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ORIGINAL ARTICLE

Cross-cultural differences in memory specificity

Peter R. Millar · Sarah J. Serbun · Akash Vadalia · Angela H. Gutchess

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Abstract Attention and memory have been shown to differ across cultures, with independent Western cultures preferring an object-based feature analysis and interdependent Eastern cultures preferring a context-based holistic analysis. In two experiments, we assessed whether these cultural differences not only affect how much information is remembered, but also the specificity of memory such that the feature analysis preference of Americans should lead to greater memory for visual detail. Americans and East Asians incidentally encoded pictures of single items (Exp 1) and pictures of focal items presented against a meaningful background (Exp 2). On a recognition test, participants made same, similar, or new decisions about items (Exp 1 & 2) and backgrounds (Exp 2) that were the same as or similar to the encoded stimuli, as well as novel lures. As predicted, Americans exhibited greater accuracy than East Asians in specific memory for objects presented alone and this trend continued across both objects and backgrounds when objects were depicted in context. The two cultural groups did not differ in general (item-level) memory. These results support the idea that the feature analysis biases of Westerners may increase the specificity of visual information contained in memory, despite equivalent item-level memory.

Keywords Culture · Cognition · Cross-cultural · Memory · Recognition · Memory specificity

Recent evidence reveals dramatic differences in the ways that people from different cultures perceive the world around them. In particular, the preference for analytical

P. R. Millar · S. J. Serbun · A. Vadalia · A. H. Gutchess (✉)
Department of Psychology, Brandeis University, 415 South Street, MS 062, Waltham, MA 02454-9110, USA
e-mail: gutchess@brandeis.edu

or holistic processing has been demonstrated to differ across cultures (Gutchess et al. 2006a; Na et al. 2010; Nisbett 2003; Nisbett and Masuda 2003; Nisbett et al. 2001). One of the most consistent findings illustrating such a pattern is Westerners' (e.g., Americans, Canadians, or Western Europeans) focus on salient objects in contrast to Easterners' (e.g., Chinese, Japanese, or Koreans) focus on context when viewing and remembering complex scenes (Chua et al. 2005a; Nisbett and Masuda 2003).

These information processing biases emerge in perceptual tasks. Ji and colleagues adopted a classic test (Witkin et al. 1954) of field-dependence to assess cultural differences in the ability to separate an object from its field. They discovered that when judging the orientation of a framed rod, Americans found it easier to ignore the frame and judge the verticality of the rod alone; East Asians were more affected by the position of the frame, which could interfere with the judgment of the absolute verticality of the rod (Ji et al. 2000). In a modified version of the framed-line test, Americans were more accurate at reproducing a line independent of its frame whereas Japanese were more accurate when reproducing the line in proportion to the frame (Kitayama et al. 2003; Zhou et al. 2008). Cultural differences in estimation extend to when contextual information is stored in memory (rather than physically present) (Duffy and Kitayama 2007), and in the perception of emotion (Cohen and Gunz 2002; Masuda et al. 2008).

Attentional differences may contribute to the cultural differences reported for analytical versus holistic processing. East Asians allocate their attention more broadly than Americans, which in turn increases their chances of detecting changes in visual arrays when change occurs in the periphery rather than the center (Boduroglu et al. 2009). Furthermore, the detection of a focal target is slower in East Asians than in Americans, which may reflect an allocation of attention to a larger field (Boduroglu et al. 2009). Part-cues (e.g., several pieces of an object) are more effective in helping Americans to identify previously presented pictures, whereas holistic cues (e.g., a blurred gestalt of the image) supported picture identification equally for Easterners and Westerners (Ishii et al. 2009). Neuroimaging studies corroborate the contribution of attentional networks to cultural differences, with greater engagement of a frontal-parietal attentional system when individuals complete tasks with their non-preferred strategy (i.e. Americans using relational processing) (Hedden et al. 2008). Japanese detect changes in the context faster than Americans, whereas both groups similarly detect changes to the focal object (Masuda and Nisbett 2006). These biases may reflect the physical environments present in different cultures. Background changes were easier to detect in Japanese than American scenes (Masuda and Nisbett 2006), consistent with the idea that Japanese environments afford more processing of context (Miyamoto et al. 2006).

Culture also shapes what information is remembered. When asked to describe animated vignettes of underwater scenes from memory, Americans focused on the prominent fish in the scene, whereas Japanese incorporated more contextual details. Changing the context impairs memory for the object for Japanese participants more than for Americans (Masuda and Nisbett 2001). Eye-tracking and fMRI measures are consistent with these findings, with Americans spending more time viewing objects and fixating to them sooner than East Asians (Chua et al. 2005a; Evans et al.

2009) and Americans modulating object processing regions more than East Asians (Goh et al. 2007; Gutchess et al. 2006a). Cultural differences in the focus on salient objects and backgrounds extend to social situations, with Westerners reporting the central character as more prominent in narratives than Taiwanese (Chua et al. 2005b), and placing themselves as the central character, retrieving memories largely from a first-person perspective, rather than a third-person perspective (Cohen and Gunz 2002). Autobiographical memory differs for cultures at both encoding and retrieval (Wang and Ross 2005), and Americans recall more specific "one-moment-in-time" episodes, events, and details whereas Asians remember more general event information (Wang 2006b, 2009).

