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Mnemonic Context Effect in Two Cultures: Attention to Memory Representations?

Sean Duffy[a], Shinobu Kitayama[b]

[a]*Department of Psychology, Rutgers University*
[b]*Department of Psychology, University of Michigan*

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Abstract

In two experiments we demonstrate a substantial cross-cultural difference in a mnemonic context effect, whereby a magnitude estimate of a simple stimulus such as a line or circle is biased toward the center of the distribution of previously seen instances of the same class. In support of the hypothesis that Asians are more likely than Americans to disperse their attention to both the target stimulus and its mnemonic context, this effect was consistently larger for Japanese than for Americans. Moreover, the cultural difference was attenuated by an experimentally induced belief in class homogeneity that augmented the context effect itself in both cultures. More important, these belief effects happened in the absence of any objective change in stimulus distribution. Implications for sociocultural shaping of cognition are discussed.

Keywords: Culture; Cognition; Memory; Context; Attention

Selective attention is ubiquitous and consequential. It influences both sensory input admitted into the processing system (Broadbent, 1958) and whether and how the available information is elaborated (Posner, 1982). Furthermore, it can also influence memory encoding and retrieval, determining which mnemonic information is activated and retrieved (Lozito & Mulligan, 2006).

Given the fundamental significance of attention, it is noteworthy that the last decade of research on culture and cognition has demonstrated substantial cultural variations in attention (Chua, Boland, & Nisbett, 2006; Kitayama, Duffy, Kawamura, & Larsen, 2003; Masuda & Nisbett, 2001). This emerging evidence suggests that culture's influence is not limited to social norms and mores, but may extend to basic processes in cognition. At present, evidence for cultural variation in attention is based exclusively on visual or auditory attention. Nevertheless,

Correspondence should be addressed to Sean Duffy, Department of Psychology, Rutgers University, Camden Campus, 343 Armitage Hall, 311 N. 5th St., Camden, NJ 08102. E-mail: seduffy@camden.rutgers.edu

attention can apply not only externally to visual or auditory stimuli, but also internally to memory representations. Thus, similar cross-cultural variations may be expected for judgments that are mediated by internally directed attention. The current work examines cultural variations in the degree to which memory representations are attended to and incorporated in reconstructive memory.

1. Culture and visual attention

In the last decade, a number of studies have documented robust cultural differences in a variety of cognitive processes (Kitayama & Duffy, 2004; Nisbett, Peng, Choi, & Norenzayan, 2001; Norenzayan et al., 2002; Choi, Nisbett, & Norenzayan, 1999; Nisbett, 2003). Many studies have compared North Americans with their Asian counterparts, demonstrating that allocation of attention to objects and their surrounding context varies across cultures (Kitayama et al., 2003; Masuda & Nisbett, 2001). An empirical generalization emerging from this work is that North Americans are socialized to develop strategies of focusing attention to focal objects in lieu of their context (the *F* [focused] strategy), whereas Asians are socialized to develop strategies of dispersing their attention more holistically to both objects and their surroundings (the *D* [dispersed] strategy; Kitayama & Duffy, 2004; Nisbett et al., 2001).

It is likely that these two attention strategies are formed through active efforts to attune attention to demands and requirements imposed by practices and public meanings of different cultural contexts. In North American culture, many social judgments require attending to each individual self as a unique and discrete entity because these selves are believed to be independent. There may be a default assumption of heterogeneity of instances in any given class (i.e., each person, each building, each dish, etc., is unique in its own way). In contrast, social contexts of many Asian cultures require dividing attention between each individual self and various social others due to expectations about the interdependencies of these selves (Markus & Kitayama, 1991; Kitayama, Duffy, & Uchida, 2007; Masuda & Kitayama, 2004). Asians may also presuppose some degree of uniqueness or heterogeneity of instances in a class, but this supposition may not be as strong as the one tacitly held by Americans.

