CN=2.5	CN=7.5
Connected n=24	6.15 (2.44)	2.92 (3.06)	5.53 (2.91)	3.28 (3.07)	4.41 (2.86)
Control n=25	6.38 (3.04)	4.79 (3.80)	5.19 (3.53)	4.59 (4.01)	5.65 (3.44)
Total n=49	6.27 (2.74)	3.88 (3.55)	5.36 (3.21)	3.95 (3.61)	5.04 (3.20)
Low to High	CN=2.5	CN=7.5	CN=2.5	CN=7.5	CN=2.5
Connected n=25	3.07 (1.98)	5.15 (3.38)	3.29 (2.92)	4.51 (3.38)	4.11 (3.53)
Control n=25	3.58 (2.63)	5.60 (3.01)	3.95 (3.05)	5.29 (3.30)	4.93 (3.19)
Total n=50	3.33 (2.32)	5.37 (3.18)	3.62 (2.97)	4.90 (3.33)	4.52 (3.36)
Control					
Connected n=26	5.75 (3.98)	5.76 (4.29)	5.62 (4.11)	6.40 (4.15)	5.89 (4.34)
Control n=25	4.31 (3.76)	3.69 (4.04)	3.85 (4.05)	3.56 (4.05)	3.63 (4.03)
Total n=51	5.05 (3.90)	4.74 (4.26)	4.75 (4.14)	5.01 (4.31)	4.78 (4.30)

4.4.3 Discussion

We found that people's contribution decisions in the connectedness cue condition were different from those in the control cue condition only when they played the money game in the High to Low condition (that is, a situation where the contribution norm started high but suddenly changed low). In particular, contribution differences between cue conditions were more salient at specific moments when the high contribution norm was suddenly dropped to low (i.e., Round 6

and Round 10); participants primed with connectedness cues were more reactive to the negative change of contribution norms and behaved more consistently with the low contribution norm.

These results are consistent with those from Experiment 1 in the sense that we found that connectedness cues were only effective in a situation associated with a high contribution norm in general. However, since participants exposed to connectedness cues (vs. control cues) were not more reactive to all high contribution norms, we figured that the differential attentiveness to contribution norms might perhaps depend on the general situation where they make contributions rather than the social information per se. In a situation where the general level of contribution is high (i.e., they were with a group of generous people), participants with primed with connected symbols (vs. control symbols) were more attentive to what others do. In particular, when the generous others suddenly changed their mind to contribute much less than their usual contributions, they were better at responding to the norm changes than were those in the control cue condition. On the other hand, in a situation where the general level of contribution is low (i.e., they were with a group of selfish people), their response was not significantly different from participants' in the control cue condition.

4.5 GENERAL DISCUSSION

In two experiments, we found that connectedness cues influenced the extent to which people conform to social norms. Connectedness cues enhanced conformity to social norms such that participants' contribution decisions became more dependent on how much others contribute. Particularly, the connectedness cues seem to be effective in a situation where people's contribution is high. In Experiment 1, after exposed to connectedness cues (vs. control cues), participants contributed more to the public account when the level of contribution norms was high (75% of the endowment). Experiment 2 demonstrated that they contributed less when the initially high contribution norm became low (25% of the endowment).

Taken together, these experiments support the idea that connectedness cues enhance people's attentiveness to generous or cooperative others. Our finding could be explained in the light of the fact that people are influenced more by others who are similar to them (Cialdini & Goldstein,

2004); that is, they cooperate more if they are with like-minded people who share a similar attitude (Gachter & Thoni, 2005). Given that people with interdependent self-construals tend to pursue collective interest in social dilemmas (Utz, 2004), we suppose that the connectedness cues promote people's pursuit of collective interest in the money game. If so, we speculate that participants primed with connectedness cues (vs. control cues) might have felt more "connected" to a cooperative group of people. Thus, they conformed more to the high contribution norm among the group as shown in Experiment 1[3]. However, when the cooperative group violated the norm of high contribution (such as in the HL condition in Experiment 2), this situation might perhaps have evoked a stronger sense of betrayal aversion from people who feel more connected, thereby resulting in their equivalent retaliation to the violation. Instead, participants primed with connectedness cues might have not felt attached to selfish others any more than those primed with control cues; both groups' contribution patterns were statistically identical. Therefore, these findings from our experiments suggest that feeling connected (i.e., connectedness cues) does not always lead to positive collective action (i.e., prosocial behavior); the effects depend solely on what others with which they feel connected do.