The emphasis of Chinese culture on the collective group and social obligations may have led to a holistic orientation in East Asian cultures whereas the emphasis of Greek culture on personal agency may have contributed to an analytic orientation in Western cultures (Nisbett 2003; Nisbett and Masuda 2003; Nisbett et al. 2001). Recent work with diverse groups (e.g., Eastern vs. Western Europeans; middle- versus working-class Americans) suggests that *social* forces may drive these cross-cultural differences in cognition. According to this view, the social orientation towards either the collective group or the individual influences whether a culture supports holistic or analytic approaches to cognition (Varnum et al. 2010). That is, having a social orientation where the self is seen as tightly interconnected with others may be associated with adopting a cognitive perspective where one observes objects and events holistically, placing them in a broader context. In contrast, a social perspective in which the self is seen as independent might lead to a cognitive perspective in which objects and events are considered in isolation. Work establishing cross-cultural differences in the nature of the self (Chiao et al. 2008, 2009; Markus and Kitayama 1991; Wang 2006a; Zhang et al. 2006) gives credence to its potentially pervasive role in shaping cognitive processes. However, the self likely consists of both interdependent and independent aspects that can alternately be brought to the foreground and affect cognition (Hannover and Kühnen 2004). Socialization processes contribute to cultural differences, consistent with the developmental timing in which cultural differences emerge (Duffy et al. 2009). In order to more closely examine the influence of cultural differences in self-construal on visual memory specificity, our experiment will manipulate self-referencing at encoding.

Even though some research has begun to probe differences in memory across cultures, the emphasis has largely been on the *quantity* of different types of information remembered, such as contextual information (Masuda and Nisbett 2001) or number of categorical versus control words recalled (Gutchess et al. 2006b). *Qualities* of memories are particularly important in that they have the potential to shape, as well as reflect, one's experiences in the world. It may often be possible to verify whether or not an event occurred, but the details of these memories play an integral part in how an individual constructs the world and her own sense of self. Cultural differences in the ways in which individuals remember the qualities of information could contribute to substantial differences in the subjective experiences of individuals. The current studies examine cultural differences in the quality of memory by focusing on memory specificity. Specificity captures "the extent to which, and sense in which, an individual's memory is based on retention of specific features of a past experience, or reflects the operation of specialized, highly specific memory processes" (Schacter et al. 2009, p. 83). By comparing general and specific memory, we hope to explore the prioritization of information in memory across cultures.

It is likely that specificity is, to some degree, malleable. Existing studies (Chan et al. 2005) show that one's orientation at encoding (e.g., focus on the meaning vs. the sound of words) can change the patterns of memory errors (e.g., falsely endorsing more conceptual vs. phonological associates). Dissociations of general and specific visual memory have been previously reported between age groups, particularly in a design comparing memory for positive, negative, and neutral emotional images (Kensinger et al. 2007a). Although this paradigm has not yet been used to explore differences between culture groups, we propose that cultural orientation, like age, may affect the specificity of memory. The lens of culture can direct preferred modes of processing and/or attention to particular features of the environment (Gutchess and Indeck 2009). Because memory is a constructive process (Schacter 1999), information is encoded and retrieved based on those aspects most salient to the individual, such as conceptual, perceptual, or relational features. If Americans tend to adopt an analytical approach when observing the world around them and processing information, they should be more likely to remember perceptual details and features than cultures that tend to adopt holistic perspectives. We predict that Americans will exhibit better memory performance for more specific perceptual details of objects than East Asians. This pattern of cultural differences in specific memory will contrast a relative convergence across cultures in general memory for the item itself. Because culture-based concepts of the self may be an important lens through which visual attention strategies may be selected (Varnum et al. 2010), our experiment will also manipulate self-referencing during encoding. Participants will encode images in reference to themselves, to their mothers (close other), and to Bill Clinton (unknown other). If the emphasis of Western cultures on the individual self supports an object focus for encoding, then we might expect that Americans will exhibit increased specific memory accuracy when items are encoded within a self-reference frame as opposed to a close-other or unknown-other frame. In contrast, East Asians should not exhibit such a boost in the encoding of object details when self-referencing compared to other conditions. Together, the manipulations of this experiment will distinguish the influence of culture on memory specificity, and investigate the contribution of self-referencing to these effects.

Experiment 1

Methods

Participants

We tested 32 American (26 female) undergraduate students[1] and 32 East Asian (20 female) young adult students from Brandeis University or other Boston-area

[1] American participants were included in a separate publication (Serbun et al. 2011) that does not investigate the influence of culture.

schools. American participants were native to the U.S. and lived no more than 5 years abroad. East Asian participants were native to an East or Southeast Asian country (i.e., China, Japan, Korea, Malaysia, Taiwan, Thailand, or Vietnam) and lived no more than 5 years in the U.S. East Asian participants were fluent, non-native speakers of English. All participants gave written consent and were reimbursed with either course credit or cash payment.

Materials

Stimuli consisted of 144 pairs of color photographs of familiar purchasable objects. Pictures in each pair shared a verbal label, such as bars of soap, but differed in visual detail (e.g., color, size, orientation, number, shape). See Fig. 1 for examples. All objects were shown against a white background. Purchasable objects were chosen to simulate a realistic situation in which a purchase decision would be made. The 144 object pairs were drawn from 180 pairs rated by 4 American and 6 East Asian pilot participants. The pilot participants provided a name for each object and rated their familiarity with each object on a 5-point Likert scale. The 144 object pairs with the highest familiarity ratings and highest conceptual agreement across cultures were selected for inclusion in the experimental stimuli.

