

The Effect of Self-Construal on Spatial Judgments

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Much prior literature has focused on the effect of self-construal on social judgment. We highlight the role of self-construal in spatial judgments. We show that individuals with independent (vs. interdependent) self-construals are more prone to spatial judgment biases in tasks in which the context needs to be included in processing; they are less prone to spatial judgment biases in tasks in which the context needs to be excluded in processing. We show such spatial judgment effects when self-construal is operationalized by different cultures (study 1) and as a construct that shifts with situational primes (studies 2 and 3).

Consumers make spatial judgments in various purchase and consumption contexts, for instance, when they decide which store to visit, which waiting line to join, which package to choose, or what size of pizza to buy (Raghubir and Greenleaf 2006). Several systematic biases in spatial judgments have been demonstrated. The direct distance bias suggests that nonstraight paths with a shorter direct distance between endpoints (distance as the crow flies) are estimated to be shorter than equally long paths with a larger direct distance (Raghubir and Krishna 1996). Similarly, the elongation bias indicates that taller-thinner cylinders appear larger than equi-volume shorter-fatter ones (Raghubir and Krishna 1999; Wansink and van Ittersum 2003). Likewise, the Muller-Lyer illusion shows that arrowheads pointing to the right placed at both ends of a line make the midpoint appear to the left of the actual midpoint (Dewar 1967). Spatial judgments can be important in influencing consum-

ers' decisions to take different routes to reach a mall or to consume different amounts of food and drink.

In this research, we highlight the role of self-construal in consumer spatial judgment. We propose and demonstrate that self-construal influences the degree to which individuals attend to a focal object versus the context and that this relative attention subsequently affects the type of spatial bias they experience. Most prior literature has focused on the relationship between self-construal and social judgment (e.g., Choi, Nisbett, and Norenzayan 1999; Norenzayan et al. 2002). We extend this stream of research by showing that self-construal also affects spatial judgment.

We distinguish between two types of spatial judgments: (1) context-relevant spatial judgments that require consumers to attend to contextual information, and failing to attend to it leads to biases (e.g., the direct distance bias or the elongation bias); (2) context-irrelevant spatial judgments that require consumers to ignore the irrelevant features in the context, and attending to such features results in biases (e.g., the Muller-Lyer illusion). We propose that, due to their analytic thinking styles, individuals with independent self-construals are more likely to pay attention to the focal aspects of the stimuli and to ignore the context in making their judgments. As a result, they are more prone to biases in context-relevant spatial judgments. In contrast, individuals with interdependent self-construals, as holistic thinkers, tend to attend to all aspects of the stimuli in spatial judgment, including the context and background. Therefore, they are more susceptible to biases in context-irrelevant judgments.

In study 1, we focus on context-relevant spatial judgments (the direct distance bias; Raghubir and Krishna 1996) across mainland Chinese and American students, proxies for individuals with interdependent and independent self-con-

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struals, respectively. We find that the Chinese are less prone to the direct distance bias. In study 2, we manipulate self-construal and show a greater direct distance bias for individuals primed with independent (vs. interdependent) self-construal. In study 3, we again manipulate self-construal but focus on both context-relevant judgments and context-irrelevant judgments. Results show that independent (vs. interdependent) self-construal leads to greater bias/longer response time in context-relevant judgments and smaller bias/shorter response time in context-irrelevant judgments.

The rest of the paper is organized as follows. We begin with a literature review and develop our conceptual framework and hypotheses. We then present three studies and conclude the paper with a discussion of implications and future research directions.

WHY WOULD SELF-CONSTRUAL AFFECT SPATIAL JUDGMENT? CONCEPTUAL FRAMEWORK

Context-Relevant and Context-Irrelevant Spatial Perception Judgments

The tendency of individuals to focus only on the most salient (focal) aspects of the spatial stimuli and to ignore the context results in biases in many spatial judgments. One manifestation of this tendency that has received much attention in both the psychology and marketing literatures is the focus on a single dimension in two-dimensional area comparison judgment tasks and three-dimensional volume comparison judgment tasks (Piaget 1967, 1968; Verge and Bogartz 1978). This is true for both children and adults. For instance, Verge and Bogartz (1978) asked children to manipulate an adjustable square to match the area of a rectangle and found that most of the children used a one-dimensional side-matching strategy, equating the side of the square with either the height or the width of the rectangle, thus ignoring the second relevant dimension.

In their psychophysical model of spatial judgment, Krider, Raghurir, and Krishna (2001) propose that when making judgments of two-dimensional figures, adult consumers also tend to anchor on one salient dimension of a spatial figure without regard to orthogonal dimensions. As such, when comparing a square lying on its side to the same square standing on its corner, respondents find the latter to be bigger since it has a longer salient spatial dimension (the diagonal of the square is the salient dimension in the second figure whereas the side is salient in the first; the diagonal is longer than the side of the square). In another experiment, they show that consumers underestimate the relative area increase of progressively larger circles. They suggest that participants anchor on the diameter and do not adjust enough for the fact that the area is not just increasing linearly in the diameter but increasing as a function of radius squared. In other words, even though the circle is a two-dimensional figure, participants anchor on one salient dimension (the diameter) to judge size increase; while the other orthogonal

dimension (again, the diameter) is equal to the first, they do not adequately take it into account.