This formulation is consistent with the notion that attention is differently attuned depending on momentary changes of the situational demand. Studies show that priming the independent self results in context-independent cognitive modes, including focused attention, whereas priming the interdependent self results in a context-dependent mode of cognition, including dispersed attention (Kuhnen & Oyserman, 2002). Similarly, Kim and Markman (2006) demonstrated that the extent that individuals experience a fear of isolation (i.e., a greater threat to the interdependent self) is positively associated with sensitivity to contextual information.

Through continuous and habitual engagement in culturally unique patterns of social interaction, East Asians develop strategies of dividing attention between the self and social others, whereas North Americans develop strategies of focusing upon the self. Once acquired through social interaction over the course of development, these strategies become general modes of attending to objects and events. In a recent developmental study, Duffy, Toriyama, Itakura, and Kitayama (2007) showed that the internalization of attention becomes evident around the age of five.

Although the socialized attention hypothesis has yet to be fully tested, there is mounting evidence for cross-culturally divergent attention strategies. For example, Masuda and Nisbett (2001) demonstrated significant cultural differences between North Americans and Japanese in the degree that context influenced recognition memory of fish within unique contexts (e.g., coral reef). Japanese were more accurate at recognizing fish presented in their original contexts as compared to the same fish in a novel context, whereas North Americans showed no difference in recalling fish whether presented in the original or novel context.

More recently, Kitayama et al. (2003) had American and Japanese participants observe a line drawn within a square paper frame. Participants were then asked to draw a line having either the same absolute length or the same proportional length in a second frame that differed in size from the initial frame. The absolute judgment requires focusing attention to the focal line and should be easier for F-strategists. Conversely, the relative judgment requires allocating attention holistically to the surrounding frame and should be easier for D-strategists. As predicted, Japanese were more accurate in the relative than in the absolute task; but the reverse was the case for Americans. In a recent fMRI study, Hedden, Ketay, Aron, Markus, and Gabrieli (2007) adopted the same task and found strong activation of the neo-frontal cortex (indicating active attention control) when the tasks are made relatively difficult. But, this effect was observed only for the relative task if the participants had Caucasian, independent backgrounds, but only for the absolute task if the participants had Asian, interdependent backgrounds. Analogous cultural differences have also been observed with eye-movement (Chua et al., 2006). Furthermore, another recent fMRI study has shown cross-culturally divergent activation patterns of the visual cortex that is consistent with the notion that object representations are far more dominant vis-à-vis the representations of context for North Americans than for Asians (Park & Gutchess, 2006). Such representational consequences may be due to culturally divergent attention strategies.

2. Mnemonic context effect

One important limitation of the current literature on culture and attention is that existing studies examined external context–stimuli that literally surround a target stimulus. Yet, context can also be internal. For example, when observing another person, individuals may recollect previous experiences with this person, when and where they met him or her, what happened, and so on. Such information constitutes mnemonic context for the processing of the information about the target person. Individuals may then simultaneously attend to this mnemonic context along with the focal information about the person in order to make judgments or form impressions about the individual. Extrapolating from the previous evidence for the attention difference in the processing of external context, we may predict that D-strategists (e.g., Asians) will be more likely than F-strategists (e.g., Caucasian Americans) to simultaneously attend to the mnemonic context when processing focal objects.

The present work tests the foregoing prediction on cultural differences in attentiveness to mnemonic context with non-social stimuli. For this purpose, we use a sequential stimulus estimation task. In this task participants observe and reproduce a set of items that vary along a dimension (i.e., stimulus size), Over time, individual estimates of focal stimuli are assimilated with the average size of the set of stimuli that preceded the focal one and are thus available only in memory (Huttenlocher, Hedges, & Vevea, 2000). The memory representations of the preceding stimuli serve as a context that helps inform judgments about the particular stimulus estimated on any given trial. This combination of prior information with present information results in a contraction bias, such that objects are remembered as being more typical of the set of which they are a member. This mnemonic context effect (MCE) can be found for virtually every class of events, objects, and stimuli that are distributed over any given quantifiable continuous dimensions, such as size, magnitude, beauty, and wealth (Bartlett, 1932; Crawford, Huttenlocher, & Engebretson, 2000; Hollingworth, 1910; Neisser, 1976).