Encoding procedure

The study took place over the course of two sessions. On the first day, participants completed the encoding procedure. For each of 108 trials, the program presented one of three questions on the screen for 2 s: "is this an object *you* would buy some time in the next year?"; "is this an object your *mother* would buy some time in the next year?"; or "is this an object *Bill Clinton* would buy some time in the next year?". Bill Clinton was selected as the personally unfamiliar other based on ratings of familiarity from pilot participants from each culture. The program then immediately presented one of the object images on the screen for 500 ms. Participants were instructed to answer "yes" or "no" to the question as quickly as possible with a key press. To standardize encoding time, the stimuli were automatically presented with a 1,000-ms inter-stimulus interval between trials in which participants' responses were recorded. Each participant viewed 36 objects in the self-reference encoding condition, 36 in the mother-referencing condition, and 36 in the Bill Clinton condition, with conditions intermixed.

The order of object presentation was randomized for each subject and the condition for each object was determined through a counterbalancing scheme. Objects were divided into four lists of 36 object pairs and any especially masculine or feminine objects, as determined by the experimenter, were equally distributed amongst the lists. The same item (e.g., candle1) within each pair of objects was presented to every participant during the encoding phase but each participant was only shown three out of the four object lists during encoding. Objects from the fourth list, not shown during encoding, were presented as new items during the recognition phase. For each participant, the order of the lists presented during the

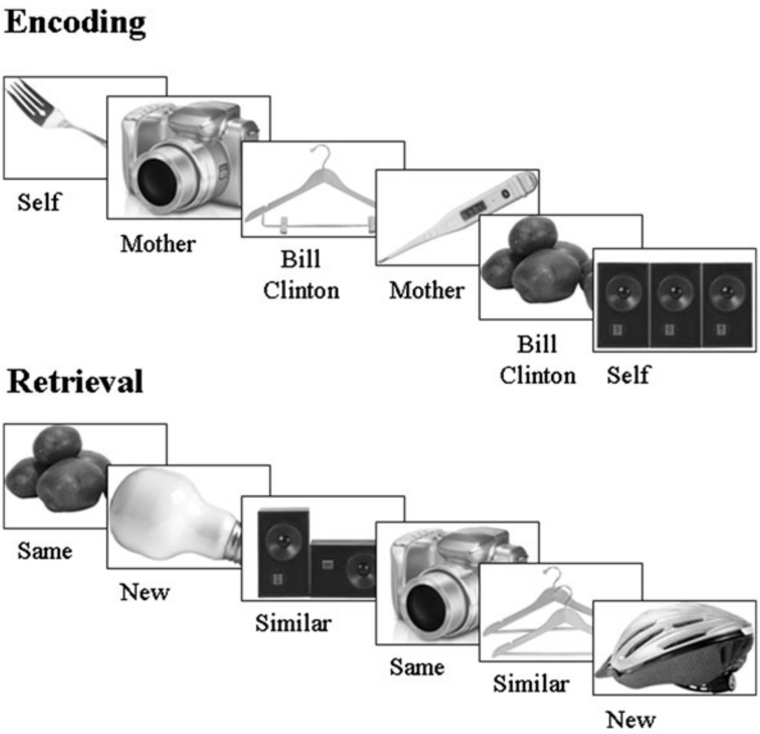

Fig. 1 Example of stimuli presented at encoding and retrieval in Experiment 1. Stimuli were presented in color

encoding and recognition phases followed one of eight counterbalancing orders, such that items were presented in different conditions across subjects.

Recognition procedure

Participants returned approximately 48 h after the first session. During the surprise computerized recognition task, participants were presented with 54 of the same objects shown in encoding (18 from each encoding condition), 54 objects similar to items previously seen in encoding (the matched pair of the item that was not shown to the participant in the initial encoding presentation), and 36 new objects. In 144 trials, the program presented each object for 1,000 ms, but the response interval was self-paced during which they pressed a key to classify each object as same, similar, or new (see Fig. 1 for example stimuli). Participants were instructed to respond whether the object was (1) exactly the *same* as an object seen in the encoding task; (2) *similar* to an object previously seen, but slightly different (e.g., in color, size, orientation, number, shape); (3) a completely *new* object. This procedure was based on that of Kensinger et al. (2007a) in their examination of memory for same, similar, and new emotional objects across age groups. Encoding and recognition tasks were presented using E-Prime 2.0 software (Psychology Software Tools, Pittsburgh, PA) on a Dell Optiplex 745 PC.

A series of demographic and cognitive measures were also administered over the course of the two sessions. These measures included a general demographic questionnaire and the abridged General Ethnicity Questionnaire developed by Tsai et al. (2000) to measure both the strength of participants' acculturation to American and Chinese cultures and participants' use of English and Chinese languages. For participants from other cultures, this measure was slightly modified by replacing references to Chinese culture with references to the appropriate native culture. American participants completed only those questions on American culture and language. Participants also completed Digit Comparison and Dot Comparison tasks to measure processing speed (Hedden et al. 2002).

Following completion of the second day, participants were debriefed with the purpose of the study, informed of the hypotheses, thanked, and presented with the advertised incentive for their participation.

Results

Participant characteristics

Samples were matched on years of education ($p > 0.30$, see Table 1). Even though East Asian samples were recruited and tested in the US, they differed from Americans in measures of acculturation and language. There was a significant difference between groups in self-reported use of the English language, with Americans rating themselves as more acculturated to English than did Asians ($p < 0.001$, see Table 1). Americans also scored significantly higher than Asians on the American cultural questions of the Tsai Bicultural Identity Scale ($p < 0.001$, see Table 1), indicating that the American sample agreed more with statements associated with American culture than did the Asian sample. On the General Ethnicity Questionnaires, Asian participants agreed that they behaved in ways considered consistent with their native culture more than they agreed with American cultural statements ($p = 0.001$, see Table 1). These measures indicate that our East Asians participants identified with their culture of origin more than American culture, despite being tested in the US. The groups also differed in measures of processing speed, used to assess cognitive ability across samples, with East Asian participants outscoring American participants in both the digit ($p < 0.01$) and dot ($p < 0.02$) comparison tasks (see Table 1). This pattern suggests that any cultural differences in memory specificity do not reflect problems from recruiting a lower ability East Asian sample.