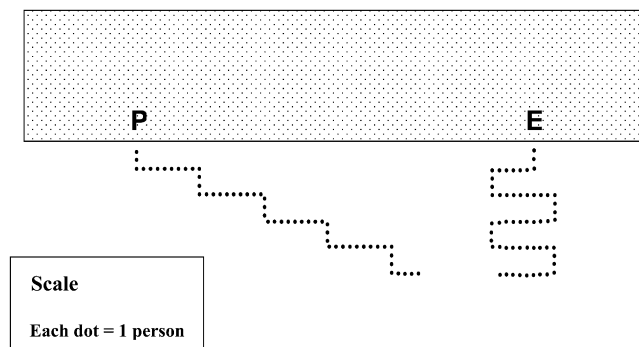
Similar findings were obtained for three-dimensional volume comparison judgments. Piaget (1967, 1968) studied children's perceptions of volume. In a typical Piagetian experiment, colored liquid was poured from a tall and thin cylinder to a shorter and wider cylinder. As such, the height of the liquid in the latter cylinder was lower. Children were then asked whether the volume of the liquid had remained the same or had decreased. In a series of studies, Piaget found that primary school children appeared to use only the height of the container while making volume judgments and to ignore the diameter (and hence cross-sectional area) of the cylinder—they believed that the volume had decreased when the liquid was poured into a wider glass (Piaget 1967, 1968; Piaget, Inhelder, and Szeminska 1960). This was replicated by Raghurir and Krishna (1999) with adults, who thought that a tall-thin glass contained more than an equi-volume short-fat glass.

The spatial biases summarized above are examples of biases that occurred for a category of spatial judgments that we label as "context-relevant spatial judgments." In order to generate accurate responses for these judgments, one needs to attend to all aspects of the spatial stimuli. Focusing only on the most salient spatial dimension and not paying enough attention to the other relevant aspects results in biases. For instance, Raghurir and Krishna (1996) proposed the direct distance bias according to which consumers use the direct distance between the endpoints of a nonstraight path as a primary input for distance judgment, with little regard for path configuration. They show that equidistant paths with different direct distances (DD) between endpoints are perceived to be of different lengths. Krishna and Raghurir (1997) further show that the perception of the number of objects in nonstraight lines is also affected by the DD bias—a nonstraight line with a smaller DD is perceived to contain fewer dots than another equi-dot and equi-distance line with a larger DD (see fig. 1).

On the other hand, for many spatial judgments, focusing on irrelevant contextual information of a stimulus can result

FIGURE 1

DIRECT DISTANCE BIAS



in judgment biases. Two examples of such biases are given in figure 2. These are the Muller-Lyer illusion and the Ponzo illusion. In the Muller-Lyer illusion, people need to estimate the middle point of the horizontal line. However, the presence of the irrelevant arrowheads at the two ends of the line results in a biased judgment, and the task is known to generate line length distortion depending on the direction that the outer arrowheads take (Dewar 1967). Typically, when people are asked to place a mark at the midpoint, they invariably place it more toward the “tail” end. In figure 2, this means that people will tend to place the midpoint to the left of the actual center. If, however, the two outer arrowheads take the opposite direction (i.e., pointing to the left), then people are more likely to place the midpoint to the right of the actual center. In other words, attention to irrelevant contextual information (the two arrowheads) leads to biases in judgments.

Similarly, the Ponzo illusion is created by drawing two identical vertical lines across a set of converging lines (see fig. 2; Shepard 1990). With the converging lines as the background, the left line *L* looks shorter than the right line

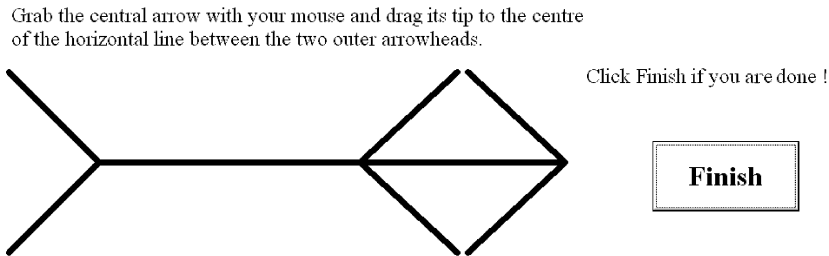
R. Again, the irrelevant converging lines create an illusion of depth that leads one to perceive the vertical line near the converging point (line *R*) to be longer. In both examples mentioned above (Muller-Lyer and Ponzo), one has to disregard the background context to generate accurate judgments and to avoid illusion and biases. In the current research, we call such tasks “context-irrelevant spatial judgments.”

Self-Construal and Systems of Thought

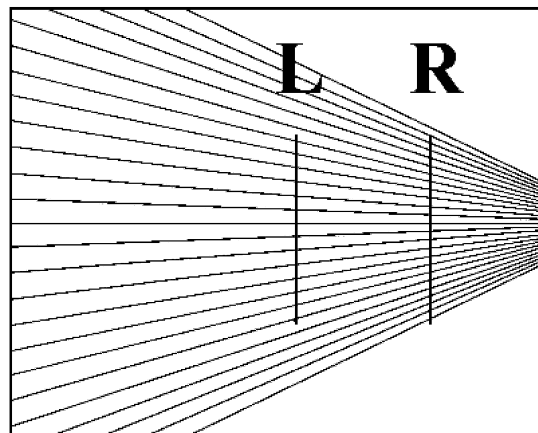
A distinction that has been made between members of Western and Eastern cultures is the extent to which the self is defined in relation to others (Markus and Kitayama 1991). The independent self-construal is more dominant in Western cultures, where people believe in the inherent separateness of distinct persons and view the self as an autonomous, independent person. The interdependent self-construal is more dominant in Eastern cultures, where people believe in the connectedness of human beings to each other and view the self as a part of a larger social group. Although the

FIGURE 2
CONTEXT-IRRELEVANT SPATIAL JUDGMENTS

The Muller-Lyer Illusion



The Ponzo Illusion



difference is well recognized across cultures, individuals within the same culture may also differ in the extent to which such self-views are characteristic of themselves.

Nisbett et al. (2001) argue that independent and interdependent self-construals are associated with two distinct systems of thought. In particular, independents are more likely to be *analytic thinkers* whereas interdependents are more likely to be *holistic thinkers*. Analytic thought involves “detachment of the object from its context,” whereas holistic thought involves “an orientation to the context or field as a whole” (Nisbett et al. 2001, 293). Therefore, independents tend to pay attention primarily to foreground objects to the exclusion of the field at large, whereas interdependents tend to attend to both the foreground object and the field (see also Nisbett and Masuda 2003; Nisbett and Miyamoto 2005).