These results also make several contributions to the extant literature. First, the present study contributes to existing research on the powerful role of subtle cues in social behavior. Our results are striking because the cues we manipulated are simply four visual stimuli either with or without a complementary joint relationship. Our experiments implicitly validated the effect of the connectedness cues on an internal state of interdependence (Kim, Yoon, & Gonzalez, 2012), and demonstrated that the connectedness cues have a downstream effect on prosocial behavior. Moreover, our works suggest a practical and novel solution to intensify the power of social norms by adding minimal cues that can be easily embedded in the real world. For example, in addition to social norm appeals, having connectedness cues in the donation box or donation request emails could perhaps give a further boost to donation amounts.

Second, prior research has investigated that the role of self-construals on cooperation and of social norms on cooperation separately. Here, our studies observed how interdependent self-

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[3] However, in Experiment 2, the mean contribution of participants primed with connectedness cues (vs. control cues) did not appear higher at Phase 1 (i.e., from round 2 to round 5) in the HL condition. We speculate that the initial four rounds might have been too short to capture the effect of connectedness cues (i.e., their contribution decision pattern could have gone up later).

construals (activated by connectedness cues) and social norms interact together to influence cooperative action in social dilemmas; we proposed and found a boundary condition of the effect of interdependent self-construals on cooperation by demonstrating how their contribution decisions vary as a function of social norms in social dilemmas.

Third, our findings also contribute to social comparison research. Scholars have suggested that strategies of using social information for self-evaluation vary as a function of self-construal (Markus & Daphna, 2001; Stapel & Koomen, 2001). Here, we investigated the role of self-construal in using social information for social interaction, that is, cooperation in social dilemmas, and suggested that interdependent self-construals might harness the conformity effect when engaged in upward social comparison with generous others.

These contributions must be qualified in light of several important limitations of our research. First, what internal status the connectedness cues actually influence and the mechanism by which the connectedness cues affect the conformity to social norms are still unclear. Moreover, our work reported the effect of connectedness cues (priming interdependent self-construals) comparative to control cues; thus, our work is not able to provide a full story of self-construals. We would expect more dramatic effect of connectedness cues if we primed independent counterparts, and this will have to be addressed in future research.

Second, assuming that connectedness cues promote the pursuit of collective interest in the standard public goods game (without any social norms), it could be argued that we should have observed a significant effect of connectedness manipulation in the control CN condition such that participants exposed to connected symbols contributed more than did those exposed to control symbols. Although we believe that connectedness cues might work that way in a situation without social norms, our experiments cannot prove anything about this idea because: i) findings from the two experiments are not consistent, and more fundamentally, ii) a compound of two factors, visibility and social information, might come into play in the money game. In the control CN condition, participants were explicitly instructed that they would not have any

information about others and their decisions would not be seen[4]. This ostensibly private contribution setting (i.e., no visibility) may therefore reduce the effect of the connectedness manipulation. According to prior research (e.g., Ji, Schwarz, & Nisbett, 2000; Ratner & Kahn, 2002), the effect of self-construals is less salient in private settings (vs. public settings) where people do not expect their decisions to be evaluated by others. In our research context, we could expect that the impact of connectedness cues may appear less significant in the control CN condition (i.e., private setting) as we observed in Experiment 1.

Although we found the more significant effect of connectedness manipulation in the control CN condition in Experiment 2, we speculate that this inconsistency between two experiments may be derived from differences in subject populations across two experiments. For example, subjects in Experiment 2 (mean age=25; age ranging from 19 to 64) were older than the subjects in Experiment 1 (mean age=19; age ranging from 19 to 23). The existing literature suggests that the prevalence of pro-socials increase from early adulthood to old age (Van Lange, De Bruin, Otten, & Joireman, 1997). Therefore, for the older subjects in Experiment 2, their chronic social value orientation of being pro-socials might have given a little boost to the impact of connectedness cues. Future research could separate visibility and social information in eliciting contribution norms or control for individuals' chronic prosocial motives to have more conclusive results on the pure role of connectedness cues in pursuit of collective interest in social dilemmas.

Finally, participants did not interact with other participants in the money game; instead, they played against a computer presenting preprogrammed information about others' contributions. Therefore, it remains unclear whether participants actually believed that they were playing the game with other players in the same room, and how their understanding would influence their contribution decisions in the money game.

To conclude, the present study is the first study that examines the effects of connectedness cues on behavior, more specifically, on cooperation in social dilemmas and that considers activation of interdependent self-construals as well as social norms in social dilemmas. Subtle

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[4] In each round, they were also presented with a list of unknown values of contributions that other players made in the previous round such as "player 1: unknown", "player 2: unknown", and "player 3: unknown", which might have continuously convinced them that their decisions are not visible, and thus not evaluated by others.

connectedness cues seem to induce people to increase the extent to which they behave consistently with social norms in a situation with a high level of cooperation. Therefore, connectedness cues promote cooperation among cooperative people.