Scoring

We calculated six memory scores for each participant to assess specific and general memory for each of the three conditions (self, mother, and Bill Clinton). *Specific memory* was the proportion of correct "same" responses given to previously viewed objects; in other words this score reflects accurate memory for those exact objects

Table 1 Demographic information and mean (with standard deviation) test scores for participants in Experiment 1

	American	East Asian	Significance
Age	19.97 (1.79)	21.19 (3.03)	$p > .06$
Years of education	14.42 (2.17)	15.00 (2.77)	$p > 0.30$
American identity	3.80 (.46)	3.21 (.39)	$p < 0.001$
English language	4.71 (.26)	3.83 (.61)	$p < 0.001$
Asian identity	N/A	3.65 (.48)	
Digit comparison	80.72 (13.66)	90.47 (11.78)	$p < 0.01$
Dot comparison	51.87 (8.58)	59.14 (12.98)	$p < 0.02$

studied in encoding and presented again during recognition. This equation is used in much of the emotion and memory research (Garoff et al. 2005; Kensinger et al. 2007a; Payne et al. 2008). We defined *general recognition* as the proportion of either correct "same" or incorrect "similar" responses given to previously viewed objects; in other words this score reflects any degree of memory for the objects studied in encoding and presented again at recognition (as used by Kensinger et al. 2007b). We wanted to look at cases in which participants had *at least* partially correct memory for a studied object. Although a "similar" response to a similar object is a correct response, it is unclear whether this response reflects specific or general recognition; for instance, this response could signal that a participant remembered specific details of the exact object studied during encoding and correctly identified this similar exemplar as "similar", or this response could result from a feeling of familiarity with this object but no real memory of its details. Therefore, responses to similar objects were not factored into the memory scores, in keeping with prior work.

Memory performance

Table 2 shows the proportion of objects given a *same*, *similar*, or *new* response, reported as a function of correct response (same, similar, or new) and condition (self, mother, Bill Clinton) for each cultural group (American, East Asian).

A 2 × 2 × 3 ANOVA was conducted on response accuracy with Culture as a between-subjects factor and Memory type (specific, general) and Condition (self, mother, Bill Clinton) as within-subject factors. Results are shown in Fig. 2. The ANOVA revealed a main effect of Culture, F (1, 62) = 7.01, $p < .02$, partial $\eta^2 = .10$, with Americans ($M = .73$) performing more accurately on the recognition task than Asians ($M = .65$). The main effect of Memory type was also significant, F (1, 62) = 434.52, $p < .001$, partial $\eta^2 = .88$, with higher performance for general recognition ($M = .84$) than for specific recognition ($M = .54$). A significant main effect of Condition also emerged, F (2, 61) = 9.64, $p < .001$, partial $\eta^2 = .14$.

Table 2 Proportion of same, similar, and new responses as a function of item type and condition for Americans and East Asians reported as Means (SD) for Experiment 1

Response type	Same	Similar	New
Americans			
Self			
Same	.62 (.15)	.27 (.13)	.11 (.08)
Similar	.14 (.10)	.46 (.11)	.40 (.13)
Mother			
Same	.61 (.17)	.26 (.13)	.12 (.09)
Similar	.12 (.07)	.47 (.16)	.41 (.15)
Bill Clinton			
Same	.55 (.20)	.25 (.11)	.19 (.14)
Similar	.10 (.10)	.42 (.15)	.48 (.15)
New	.04 (.04)	.21 (.10)	.76 (.12)
East Asians			
Self			
Same	.50 (.18)	.32 (.16)	.18 (.13)
Similar	.14 (.11)	.46 (.16)	.40 (.17)
Mother			
Same	.51 (.17)	.33 (.14)	.16 (.11)
Similar	.12 (.10)	.47 (.19)	.39 (.18)
Bill Clinton			
Same	.45 (.20)	.35 (.18)	.20 (.13)
Similar	.12 (.10)	.44 (.19)	.44 (.19)
New	.06 (.06)	.26 (.13)	.68 (.16)

To further investigate the main effect of Condition, we performed a series of contrasts between the levels of Condition. Contrast comparisons collapsing across Culture and Memory type revealed that objects encoded in the self condition ($M = .71$) were remembered better than objects encoded in the Bill Clinton condition ($M = .65$), t (63) $= 3.26$, $p < 0.01$. Memory for objects encoded in the mother condition ($M = .71$) was also significantly better than memory for Bill Clinton-encoded objects, t (63) $= 4.12$, $p < 0.001$. No differences were found between the self and mother conditions, t (63) $= 0.25$, $p > 0.80$.

Crucially, a significant interaction between Culture and Memory type emerged, F (1, 62) $= 6.18$, $p < .02$, partial $\eta^2 = .09$. Follow-up tests revealed significant differences between cultures in specific memory, t (62) $= 2.83$, $p < .01$, with Americans ($M = .60$) performing significantly better than Asians ($M = .49$), but no significant differences between cultures in general memory, t (62) $= 1.75$, $p > .08$ (American $M = .86$; Asian $M = .82$). None of the other interactions approached significance, p's $> .30$.