For example, Masuda and Nisbett (2001) presented animated scenes of fish and other underwater life to American (independent) and Japanese (interdependent) participants and later asked them to report what they had seen. Although Americans and Japanese were equally likely to refer to the focal fish, Japanese participants were more likely to begin by setting the scene (“There was a lake or pond” or “The bottom was rocky”). Japanese participants were also more likely to refer to relationships between the focal fish and aspects of the environment (“The big fish swam past the gray seaweed”). Overall, Japanese participants made 70% more statements about background features than Americans, and twice as many statements about relationships between objects. Similarly, when asked to compare two flickering images, Americans detected more changes in focal objects, while the Japanese detected more changes in the scene background (Masuda and Nisbett 2006). Studies monitoring eye movements additionally demonstrate that Americans concentrate on focal objects sooner and longer than East Asians, who concentrate on the background and away from focal objects (Chua, Boland, and Nisbett 2005).

The holistic-analytic thinking distinction has also been used to explain many differences in social judgments across cultures. People with interdependent (vs. independent) selves tend to be more influenced by the situational context in their thinking, knowledge, and characterization of people (Choi et al. 1999; Lee, Hallahan, and Herzog 1996). Thus, Choi et al. (1999) argue that interdependents may find more (situational) factors to be relevant and responsible for a given behavior than independents do. For example, Choi et al. (2003) find that when attempting to explain a criminal act (e.g., murder) or a prosocial behavior (e.g., helping victims of traffic accidents), Korean participants take into consideration a greater amount of information than do either American or Asian American participants. These differences stem from the fact that East Asians tend to notice more factors and believe them to be potentially relevant in a situation (Choi and Nisbett 2000). This tendency is so robust that even when the various inputs are contradicting each other, East Asians are more capable of accepting, reconciling, and utilizing them than their Western counterparts (Peng and Nisbett 1999). For example, Williams and Aaker (2002) find

that consumers from Eastern cultures (vs. Western cultures) have a greater propensity to accept duality and therefore react more favorably to mixed emotion appeals in advertising.

To summarize, individuals with interdependent self-construal are more likely to rely upon various inputs (salient or nonsalient, focal or contextual) in judgments compared to individuals with independent self-construal. In other words, individuals with interdependent self-construals are more likely to engage in context-inclusive processing whereas those with independent self-construal are more likely to exclude contextual information in their processing.

The Effect of Self-Construal on Spatial Perception Biases

The preceding discussion suggests that individuals with an interdependent self-construal may be more likely to use both salient and less salient, both focal and contextual inputs in forming judgments compared to individuals with an independent self-construal. This might result in different responses to both social stimuli and spatial stimuli for interdependents versus interdependents. In the social domain, the disparity may manifest itself in the tendency to define oneself in relation to one’s social context as opposed to defining oneself independently of one’s social context. In the spatial domain, this difference may be evidenced in the tendency to use both focal and contextual criteria as opposed to using only focal criteria to judge spatial stimuli.

As mentioned before, in context-relevant spatial judgments, biases arise from overutilization of the most salient dimension while other potentially important dimensions (e.g., direct distance bias) are ignored. Therefore, it is reasonable to expect that individuals with independent self-construals (as analytic thinkers) would have a greater proclivity for these biases compared to individuals with interdependent self-construals. In contrast, in context-irrelevant spatial judgments, biases arise from attending to irrelevant contextual information (e.g., Muller-Lyer illusion). Therefore, we would expect individuals with interdependent self-construals (as holistic thinkers) to have a greater proclivity for these biases compared to individuals with independent self-construals.

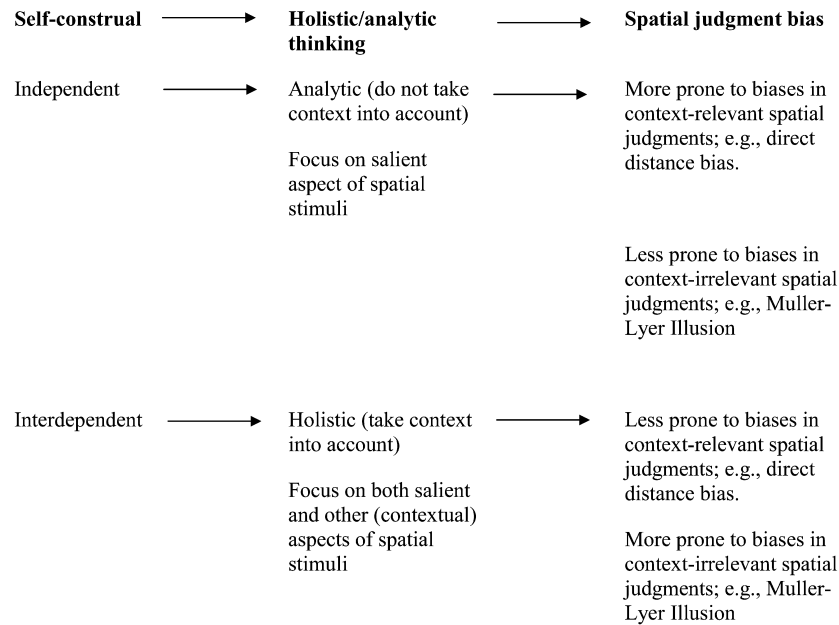
To conclude, we propose that:

- H1:** Individuals with independent self-construals will be more prone to biases in context-relevant spatial judgments compared to individuals with interdependent self-construals.
- H2:** Individuals with interdependent self-construals will be more prone to biases in context-irrelevant spatial judgments compared to individuals with independent self-construals.

In figure 3, we have summarized and illustrated our conceptualization of the relationship between self-construal and thinking styles, and the related predictions for perceptual

FIGURE 3

CONCEPTUAL FRAMEWORK



biases. Studies 1–2 provide a test of hypothesis 1 on context-relevant spatial judgments using different operationalizations of self-construal. Study 3 tests hypothesis 1 and hypothesis 2 such that both context-relevant and context-irrelevant spatial judgments are considered.