In order for this effect to occur, when people are faced with the task of estimating a particular stimulus, they must divide their attention between the stimulus in question and their representations of previous instances stored in memory. Because a propensity toward simultaneously processing context is likely to apply regardless of the nature of context being external or internal, we expect that the extent to which people attend to either a focal stimulus or its mnemonic context would vary as a function of their attention strategy. Specifically, our hypothesis is that D-strategists (Asians) should be more likely than F-strategists (Caucasian Americans) to attend to previous instances. If so, the MCE should be more pronounced for the D-strategists than for the F-strategists.

In order to test the foregoing prediction, Experiment 1 presented Japanese and American participants with lines that vary in length. These stimuli were presented one at a time, 1 sec after disappearance of the previous one; participants reproduced the length of the line by adjusting a second line to equal the length of the target. The MCE is indexed by the amount of bias toward the center of the underlying distribution. Bias is calculated simply as the difference between the participant's response and the actual stimulus length. Plotted against objective stimulus values, bias forms a negative slope. The steepness of this slope provides a measure of the strength of the MCE. We predict that the slope is more negative for Japanese (the D-strategists) than for Americans (the F-strategists).

3. Experiment 1: MCE in Japan and the United States

3.1. Method

3.1.1. Participants

The sample consisted of 28 North American college students (14 men and 14 women) and 26 Japanese college students (11 men and 15 women). U.S. participants received $5.00; Japanese received 500 yen.

3.1.2. Procedure

Stimuli consisted of a total of 192 lines of 24 distinct lengths varying in 16 pixel increments from 48 to 416 pixels. These lines were presented on laptop computers with 12-in. (diagonal) monitors. Participants viewed a target line for 1.5 sec, it disappeared for 1 sec, and then they reproduced the length of the target line by adjusting a reproduction line by using the keyboard, pressing the "J" key to make the line smaller and the "K" key to make the line larger. For one half of the participants, the reproduction line began at 32 pixels; for the other half, 432 pixels.[1] After they were satisfied with the length of the reproduction line, participants pressed the return key and received the next stimulus. The entire procedure lasted 30 min.

3.2. Results

Non-responses in which participants did not adjust the reproduction line were eliminated, as were responses greater than 3 *SD*s from the mean bias for each stimulus value, eliminating less than 0.5% of the total data. Bias (the signed difference between the participant's response and the true stimulus value) was computed for each stimulus by subtracting actual stimulus length from each estimate.

We first examined the mean bias for each of the 24 stimulus values separately for Japanese and Americans. These means are plotted in Fig. 1, which shows bias against objective stimulus size. The bias curve forms a negative slope because smaller stimuli are generally overestimated, whereas larger stimuli are underestimated. The figure reveals that both groups of participants showed a clear MCE, however, the effect is stronger for the Japanese than American participants. One can also find some decline of the slope at the shorter end and some incline of it at the longer end. The cutoff effects like these have been observed in the past work (Huttenlocher et al., 2000) and are usually interpreted to mean that extreme values are sometimes rejected as typical members of the class. However, the cutoff effects were fairly minor. For example, for both cultures the linear component accounted nearly 96% of the variance jointly accounted for by both the linear and the cubic components. In addition, eliminating the extreme stimuli