Discussion—Experiment 1

In an investigation of cultural differences in specific versus general memory of pictures, we found evidence that cultures differed in their accuracy for these types of

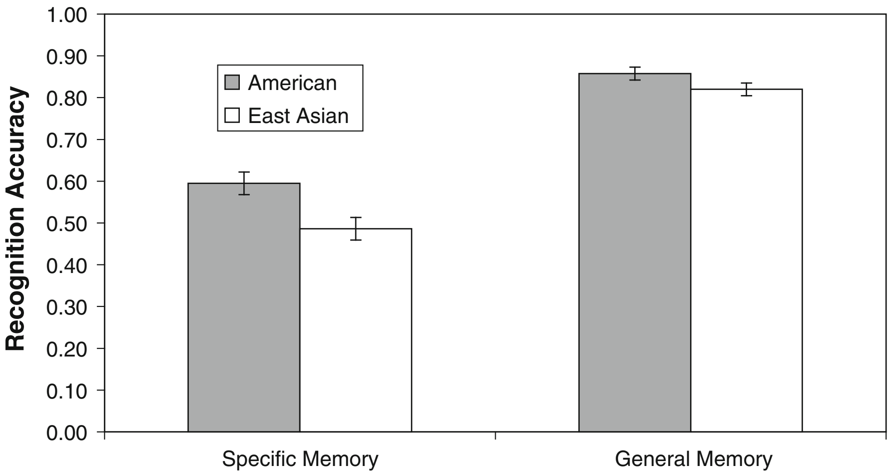

Fig. 2 Americans' and East Asians' specific and general recognition accuracy (with standard error of the mean) for images in Experiment 1

memory. Consistent with our hypotheses, Americans exhibited more accurate specific memory, but not general memory, for objects than East Asians. We propose that this occurs because Western cultures tend to favor a feature-based approach to visual analysis, placing more emphasis on visual details than East Asian cultures do (Nisbett and Masuda 2003). This attention to detail should benefit specific memory, which requires the detection of slight differences between different exemplars with the same verbal label (e.g., two different candles). In contrast, memory for this level of detail is not necessary for general memory, in which memory for the item without specific details (e.g., "I saw a candle, but I forget what it looked like") is sufficient to support recognition. This finding indicates that cultural differences may emerge for only some types of memory, and further suggests that memory for specific details may be more sensitive to cultural differences than memory for general item-level information. General memory encompasses a number of different types of information, and can be supported by a general feeling of familiarity rather than recollection of specific details.

One potential confound could be whether the cultural differences in specific memory reflect East Asians' reduced familiarity with the items. As the experiment was designed by American experimenters, there may well be a bias in the types of items selected such that they are more familiar and easily discriminated by Americans. It is possible that only the more difficult judgments of specific memory were impacted by potential differences in item familiarity, whereas general memory can be supported even for unfamiliar information. To address this concern, we compared memory performance for the objects rated as more or less familiar by the pilot East Asian raters. If the East Asians' decrement in specific memory reflected their lack of familiarity with the object exemplars, we expected that the cultural difference in memory specificity would be more pronounced for the least familiar items relative to the more familiar ones. Although we found a significant interaction of familiarity × memory specificity for the East Asian participants, F (1, 31) = 5.63, $p < .03$, partial $\eta^2 = .15$, it actually goes in the opposite direction such that specific memory is *worse* for the items rated as of high familiarity ($M = .45$) rather than of low familiarity ($M = .49$), t (31) = 2.01, $p < .05$.[2] Thus, we do not believe that cultural differences in familiarity with the stimuli account for the cultural differences in specific memory.

In contrast to our predictions, we did not find any evidence for cultural differences as an effect of referencing the self versus others. While this is surprising based on previous studies finding cultural differences in memory for information referencing the self and others (Wagar and Cohen 2003; Zhu and Zhang 2002), the effects of self-referencing on memory for visual objects may differ from the common paradigm investigating memory for adjectives. In comparisons of self- and other-referencing in our American sample (Serbun et al. 2011), we failed to find a memory benefit for referencing information to the self relative to close others, making it difficult for East Asians to exhibit *less* of a difference between these conditions than Americans. This failure to differentiate self from close other was also true for a distinct sample of younger Americans as well as for older Americans (Hamami et al. 2011). Although the literature is mixed on whether self-referencing benefits memory relative to close others in Americans (Bower and Gilligan 1979; Symons and Johnson 1997), we suggest that this paradigm is limited in its usefulness for comparing Americans and East Asians on self and close other-referencing.

Experiment 2

In Experiment 1, American participants exhibited greater specific recognition for objects than East Asians did, consistent with the pattern of object-oriented feature analysis favored by Western cultures (Nisbett and Masuda 2003). However, this finding was only tested for objects without background or contextual information. Because Eastern cultures tend to holistically process images, focusing on context and background, the presence of a background may mitigate cultural differences in memory specificity. However, if American participants are able to treat the backgrounds with the same type of feature analysis as they do objects, they could outperform East Asians in specific memory for both objects and backgrounds. To explore the contribution of background context to memory specificity, we designed a follow-up experiment in which specific and general memory scores were measured for both focal objects and background images presented as composite scenes. Since Experiment 1 did not reveal any differences in self- versus other-referencing across cultures, we removed the manipulation of referencing to simplify the paradigm. Instead, a new incidental encoding procedure was selected to actively engage the participants with the stimuli without leading them to expect an upcoming memory test.

[2] Results available from the authors by request.