STUDY 1: CONTEXT-RELEVANT SPATIAL JUDGMENTS WHEN SELF-CONSTRUAL IS MANIFESTED IN DIFFERENT CULTURES

In this study, we operationalize self-construal by different cultures and examine spatial perception biases in context-relevant tasks among Americans and Chinese. Since the independent self-construal is more dominant in the American culture and the interdependent self-construal is more dominant in the Chinese culture, we expect that American participants will demonstrate greater spatial judgment biases than Chinese participants.

Method

One hundred and forty-one graduate students of business participated in the study as part of the requirement for a class, 77 at a university in mainland China and 64 at an American university. Questionnaires for Chinese students were in Chinese. In order to ensure that the questionnaire was correctly translated and conveyed the same meaning in both cultures, the standard technique of back translation (Aaker and Williams 1998; Hui and Triandis 1985) was used. Additionally, the questionnaires were not only translated

from English to Chinese and then back to English, but they were also translated the other way around (starting with Chinese).

Participants were told to imagine that they went to the stadium to buy tickets to a football game and found two lines in front of the ticketing office. They were presented with a map (see fig. 1; see also Krishna and Raghurir 1997) with a pair of lines, *P* and *E*. Both lines contained 56 dots (each dot represents a person in line), but the first line was unidirectional (line *P*) whereas the second retraced direction (line *E*). For the unidirectional line *P*, the direct distance (DD) between the two endpoints of the line was 60 millimeters and for the retraced line *E*, the DD was 22 millimeters. After viewing the map, participants then turned to the next page where they were asked to give an estimate of the number of persons in each line. While participants could turn to the previous page with the stimuli, they were explicitly asked not to count the number of dots but to use their best estimate.

If Krishna and Raghurir’s results hold, then the direct distance between the endpoints of the line should be the most salient feature of the stimuli, and people should use it as a simple heuristic to estimate the number of objects in the lines while ignoring the specific line configuration. Therefore, we expect that people would judge line *E* as containing fewer persons. Additionally, we expect American participants (with a predominant independent self-construal) to be more likely to demonstrate such a bias compared to Chinese participants (with a predominant interdependent self-construal).

Results

Estimates of the number of persons in line *P* and line *E*, respectively, were subjected to a 2 (line configuration) \times 2 (culture) mixed ANOVA with line configuration as a within-subjects factor and culture as a between-subjects factor. First, replicating prior findings of Krishna and Raghurir (1997), we found a main effect of line configuration and hence support for the DD bias ($F(1, 139) = 9.44, p < .01$)—line *E* with the shorter DD was estimated to contain fewer persons ($M = 54.3$) than line *P* with the larger DD ($M = 56.84$). In other words, the DD of the line was found to affect the perceived numerosity of lines even though the two lines (*P* and *E*) contained an identical number of dots.

In addition, there was a significant interaction between line configuration and culture ($F(1, 139) = 5.8, p < .05$). More specifically, while American and Chinese participants were equally accurate in their estimates of number of persons in the unidirectional line *P* ($M_{\text{Chinese}} = 56.8, M_{\text{American}} = 56.9; F < 1$), Chinese participants were much more accurate in their estimates of the retraced line *E* ($M_{\text{Chinese}} = 56.1$) compared to their American counterparts ($M_{\text{American}} = 51.4; F(1, 139) = 5.32, p < .05$). This is consistent with hypothesis 1. The main effect of culture was not significant ($F(1, 139) = 1.9, p > .15$).

We also computed the difference between the two estimates, that is, the number of persons in line *P* minus the number of persons in line *E*. A greater difference would indicate greater bias. Consistent with hypothesis 1, we found that American participants ($M = 5.47$) demonstrated a greater bias than Chinese participants ($M = 0.66; F(1, 139) = 5.8, p < .05$). In fact, Chinese participants demonstrated little bias, and they judged the two lines to be similar in length (the difference 0.66 was close to 0; $t = .79, p > .4$). In summary, the results are consistent with our predictions.

Discussion

Our results suggest that Americans demonstrate greater bias in spatial perception tasks involving numerosity judgments. In particular, American participants' bias primarily lies in the fact that they tend to underestimate the number of dots in a retraced line, though they are reasonably accurate in estimating a unidirectional line. Such results are consistent with our hypothesis that people with an independent (vs. interdependent) self-construal tend to rely on the most salient feature (direct distance) in their judgment without regard to the specific context (line configuration).

An alternative explanation for our results could be that compared to American participants, Chinese participants paid less attention to our instructions of not "counting" the dots. We examined the number of participants who were exactly accurate (i.e., could have counted the dots) for at least one of the two lines. We found that this was the case for only 14 people (only one person was accurate in both estimates). More importantly, the number of participants who were exactly accurate was not different across countries. Analyses without these participants revealed identical

results. Additionally, in study 3, different stimuli are used where disregard for instructions is less likely to result in accuracy. Finally, in studies 2 and 3, differences in results are not linked to nationality but to self-construal priming.

One limitation of study 1 is that using culture as an operationalization of self-construal presents several alternative explanations such as Chinese participants may have better math training (Leung 2001; Stevenson, Chen, and Lee 1993), greater motivation to be accurate, better imagery abilities, or even different processing styles triggered by the testing language (Ji, Zhang, and Nisbett 2004). To rule out such alternative explanations inherent in country-level analyses, in study 2 we use self-construal priming and examine its effect on spatial judgments.

STUDY 2: CONTEXT-RELEVANT SPATIAL JUDGMENTS WHEN SELF-CONSTRUAL IS PRIMED

Although the culture from which the participants come would strongly determine the chronically accessible self-construal, much recent research has shown that people from Eastern (and Western) cultures are capable of demonstrating both independent and interdependent self-construals (Triandis, McCusker, and Hui 1990), and the weight of each type of self-construal can shift in response to situational accessibility (Trafimow, Triandis, and Goto 1991). Manipulating self-construal therefore can better guard against alternative explanations related to country differences. In this study, we prime independent versus interdependent self-construal for both American and Chinese participants. Unlike study 1, here we recruit participants from a university in Hong Kong where English is the official language. As such, questionnaires are also in English for these participants. However, the participants in Hong Kong are of Chinese ethnicity.