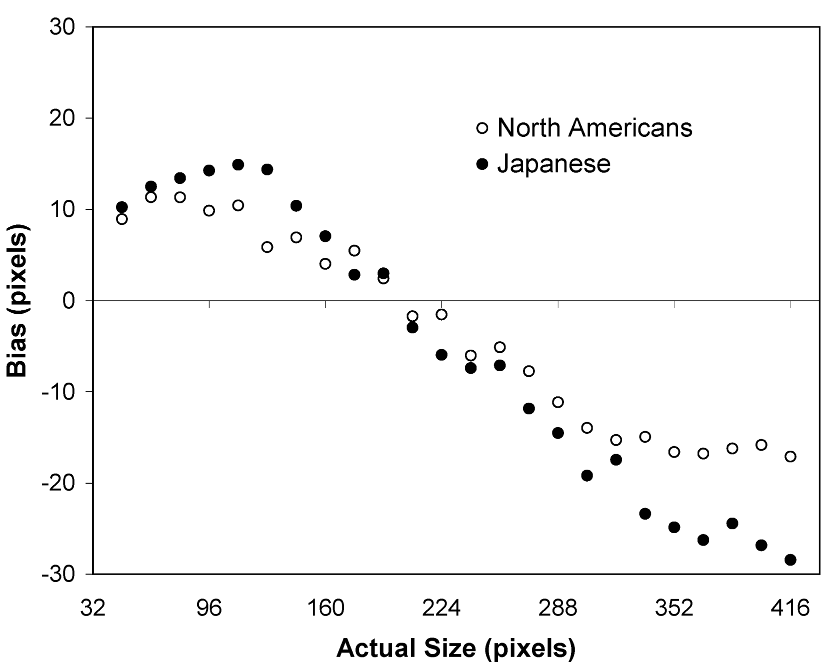


Fig. 1. Results, Experiment 1.

from the analysis did not alter the main findings. Thus, we will focus only on the linear effect of stimulus length on bias.

To determine whether the MCE is stronger in Japan than in the United States, we computed mean bias for each participant for each of the 24 stimulus values. These mean estimates were then regressed on the 24 stimulus values, yielding both a slope (standardized regression coefficient, β) and an intercept. We performed Fisher's z-transformation on the βs for the estimates of slope to approximate a normal distribution and submitted these values to an analysis of variance (ANOVA) with two between-subject variables of culture and gender. The culture main effect was significant, $F(1, 52) = 4.973$, $p < .05$, $MSE = 0.019$, Cohen's $d = .56$, showing that the Japanese β was significantly steeper than the American β (Ms [SEs] = –0.13 [0.011] versus –0.09 [0.014], respectively). There were no other significant effects or interactions.

The above finding is consistent with the hypothesis that internally directed attention is more likely to be extended to mnemonic context for Japanese than for Americans. Nevertheless, there are two alternative explanations. The first is that compared to Americans, Japanese were less careful in encoding the size of the target line, resulting in greater inexactness of the fine grain memories, which was compensated for by introducing stronger bias toward the central region of the distribution. If this were the case, one would expect the standard deviations of estimates to be larger for the Japanese sample. To test this, we calculated for each participant the average standard deviation of estimates for each of the 24 stimulus values to yield a mean standard deviation of the estimate. This average was then submitted to an ANOVA with two between-subject variables (culture and gender). This analysis revealed that the average standard deviation was no larger for Japanese participants than for American participants (Ms = 34.6 vs. 35.0, respectively), $F < 1$. A second explanation for the findings is that Japanese were more judicious in adjusting the response lines, hesitating for a period of time before adjusting the response line, causing the stimulus memories to degrade. However, the amount of time between the appearance of the response line and the initiation of adjustment did not differ between the samples (Ms = 352.6 vs. Ms = 347.2 for the Japanese and American sample, respectively), $F < 1$.

3.3. Discussion

The results of Experiment 1 suggest that in reconstructing a stimulus from memory, Japanese exhibited a stronger MCE than North Americans. This finding may result from East Asians allocating greater attention to memory representations of prior instances of the set when reconstructing estimates of particular stimuli stored in short-term memory.