Methods

Participants

We tested 32 American and 32 East Asian undergraduate students from Brandeis University. Inclusion in American and East Asian culture groups was determined by the same criteria outlined in Experiment 1. All participants gave written consent and were reimbursed with either course credit or cash payment.

Materials

Stimuli consisted of 44 composite scene pairs, 66 isolated object pairs, and 66 isolated background pairs. Each composite scene image was composed of an object image digitally placed within the context of a background image (see Fig. 3 for examples). Scenes in each pair were composed of objects and backgrounds that shared verbal labels, such as two cabs on a street, but both object and background differed in visual detail (e.g., color, size, orientation, number, shape). The isolated object and background images corresponded to components present in each of the composite scene images. These stimuli were developed by Kensinger et al. (2007b) to test memory for specific details of foreground objects and backgrounds. We used only neutral objects and backgrounds, avoiding potential cultural differences in the processing of emotional images.

Procedure

Encoding and recognition phases were completed in a single session. In 44 trials, the encoding program presented a composite scene image for 1,000 ms. Participants were instructed to indicate as quickly as possible by a key press whether they would approach, back away from, or stay at the same distance from each scene if they were to encounter it in real life (adapted from Kensinger et al. 2007b). To regulate encoding time, stimuli were automatically presented with a 2,000-ms inter-stimulus interval between trials in which participants' responses were recorded. The order in which scene images appeared was randomized. The assignment of versions within each scene pair was determined by a counterbalancing scheme so that across all participants, both versions of the scene appeared with equal frequency.

Following a 15-min retention interval, in which participants completed the demographics questionnaires, Digit Comparison Task, and Dot Comparison Task (as described in Experiment 1), memory was tested. In the recognition test, participants were presented with only isolated object or background images. No composite scene images were presented at recognition. 44 of these images were identical to objects or backgrounds presented in the encoded scenes, 42 were similar to objects or backgrounds in the encoded scenes, and 43 were entirely new backgrounds or scenes. In 129 trials, a typed verbal prompt asked the subject "Did you see a *[name of object/background]*?", paired with an image of the target object or background. As in Experiment 1, participants were instructed to respond whether the object or background was (1) exactly the *same* as an object or background seen

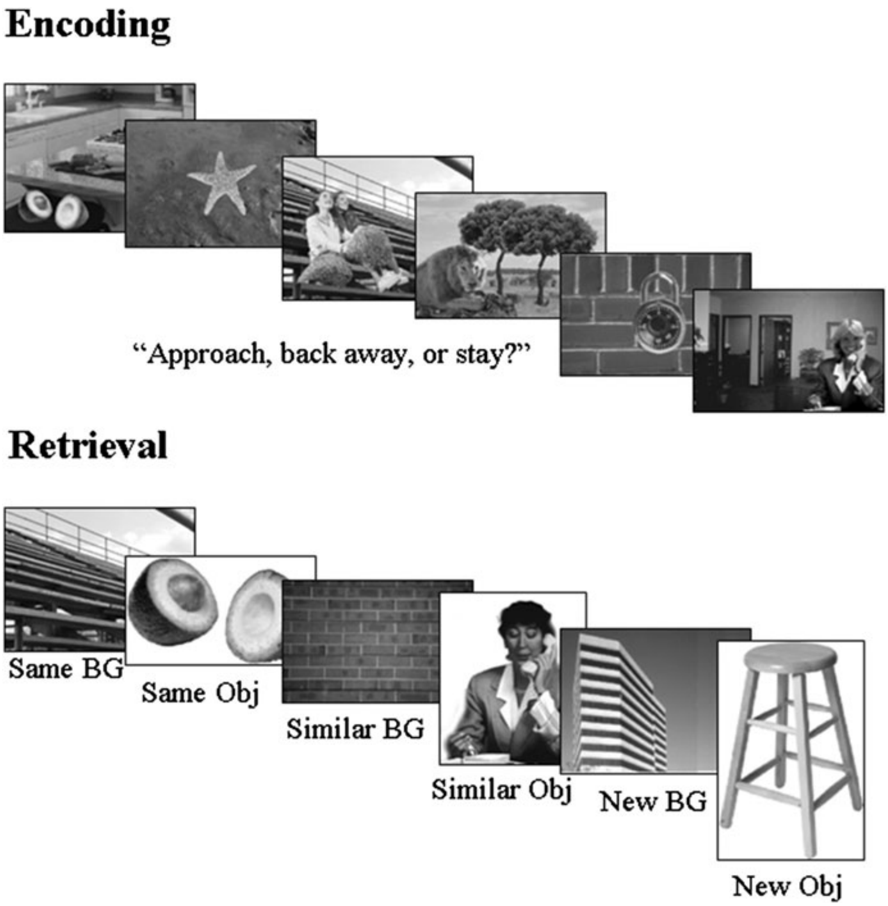

Fig. 3 Example of stimuli presented at encoding and retrieval in Experiment 2

in the encoding task; (2) *similar* to an object or background previously seen, but slightly different (e.g., in color, size, orientation, number, shape); or (3) a completely *new* object or background. This task was entirely self-paced.

Following recognition, participants completed the abridged General Ethnicity Questionnaire (Tsai et al. 2000), described in Experiment 1. They were then debriefed with the purpose of the study, informed of the hypotheses, thanked, and presented with the promised incentive for their participation.