Method

We adopted the priming procedure of Gardner, Gabriel, and Lee (1999; also used successfully by Mandel [2003]) to induce independent and interdependent self-construals. Ninety-eight undergraduate students participated in the study, 50 at a large university in Hong Kong and 48 at a large American university. They were given \$5 to participate (Hong Kong participants were paid an equivalent amount in Hong Kong dollars). Participants were first asked to complete the two self-construal manipulation tasks. In the first task, participants read an article about a dilemma that a general faces in choosing a warrior to send to the king. In the independent condition, the general chose the best person for the job and considered benefits to himself. In the interdependent condition, however, the general chose a member of his own family and his decision was driven by what was best for the family. After reading the article, participants were asked to form an impression about the general. The second task involved a word search task. Participants were asked to circle the pronouns in a short paragraph which

describes a visit to the city. In the independent condition, the pronouns are all singular (e.g., “I,” “you,” and “mine”). In the interdependent condition, the pronouns are all plural (e.g., “we,” “they,” and “us”). After the self-construal manipulation, participants completed the same spatial perception task as in study 1 (see fig. 1).

Results

A 2 (line configuration) × 2 (self-construal priming) × 2 (culture) mixed ANOVA was performed with self-construal priming and culture as between-subjects factors and line configuration as a within-subjects factor. As expected, the three-way interaction was not significant ($p > .2$), which indicates that self-construal priming had similar effects on spatial perception biases across both cultures (see fig. 4). The only significant effects were a main effect of line configuration, with participants estimating the retraced line *E* ($M = 51.56$) to be shorter than the unidirectional line *P* ($M = 55.12$; $F(1, 94) = 13.65, p < .001$) and a two-way interaction between line configuration and self-construal priming ($F(1, 94) = 13.01, p < .001$). While participants in the interdependent priming condition gave similar estimates to the retraced line ($M = 54.7$) and the unidirectional line ($M = 54.8$; $F < 1$), those in the independent priming condition estimated the retraced line to contain a fewer number of dots ($M = 48.3$) than the unidirectional line ($M = 55.5$; $F(1, 94) = 15.6, p < .001$).

A difference score was also computed between the line estimates (the number of persons in line *P* minus the number of persons in line *E*) to reflect the magnitude of the perception bias. A larger score would indicate greater bias. The score was submitted to a 2 (self-construal priming) × 2 (culture) between-subjects ANOVA. Consistent with hypothesis 1, we found that such a bias was more pronounced in the independent self-construal condition ($M = 7.17$) than in the interdependent self-construal condition ($M = .01$; $F(1, 94) = 13.01, p < .001$). The culture main effect and the interaction were not significant (p 's $> .2$). Since “culture” had no significant effects, we do not report separate analyses by culture.

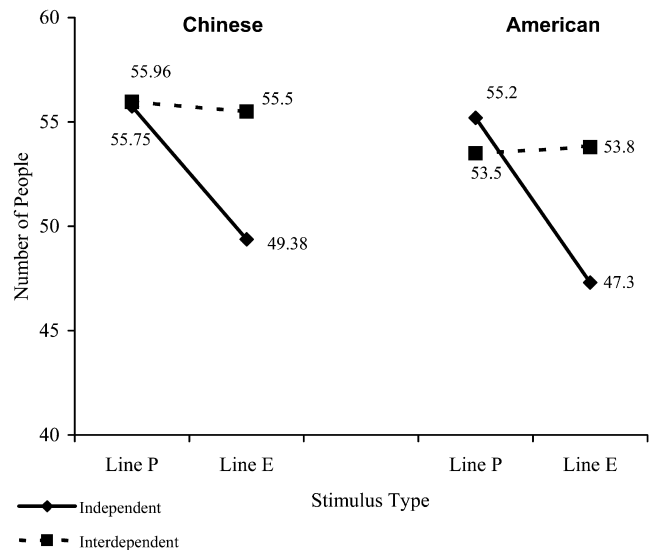
Discussion

Results of study 2 show that self-construal, when manipulated through unrelated priming tasks, can affect spatial judgment in the same manner as inherent self-construal does. In addition, the self-construal priming seems to induce differences in spatial perception biases regardless of which country the participants were from.

Note that in study 1, the Chinese participants were recruited in mainland China where the questionnaires were administered in Chinese. In contrast, study 2 was conducted in Hong Kong in English since English is the official language there. Given that results were consistent across the studies, language of testing cannot be an alternative explanation for our results.

In studies 1 and 2 we focused on tasks that require pro-

FIGURE 4
STUDY 2: RESULTS



cessing of the context (hypothesis 1). In the next study we also focus on tasks that require context-independent processing (hypothesis 2).

STUDY 3: CONTRASTING CONTEXT-RELEVANT AND CONTEXT-IRRELEVANT SPATIAL JUDGMENTS

In this study, we focus on both context-relevant and context-irrelevant judgments. Per hypotheses 1 and 2, individuals with independent self-construal should be more prone to biases in context-relevant judgments compared to individuals with interdependent self-construal (consistent with results in studies 1 and 2); on the other hand, individuals with interdependent self-construal should be more prone to biases in context-irrelevant judgments compared to individuals with independent self-construal.

The study was conducted in Hong Kong and in the United States. In both countries, participants were primed for self-construal. For the context-relevant judgment, we used the direct distance bias as before. For the context-irrelevant task, we used the Muller-Lyer illusion shown in figure 2. The specific operationalization of the Muller-Lyer illusion requires participants to grab the central arrow with a mouse and drag its tip to the perceived center of the line (the line that lies between the outer arrowheads).