Although the results are encouraging, they do not permit an examination of potential mechanisms that explain the cultural difference in the MCE. As noted earlier, it is possible that (a) North Americans tacitly hold a default assumption that instances in any given class (e.g., person, building, dish, . . . , etc.) are relatively unique in their own ways and, thus, are relatively heterogeneous and, as a consequence; (b) they do not pay close attention to context in making a judgment on the current instance, thereby showing a weak MCE. Conversely, (c) Japanese may show a substantial MCE because they tacitly hold an assumption that instances in a class are relatively homogeneous. We suspect that these perceptual assumptions are very tacit and, in all likelihood, are simply inaccessible to conscious awareness or explicit reflections (Nisbett & Wilson, 1977).

In agreement with this reasoning, the extent that people incorporate mnemonic information about previously instances in estimates of particular stimuli is likely to depend on the perception of homogeneity–heterogeneity of a class. Kashima, Woolcock, and Kashima (2000) suggested that stimuli are encoded in memory as a category label (*X* is an apple), exemplar features (*X* has a certain level of sweetness), and context (the apple was red, consumed in the afternoon). They have advanced a mathematical model predicting that the more homogeneous the class is perceived to be (i.e., greater similarity among the contexts of the individual exemplars), the more likely it is that people rely on previously seen instances to inform estimates of the current target. Conversely, the more heterogeneous the class is believed to be (the greater the dissimilarity among the exemplar contexts), the less likely it is that people rely on prior instances to inform estimates.

One important implication of this line of analysis is that the cultural difference observed in Experiment 1 is likely to be attenuated if (a) Americans are challenged on their perceptual assumption about heterogeneity of instances, (b) Japanese are challenged on their perceptual assumption about homogeneity of instances, or (c) both. We generally predict that the MCE would be greater if instances were perceived as more homogenous. This effect, however, may be separate from and, thus, largely independent from the cultural difference. This would imply that the MCE shown by Americans under the condition of induced perception of homogeneity of instances would be very similar to the MCE shown by Japanese under the condition of induced perception of heterogeneity of instances. The goal of Experiment 2 is to test this possibility by varying the perceived homogeneity of a class of stimuli by a simple manipulation of stimulus color.

4. Experiment 2: Class variability and the MCE

4.1. Method

4.1.1. Participants

Forty participants (20 Japanese and 20 North Americans) participated in Experiment 3. The Japanese sample had 10 males and 10 females while the American sample consisted of 9 males and 11 females. The population and payment was identical to Experiment 1.