CHAPTER 5 Conclusion

This dissertation investigated the relation of social harmony and visual form of objects, particularly with regard to how visual form reflects social harmony as a cultural value and promotes harmonious social interaction. It was found that connectedness in visual form communicates a sense of harmony (Chapter 2), elicits a greater sense of social connectedness (Chapter 3), and promotes prosocial behavior (under specific circumstances; Chapter 4) (See Figure 10).
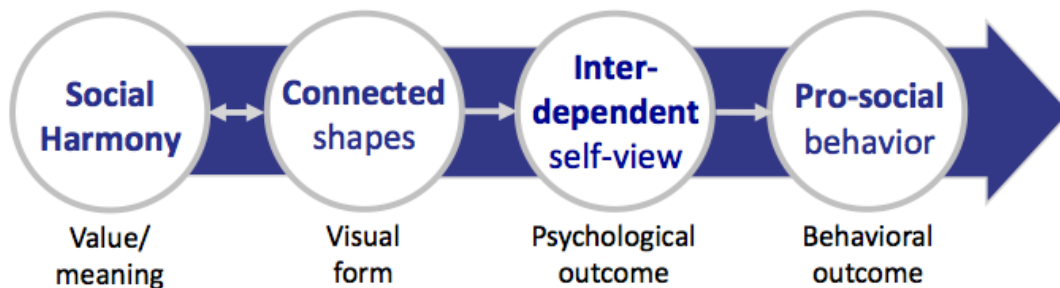
Figure 10 Visual form and meaning, and their downstream consequences

The first essay (Chapter 2) focused on the notion that social harmony is one of the core cultural values distinguishing individualistic and collectivistic cultures. A comparison of actual corporate logos from Korea and the US revealed that Korean logos are perceived as more continuous, united, and harmonious in their design principles and as better representing the concept of harmony than the US logos. The results suggest that visual form from a collective culture where people seek social harmony visually communicates the sense of harmony via connected visual elements (i.e., the principle of continuation). Similar to previous studies, this study provides evidence that visual form is a reflection of cultural values and preference, yielding practical implications for visual communication strategies for different cultures.

The second essay (Chapter 3) demonstrated that when individuals perceive design features as expressive of the theme of connectedness (i.e., connectedness cues) this influences self-construal judgments (i.e., how one views oneself in relation to others). Exposure to connectedness cues yields more descriptions of the self in reference to social roles, groups, status, and relationships. This outcome suggests that connectedness cues influence the extent to which individuals define the self as an interdependent entity.

Building on this finding, the third essay (Chapter 4) examined the effect of connectedness cues on downstream prosocial behavior, particularly cooperative behavior in social dilemmas. The results from the public goods games revealed that connectedness cues cause people to behave in ways that are more consistent with how others act in a specific situation where the level of social norms is high. The second and third essays taken together demonstrate that the sense of harmony or connectedness brought about by physical connectedness in visual form, whether created via coffee mugs at a business meeting, a set of plates on a dinner table, or simple marks on donation envelopes, can yield dramatic results for people's cooperative action. By contributing to the general understanding of the role of visual form, this study provides one novel and simple method to encourage various forms of collective behavior among people.

Taking all three essays together, this dissertation demonstrates the important role of visual form as a conveyer of meaning; visual form not only reflects cultural values, but also produces downstream consequences for the attitudes and behaviors of individuals. This work expands our understanding of both cultural impact on design and meanings constructed through design as a situational influence on human behavior. This understanding has implications for persuasive design strategies that appeal to different cultures and facilitate meaningful behavior change.

Despite this contribution, this research demonstrated only a single case of downstream effects from particular visual form (i.e., connected shape) and meaning (i.e., social harmony or connectedness). To validate the phenomenon of downstream effects of design, future research should explore other kinds of form and meaning. Moreover, although the effect of connectedness cues was found to be statistically significant in the laboratory experiments, it is still an open question whether visual cues or any other design cues could work effectively to influence

behavior in natural settings where individuals are bombarded with many kinds of visual information as well as other sensory information. For example, is it necessary for one to consciously attend to the visual cues in order for the downstream behavioral effects to occur? What kinds of people are more sensitive to these types of cues? Fleshing out such boundary conditions of the effects of design cue will be important in future research.

To conclude, the present research enlightens the reciprocal nature of visual form and our value system: people who pursue social harmony would choose a harmonious form (e.g., connected shape) and being surrounded by harmonious form encourages people to pursue social harmony. This pursuit of social harmony in turn leads to the choice of harmonious form because it is congruent with the sought value. Thus, the linear flow diagram shown in Figure 10 should perhaps be construed as a circular feedback loop, and this may in fact be how we maintain and nourish our cultural values, traditions, and beliefs.

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