Besides collecting spatial judgment estimates as we did in studies 1 and 2, in this study we also collected response time measures. To enable this, the experiment was conducted on computers using Medialab. Kuhnen and Hannover (2001) show that individuals have faster response times for tasks consistent with their style of processing. Assuming that independent versus interdependent self-construals induce pro-

cessing that excludes versus includes the context, respectively, they should lead to varying response times for these tasks. More specifically, independents should be faster with context-irrelevant tasks, and interdependents should be faster with context-relevant tasks. Thus, our prediction is that better performance is reflected in both more accurate estimates and faster response time.

Method

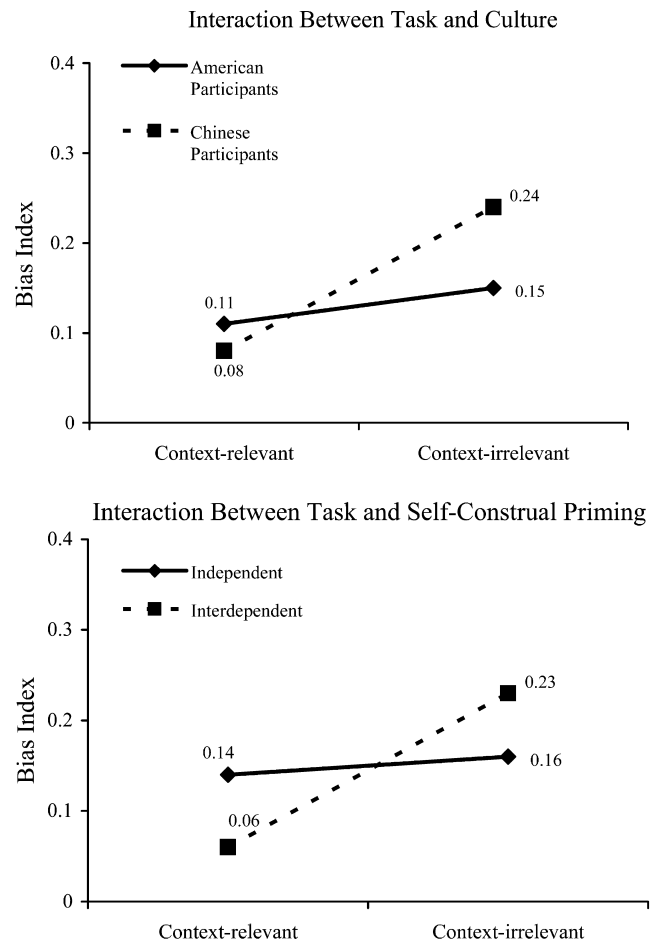
Seventy-three participants took part in this study, 34 at a university in Hong Kong and 39 at a university in the United States. Participants were recruited from both campuses using fliers. Each participant was paid \$15 for participation (an equivalent amount was paid to Hong Kong participants in Hong Kong dollars). Participants reported to a laboratory and were randomly assigned to the treatment conditions. Participants sat in front of a computer, followed the instructions presented on the computer and completed the task. They were then debriefed and paid. The average time spent on the study was 25 minutes. The design of the study is 2 (self-construal priming) \times 2 (culture) \times 2 (task: context-relevant vs. context-irrelevant), where self-construal priming and culture are between-subjects factors and task is a within-subjects factor.

Results

Response Bias. In order for the dependent variables in the two tasks to be comparable, we constructed separate indices to reflect the bias in each task. For the context-relevant judgment (DD bias task), an index was constructed by taking the difference in estimates of line *P* and line *E* and dividing this difference by the actual number of dots in the two lines, which was 56. For the context-irrelevant judgment (Muller-Lyer illusion task), an index was created by taking the actual deviation from the central point (in millimeters) and dividing it by the maximum possible deviation (half the length of the line in millimeters). For both indices, a greater number represents greater bias and zero suggests no bias at all. Results from a 2 (self-construal priming) \times 2 (culture) \times 2 (task) mixed ANOVA revealed a significant main effect of task ($F(1, 69) = 13.64, p < .001$). There was a significant interaction between task and culture ($F(1, 69) = 4.61, p < .05$) and, more importantly, a significant interaction between task and self-construal priming ($F(1, 69) = 7.9, p < .01$). The three-way interaction was not significant. No other main or interaction effects were significant (p 's $> .1$).

A closer look at the interaction effect between task and culture revealed that, for the context-relevant judgment (DD bias task), Hong Kong participants ($M = .08$; see fig. 5) were slightly less biased (but not significantly) than American participants ($M = .11$; $p > .2$). For the context-irrelevant judgment (Muller-Lyer illusion task), Hong Kong participants ($M = .24$) were more biased than their American counterparts ($M = .15$; $F(1, 69) = 6.10, p < .05$). More importantly, the interaction between task and self-construal

FIGURE 5
STUDY 3: RESULTS ON RESPONSE BIAS



priming suggests that, for the context-relevant judgment, interdependent participants ($M = .06$; see fig. 5) were less biased than independent participants ($M = .14$; $F(1, 69) = 5.78, p < .05$). In contrast, for the context-irrelevant judgment, interdependent participants ($M = .23$) were more biased than their independent counterparts ($M = .16$; $F(1, 69) = 4.12, p < .05$). These results are strongly supportive of hypotheses 1 and 2.

Response Time. In the context-relevant judgment task, we recorded the time it took the participants to provide estimates for line *P* and line *E* in milliseconds. Similarly, in the context-irrelevant judgment task, we recorded the time it took participants to finally mark the central point on the horizontal line. The response time data were submitted to a 2 (self-construal priming) \times 2 (culture) \times 2 (task) mixed ANOVA. Results revealed a marginally significant main effect of task ($F(1, 69) = 3.52, p < .07$), a significant interaction between task and culture ($F(1, 69) = 4.68, p < .05$), and a significant interaction between task and self-construal

priming ($F(1, 69) = 14.41, p < .001$). No other effects were significant (p 's $> .1$).