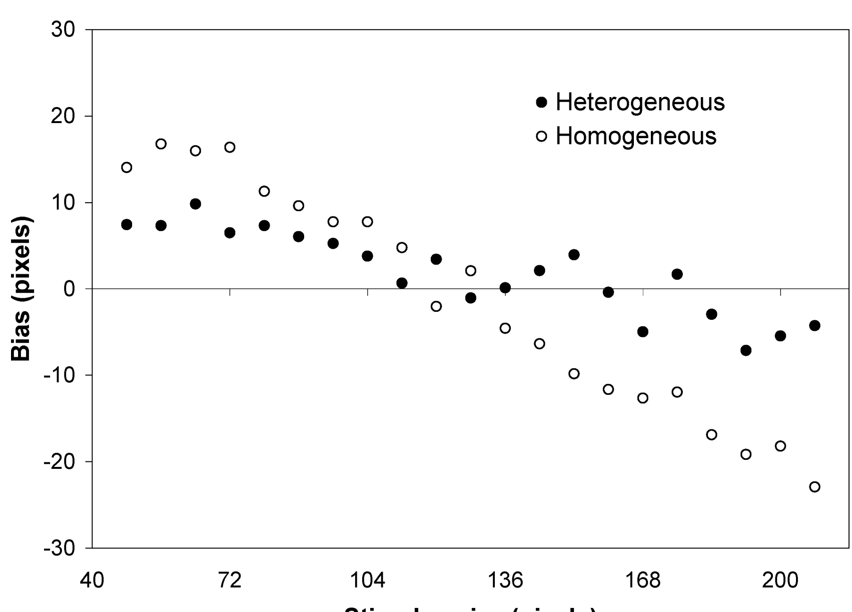
4.1.2. Procedure

Participants were told that they were to participate in a study investigating how accurately people estimate the size of blood cells for medical diagnosis. All participants were presented with a total of 105 circles, one at a time, that they had to reproduce from memory. There were 21 unique stimulus sizes, ranging from 48 pixels to 208 pixels in 8 pixel increments. There were 5 stimuli from each of these 21 sizes forming a uniform distribution of 105 circles. Each target circle was presented on the left side of the screen of a laptop computer for 250 msec. We decreased the stimulus presentation time from Experiment 1 in attempt to accentuate the MCE, as shorter presentation times would lead to greater inexactness in the memory for particular stimuli. After a 1-sec delay, a black circle appeared on the right half of the screen. The participant adjusted this second circle to be the same size as the first circle by pressing the J and K keys on the keyboard. For one half of the participants, the reproduction circle began at 32 pixels; for the other half, 332 pixels. Once they were satisfied with their response, participants pressed the return key, at which point the computer showed another circle, and the process repeated until they completed all trials.

There were two between-subject conditions within each culture: heterogeneous or homogeneous class conditions. In the homogeneous class condition, all the circles for a given participant had were one of five colors: yellow, magenta, blue, cyan, and red. In the heterogeneous class condition, the cells varied in color within each participant so that for each of the 21 size levels, each of the five circles from that size level was one of the five colors noted above.

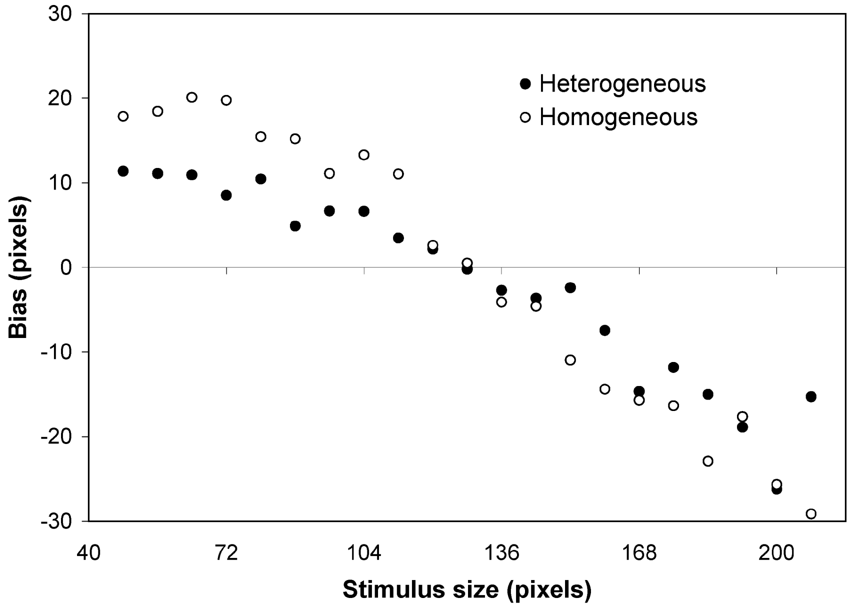
4.2. Results

For each response, we computed bias as the difference between the actual stimulus diameter and the participant's estimate for the diameter. Non-responses and responses greater than 3 *SD*s from the mean bias for that stimulus value were culled, eliminating less than 0.5% of the data. Average bias for each of the 21 stimulus sizes by condition is shown in Figs. 2a and 2b. In all conditions, the linear effect was quite evident. We also observed some signs of the cutoff effect. But, this effect was less pronounced in Experiment 2 than in Experiment 1.



(a)

Fig. 2a. Results for the North American sample, Experiment 2.



(b)

Fig. 2b. Results for the Japanese sample, Experiment 2.