Results

Participant characteristics

Groups were well-matched on years of education, with no significant difference between American and East Asian groups ($p > 0.40$, see Table 3). Also consistent

Table 3 Demographic information and mean (with standard deviation) test scores for participants in Experiment 2

	American	East Asian	Significance
Age	18.75 (1.21)	20.00 (2.20)	$p < 0.01$
Years of education	13.65 (1.65)	14.00 (1.84)	$p > 0.40$
American identity	3.64 (.52)	2.96 (.32)	$p < 0.001$
English language	4.67 (.28)	3.52 (.55)	$p < 0.001$
Asian identity	N/A	3.67 (.41)	
Digit comparison	80.00 (23.94)	88.06 (20.27)	$p > 0.15$
Dot comparison	49.13 (16.69)	57.59 (11.67)	$p < 0.03$

with experiment 1, Americans rated themselves as more acculturated to American culture and the English language (both p's < .001, see Table 3). In measures of processing speed, East Asian participants outscored American participants in dot comparison ($p < 0.03$) but not digit comparison ($p > 0.15$, see Table 3). Finally, on the General Ethnicity Questionnaires, Asian participants identified more strongly with their respective native cultures than with American culture ($p = 0.001$, see Table 3.

Scoring

We calculated four memory scores for each participant to assess specific and general memory for both item types (object and background). *Specific memory* and *general recognition* scores for each item type were calculated using the same formulae described in Experiment 1.

Memory performance

Table 4 shows the proportion of objects given a *same*, *similar*, or *new* response, reported as a function of correct response (same, similar, or new) and item type (object, background) for each cultural group (American, East Asian).

A 2 × 2 × 2 ANOVA was conducted on response accuracy with Culture as a between-subjects factor and Memory type (specific, general) and Item type (object, background) as within-subject factors. Results are shown in Fig. 4. The main effect of Memory type was significant, F (1, 62) = 248.36, $p < .001$, partial $\eta^2 = .80$, with higher performance for general recognition ($M = .75$) than for specific recognition ($M = .54$). A significant main effect of Item type also emerged, F (1, 62) = 7.02, $p = .01$, partial $\eta^2 = .10$, with memory performance for objects ($M = .66$) greater than memory for backgrounds ($M = .62$).

The interaction of Culture and Memory type was marginally significant, F (1, 62) = 3.63, $p = 0.06$, partial $\eta^2 = .06$. This trend indicated that the cultural difference for specific memory (American $M = .57$, Asian $M = .50$, t (62) = 1.67, $p < 0.10$) tended to be greater than that for general memory (American $M = .75$, Asian $M = .74$, t (62) = .41, $p > 0.60$), see Fig. 4. The interaction of memory

Table 4 Proportion of same, similar, and new responses as a function of item type and condition for Americans and East Asians reported as Means (SD) for Experiment 2

Response type	Same	Similar	New
Americans			
Object			
Same	.60 (.13)	.18 (.12)	.21 (.10)
Similar	.32 (.15)	.30 (.17)	.38 (.15)
New	.04 (.07)	.14 (.14)	.82 (.17)
Background			
Same	.50 (.17)	.21 (.12)	.28 (.12)
Similar	.20 (.12)	.31 (.16)	.49 (.18)
New	.04 (.05)	.20 (.18)	.76 (.19)
East Asians			
Object			
Same	.54 (.16)	.21 (.12)	.24 (.11)
Similar	.30 (.18)	.28 (.16)	.42 (.18)
New	.07 (.16)	.15 (.11)	.79 (.21)
Background			
Same	.47 (.22)	.27 (.17)	.25 (.12)
Similar	.24 (.18)	.27 (.15)	.49 (.20)
New	.10 (.17)	.20 (.13)	.70 (.19)

specificity and item type also approached significance, F (1, 62) = 3.903, $p = 0.053$, partial $\eta^2 = .06$. According to this trend, specific memory for objects ($M = .57$) was greater than that for backgrounds ($M = .50$), but the image components did not differ as much on measures of general memory (object $M = .76$, background $M = .74$). No other effects or interactions approached significance, including the interaction of Culture × Specificity × Item Type.

Discussion—Experiment 2

Experiment 2 extended the results of Experiment 1 by testing memory for background images. Backgrounds could potentially reduce cultural differences in memory specificity and benefit East Asians' memory, as Eastern cultures tend to holistically process scenes and preferentially remember context (Nisbett and Masuda 2003). Our results for specific memory do not fit with such an account; East Asians did not outperform Americans in either general or specific memory for backgrounds. In fact, Americans tended to exhibit more accurate specific memory for backgrounds than East Asians did. This pattern is consistent with the specific memory for lone objects in Experiment 1, suggesting that Americans' advantage in specific memory does not simply reflect a cultural difference in the processing of decontextualized objects. Rather, the cultural difference in specificity appears to extend to memory for contextualized objects, as demonstrated in Experiment 2. Although differences in methods make it not appropriate to compare directly across these two studies, it is interesting to note that the cultural differences in memory

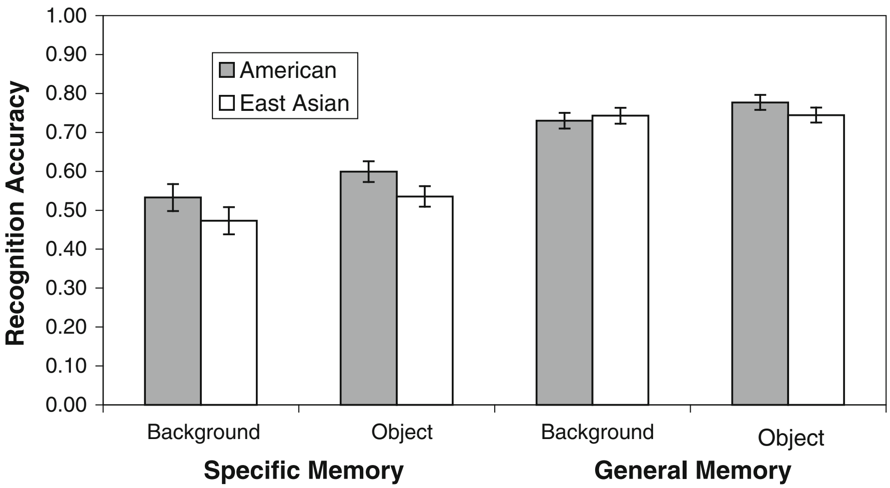

Fig. 4 Americans' and East Asians' specific and general recognition accuracy (with standard error of the mean) for objects and backgrounds in Experiment 2