For the context-relevant judgment, Hong Kong participants ($M = 30,676.7$; see fig. 6) took slightly (but not significantly) less time to complete the task compared to Americans ($M = 32,350.8$; $F < 1$). They ($M = 31,168.0$) took a much longer time to complete the context-irrelevant task than Americans ($M = 25,442.6$; $F(1, 69) = 6.17, p < .05$). More central to our theory is the task and self-construal priming interaction. As expected, for the context-relevant judgment, those in the interdependent priming condition took less time to complete the task ($M = 28,034.2$; see fig. 6) compared to those in the independent priming condition ($M = 34,993.3$; $F(1, 69) = 5.11, p < .05$). On the other hand, interdependents ($M = 31,317.1$) took a much longer time to complete the context-irrelevant task than independents ($M = 25,293.5$; $F(1, 69) = 6.82, p < .05$). These results provide further complementary support for our hypotheses. All analyses on response times reveal similar results if a logarithmic transformation is used to normalize the distribution or if baseline differences in reaction time are controlled for.

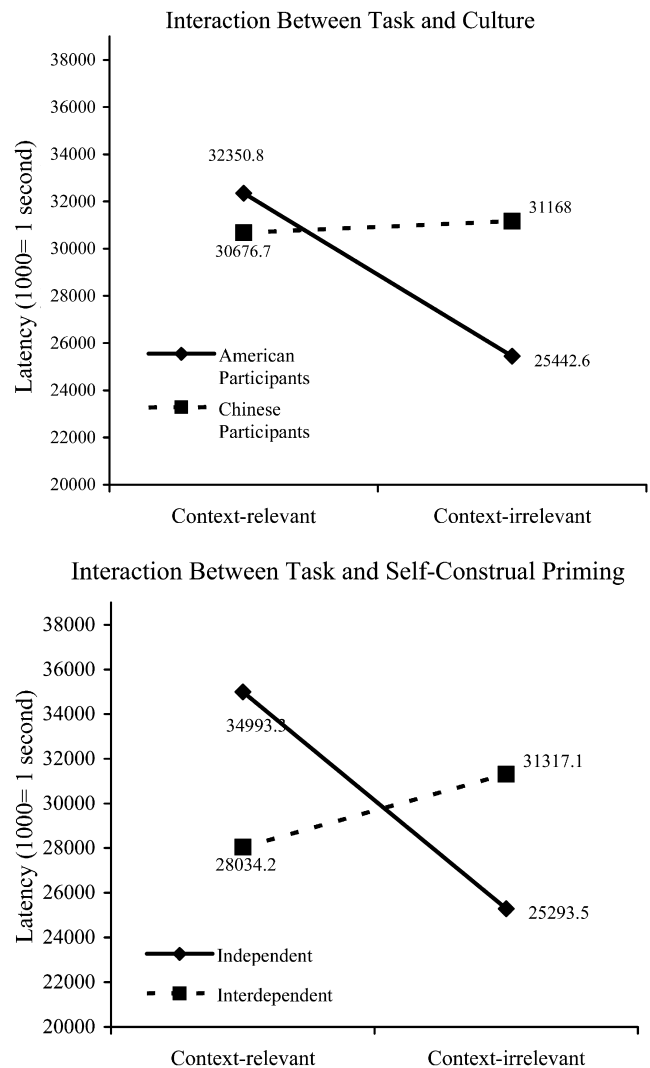
Discussion

Our results show that for the context-relevant judgment, individuals primed with interdependent self-construal were more accurate (less biased) and responded faster than those primed with independent self-construal. In contrast, for the context-irrelevant judgment, those in the independent priming condition performed far better (less bias and faster response) than their interdependent counterparts.

These results support our basic premise that the effect of self-construal on spatial perception biases is due to the fact that independents are more likely to attend to the focal object whereas interdependents are more likely to attend to the field and context. Thus, it is not the case that interdependents are always less biased in spatial perception tasks than independents. Response accuracy and speed depend on the nature of the task as well as the type of self-construal. Tasks that require the viewer to take into account context are more conducive to the interdependent self-construal participants, whereas tasks that require the viewer to disregard the context are more conducive to the independent self-construal participants. Thus, the underlying differential processing styles contribute to the consistently observed spatial judgment differences between independents and interdependents.

Study 3 particularly rules out an alternative mechanism for the results obtained in studies 1 and 2 in which interdependents exhibit greater accuracy in spatial judgment compared to independents. One could have argued that interdependents are more motivated to be accurate than independents. Thus, the mechanism for the self-construal effects may not be procedural (i.e., the results are not because interdependents do pay more attention to the context; Kuhn and Hannover 2001); instead, it could be motivational. However, in study 3, independents are more accurate in (and respond faster to) the context-irrelevant task, which cannot

FIGURE 6
STUDY 3: RESULTS ON RESPONSE TIME



be explained by the motivational mechanism. To further rule out this possibility, in study 3, we collected self-reported measures of motivation by asking participants to characterize the way they responded to the questions on two 1–7 scales (1 = I was not at all motivated/interested; 7 = I was highly motivated/interested). The two scales were significantly correlated ($r = .74$) and were averaged to create a single motivation index. This motivation measure was submitted to a 2 (culture) \times 2 (self-construal priming) ANOVA. Results suggest that neither culture nor self-construal priming is related to any differences in motivation levels (p 's $> .2$).

GENERAL DISCUSSION

In this paper, we highlight the role of self-construal in consumer spatial judgment. We propose that distinct self-

construals are not only related to different social perceptions as has been commonly studied (for an exception, see Holland et al. 2004) but are also related to spatial perceptions and associated biases. Specifically, we suggest and demonstrate that individuals with independent self-construal are less accurate (more biased) in context-relevant judgment tasks than individuals with interdependent self-construal. Context-relevant judgment tasks require respondents to take into account less salient contextual information in the field in order to generate accurate responses. Our data indicate that individuals with an independent (vs. interdependent) self-construal are more likely to pay attention to only the focal aspects of stimuli and to ignore the context and background information in forming spatial judgments, resulting in biases. In contrast, interdependents are capable of going beyond the most salient dimension (e.g., direct distance) and incorporating other information (e.g., line configuration) in their judgments, leading to greater accuracy in these tasks.