As in the previous experiment, a slope was computed for each participant. These slopes were submitted to an ANOVA after $z-$transformation. As predicted, the culture main effect was highly significant, indicating again that the slope is steeper (and, thus, the MCE is stronger) for Japanese than for Americans (*M*s [*SE*s] = –0.26 [0.013] and –0.16 [0.014]), $F(1, 37) = 26.55$, $MSE = .094$, $p < .0001$, $d = .446$. Also as predicted, the class variability main effect proved significant, showing that the slope was significantly steeper in the homogeneous condition than in the heterogeneous condition (*M*s [*SE*s] = –0.27 [0.014] and –0.14 [0.013]), $F(1, 37) = 52.56$, $MSE = .186$, $p < .0001$, $d = .614$. As predicted, the average slope of Americans in the homogeneous condition was no different from the average slope of Japanese in the heterogeneous condition, $F < 1$.

Unexpectedly, the interaction between culture and class variability reached statistical significance, $F(1, 37) = 4.05$, $MSE = .014$, $p < .05$, Cohen's $f = .136$. Although the cultural difference was significant in both of the two class variability conditions, it was significantly larger in the heterogeneous condition than in the homogeneous condition. Because individuals are likely to try ignoring mnemonic context in the heterogeneous condition but probably not in the homogeneous condition, the results might indicate, consistent with earlier findings with externally oriented attention (e.g., Hedden et al., 2007; Kitayama et al., 2003), that Americans are more capable than Japanese to ignore mnemonic context especially when they try to do so. As in Experiment 1, the estimates were no more variable for Japanese than for Americans, and there was no cultural difference in reaction times, $F < 1$.

4.3. Discussion

The results of Experiment 2 replicated the main cultural difference found in Experiment 1. Furthermore, they provided evidence for the hypothesis that the cultural difference is mediated by perceptual assumptions about variability of instances in a class. Specifically, the bias shown by Japanese when they were induced to assume a relatively high variability was nearly identical to the bias shown by Americans when they were induced to assume a relatively low variability. Finally, the results indicated that as compared to Japanese, Americans are especially capable of ignoring mnemonic context when they try.

5. General discussion

The experiments reported here provide evidence that Japanese were more likely than North Americans to incorporate their memories of previously seen instances of a class into a judgment about a particular object, and thus exhibit a stronger MCE in their estimates of stimuli. Moreover, we found initial evidence for the prediction that the cultural difference is moderated by perceived class variability such that the MCE is more pronounced when the class is considered heterogeneous than homogeneous.

The current set of findings is consistent with an accumulating body of evidence for analogous cultural differences in externally directed attention (Ishii, Reyes, & Kitayama, 2003; Ji, Peng, & Nisbett, 2001; Kitayama et al., 2003; Masuda & Nisbett, 2001). These findings suggest that many cultural variations in higher-level cognitive processes originate in divergent attention strategies that arise within individuals socialized and engaging in different cultural contexts (Chavajay & Rogoff, 1999; Kitayama & Duffy, 2004). Divergent practices of cultures may require directing attention to different perceptual and conceptual information. Hence, it is likely that cognitive mechanisms are shaped by such cultural practices and attendant lay beliefs so that attention becomes directed toward relevant aspects of the cultural environments.

The evidence presented on perceived variability is important because it suggests that the cultural difference in MCE is likely to be mediated by culturally divergent assumptions about the variability of instances in a category. However, it offers more general insights into the process of category induction as well. Theoretical models generally assume that information about class variability itself is induced, bottom-up, from observed instances (Huttenlocher et al., 2000). However, these models may not be complete without explicitly incorporating the profound top-down influences higher order social and cultural knowledge can have on lower order processes of reconstructive memory.

To conclude, culture's influences well extend norms and mores. They include cognitive processes that are far more basic than have typically been assumed in the literature. Such influences are quite subtle. Yet, precisely because of their subtlety, they may end up having pervasive influences on the conscious experience of people engaging in different cultures. In fact, these effects may serve as an indispensable psychological anchor for norms and mores of different cultures.

Note

1. For both experiments, a preliminary analysis showed that there was no significant effect of the initial size of the reproduction line, so we dropped this factor from subsequent analyses.

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