specificity may be less pronounced when backgrounds are present, as in Experiment 2, compared to in the absence of backgrounds, as in Experiment 1.

General discussion

In two experiments, we found evidence for cultural differences in the specificity of memory for visual information. Americans exhibited greater accuracy in tests of specific memory than East Asians did, although both cultures performed similarly on measures of general memory, assessed at the item level. This pattern occurred both when objects were presented without a background (Exp 1) as well as when objects are presented against a background scene (Exp 2). We suggest this finding is a result of a Western-favored pattern of visual feature analysis such that in more independent Western cultures, individuals are more likely to study the specific details of focal objects (Nisbett and Masuda 2003). Crucially, this advantage in memory specificity does not seem to affect general recognition of images, which would suggest that difference lies in the quality, but not the quantity, of visual information remembered. It would seem that a general gist of objects and backgrounds may be recognized with equal accuracy, despite cultural differences in visual analysis and specific detail in memory.

One limitation of our study was in the study materials for Experiment 2. Our figure-background scenes were produced by placing a cropped object image onto a background image. Designing images in this way allowed for greater control over the types of images used and how they appeared visually to the participants. This approach, however, had the limitation of appearing unnatural to the participants. Object and background figures often had inconsistencies in lighting or orientation, as often anecdotally noted by our subjects following presentation. Memory accuracy for scene items has been shown to diminish when object-background pairs are *semantically* incongruent due to the interactive processing of object and background (Davenport and Potter 2004). Cultures may differ in their sensitivity to semantic incongruity; in an fMRI study, Chinese participants exhibited greater adaptation of the right and left lateral occipital complexes than Americans to semantically inconsistent scenes, suggesting a heightened response to contextual incongruity (Jenkins et al. 2010). Perhaps the *visual* incongruity of our scenes affected East Asian participants more than Americans, preventing them from benefitting from the contexts present in Experiment 2. Furthermore, the composition may have made the focal object pop out from the scene, facilitating object-based analysis. To address this, unedited figure-background scenes photographed as they appear in real life could be used in future studies.

Future work could also further address potential limitations based on familiarity of the images. Although we attempted to account for cultural differences in the familiarity of the stimuli in Experiment 1 through follow-up analyses, future work could extend these results using Eastern-biased stimuli. Creating culture-fair stimuli would also better support testing of East Asian participants in their natives countries, as the East Asians tested in the US in the present studies may differ in systematic ways from individuals who remain in East Asia. However, the East Asians tested in the US in the present study could be expected to be more similar to the American sample, due to the shared cultural environment and potential self-selection effects for which East Asians choose to come to the US. Thus, the effects in the present studies would be expected to be underestimations of cultural differences for Americans compared to East Asians tested in Asia. An additional reason to test participants in their native countries may stem from the characteristics of our East Asian sample. East Asian participants outperformed Americans on both measures of processing speed: Digit Comparison (Exp. 1) and Dot Comparison (Exp. 1 & 2) (see Tables 1 and 3). This may indicate a potential selection bias by which the intellectual and socioeconomic requirements associated with being able to study internationally create a sample with higher cognitive functioning than the peer population in the native country. Testing East Asian participants in their native countries could further address concerns about comparing cognitively unmatched samples. However, if the speed of processing scores reflect differences in cognitive ability across these samples, selection of a more cognitively select East Asian sample would not seem to explain the *lower* memory specificity performance of East Asians in the present studies.

While previous research has largely focused on cultural differences in the accuracy or amount of information remembered (as reviewed by Gutchess and Indeck 2009), our findings extend prior reports of cultural differences in memory by focusing on cross-cultural differences in the quality of memory. These results indicate the potential for memory traces to differ in numerous and potentially dramatic ways across cultures. The constructive nature of memory contributes to distortion as well as fabrication of memory (see Schwartz et al., in press, for a report of cultural differences in memory errors), so it is important to understand systematic ways in memory reports may differ across cultures. In addition, cultural differences in memory specificity would be particularly interesting to study in terms of cognitive aging. Older adults in the US experience pronounced difficulty with memory for specific details of information, as opposed to the theme or gist (Koutstaal and Schacter 1997; Schacter 1999). Whether the loss of detail in memory is a universal process or one impacted by the information processing styles and priorities of a culture is an important question for future work. Further work also is needed to assess whether cultural differences in memory specificity indicate that cultures reporting less specific memories may be vulnerable in their memory for complex, detailed information of all types over longer time delays, or whether cultural differences in memory are restricted to visually detailed objects.

As the world around us continues to grow more and more interconnected, it is important to understand systematic differences in cognition across cultures. The ways in which different cultures perceive and remember specific details may have implications for reporting international news, interpreting eyewitness testimony, or even conducting business operations. Our study contributes to the understanding of the intricate ways in which culture and memory are intertwined, reflecting and shaping one's experience of events.

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