In contrast to context-relevant judgment tasks, context-irrelevant judgment tasks require individuals to ignore irrelevant contextual features of the spatial stimuli (e.g., Muller-Lyer illusion). In these tasks, we show that individuals with interdependent self-construal are less accurate compared to those with independent self-construal. This is consistent with the view of individuals with an interdependent self-construal being holistic thinkers, who take both the focal aspect of stimuli and (irrelevant) context and background information into account in their spatial judgments, generating such biases. In contrast, individuals with an independent self-construal, as analytic thinkers, are more likely to ignore the irrelevant contextual information, thus demonstrating less bias in context-irrelevant judgments.

Across the set of three studies, we examine self-construal operationalized by different cultures and as a malleable construct that shifts in response to situational primes. The findings are consistently supportive of the idea that it is self-construal that influences the observed differences in spatial perception judgments. Our findings also clearly rule out other artifacts of country-related differences (e.g., familiarity with tasks, motivation, and language) as alternative explanations.

We believe that this is the first research to identify self-construal as a determinant of spatial perception biases. Although some past studies have found greater judgment biases (in the social domain) associated with independent (vs. interdependent) self-construal, the current research is one of the few instances in which the opposite is also shown. Results from study 3 clearly show that while independent self-construal leads to greater bias in context-relevant tasks, it also leads to less bias in context-irrelevant tasks. As such, our research suggests that response accuracy is a function of self-construal as well as type of task. In other words, it is not that independents are always more biased than interdependents—in tasks in which accuracy results from attending only to the focal object and ignoring irrelevant context, independents can perform better.

The current research also contributes to a better under-

standing of the different information-processing styles associated with interdependent and independent self-construals. Consistent with the idea of holistic versus analytic thinking (Nisbett et al. 2001), our findings suggest that individuals with interdependent self-construal tend to incorporate multiple perspectives in judgment and decision making. In contrast, those with independent self-construals are more likely to rely on the most salient dimension(s) and ignore context and background information in making spatial judgments. The salient dimension(s), having been used repeatedly as the basis of judgment, may become a simple heuristic (e.g., using direct distance to assess length and numerosity) that independents apply without adjusting according to specific contexts.

The finding that people from independent cultures are more likely to demonstrate biases in context-relevant tasks has interesting managerial and social welfare implications. For example, when people are waiting for products and services, especially in crowded locations such as theme parks, lines often retrace to the original direction (like a snake) rather than continuing in the same direction. It is conceivable that people in Western cultures are more likely to rely on direct distance between the spot they are at and the service counter as the primary input in judgment, thus leading to an underestimation of the number of people in the queue. Therefore, in such cultures, it might be especially helpful to provide information about the number of people in line so as to assist people in deciding whether or not to join a particular queue. In Eastern cultures, such information is less crucial but may also help individuals in such cultures who have higher independent self-construal.

Finally, results from studies 2 and 3 show that independent and interdependent self-construals could shift in response to situational primes, leading to differences in spatial perceptions. Marketers could attempt to trigger different mind-sets (independent vs. interdependent) by varying the marketing stimuli that consumers are exposed to. For instance, advertisements that feature the protagonists in a group setting (vs. alone) could presumably activate interdependent (vs. independent) aspects of the self. As a result, this could lead to differences in spatial perceptions such as judgment of sizes of area rugs or distance between two shops in an outlet mall.

Limitations and Future Research

A limitation of the present studies is that they did not offer direct measures of the underlying process. Our results show that compared to independents, interdependents are more accurate in context-relevant judgments (direct distance bias) and less accurate in context-irrelevant judgments (Muller-Lyer illusion). While one could, with some confidence, infer from these results that interdependents incorporated context and background information into their judgment to a greater extent than independents, a more direct way to understand such processes would be with thought protocols. Future research examining the thought processes could also generate other interesting insights. For example, in the Mul-

ler-Lyer illusion task, it is possible that interdependents do recognize the distracting role of the two outer arrowheads. However, they might be unable to suppress utilizing the (irrelevant) contextual inputs—they may have been conditioned through socialization processes in such a way that contextual factors should be considered in judgments. Future research could check whether such recognition by interdependents exists.

Our findings may be fruitfully extended to other domains beyond spatial perceptions. For example, in the area of affective forecasting, compared to East Asians, Westerners were found to be more susceptible to the so-called impact bias (Lam et al. 2005), whereby people overestimate the enduring impact that future events (positive or negative) have on their emotional states. This is because, when generating affective forecasts, Westerners are more likely to give most attention to the future event in question and deemphasize other less salient events, leading to an overestimation of the emotional consequences of the focal event. While Lam et al. (2005) restricted their investigation to cross-cultural comparisons, it is possible that different self-construals underlie their effects. That is, Westerners, with predominant independent self-construals, are more likely to focus on the target event and ignore the context and background information. Future research could examine, for example, whether priming interdependent self-construal could lead to greater attention paid to the less salient events and thus help reduce the impact bias.

In our research, it was found that independents perform better than interdependents in judgments that require the individual to ignore irrelevant contextual information. Numerous research on consumer behavior has identified context effects in which irrelevant context seems to have great influence on consumers' judgment and decision making, resulting in certain biases. For example, according to the attraction effect (Simonson 1989), the introduction of an inferior alternative to an existing choice set can increase the likelihood that one of the original alternatives (the dominating alternative) will be chosen. It would be interesting to examine whether individuals with independent self-construals are less subject to the attraction effect and whether priming independent self-construal would have similar debiasing effects as found in the current research. Many other such context effects could also be explored for the possible impact of self-construal. We hope that our research linking self-construal to spatial judgment would spark much more research on self-construal and cognitive judgment in general.

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