Culture Modulates Implicit Ownership-Induced Self-Bias in Memory

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Abstract

The relation of incoming stimuli to the self implicitly determines the allocation of cognitive resources. Cultural variations in the self-concept shape cognition, but the extent is unclear because the majority of studies sample only Western participants. We report cultural differences (Asian versus Western) in ownership-induced self-bias in recognition memory for objects. In two experiments, participants allocated a series of images depicting household objects to self-owned or other-owned virtual baskets based on colour cues before completing a surprise recognition memory test for the objects. The 'other' was either a stranger or a close other. In both experiments, Western participants showed greater recognition memory accuracy for self-owned compared with other-owned objects, consistent with an independent self-construal. In Experiment 1, which required minimal attention to the owned objects, Asian participants showed no such ownership-related bias in recognition accuracy. In Experiment 2, which required attention to owned objects to move them along the screen, Asian participants again showed no overall memory advantage for self-owned items and actually exhibited higher recognition accuracy for mother-owned than self-owned objects, reversing the pattern observed for Westerners. This is consistent with an interdependent self-construal which is sensitive to the particular relationship between the self and other. Overall, our results suggest that the self acts as an organising principle for allocating cognitive resources, but that the way it is constructed depends upon cultural experience. Additionally, the manifestation of these cultural differences in self-representation depends on the allocation of attentional resources to self- and other-associated stimuli.

Keywords: self; cross cultural differences; implicit memory; individual differences; memory; self reference effect

1. Introduction

Cognition research over the last decade or so has provided an increasingly nuanced understanding of how perception, attention and memory operate. It is clear that both the physical properties of stimuli and the relation of stimuli to the self, the social context, and individual differences are important considerations (e.g., Bayliss & Kritikos, 2011; Caudek, 2014; Constable, Kritikos, Lipp, & Bayliss, 2014; He, Sebanz, Sui, & Humphreys, 2014; Humphreys & Sui, 2015). Culture is a major source of individual differences, particularly with respect to representation of self and social context (Heine & Ruby, 2010; Markus & Kitayama, 2010). Until recently, the field of cognitive science predominantly recruited Western samples, often without noting participants' cultural background or ethnicity (Arnett, 2008; Henrich, Heine, & Norenzayan, 2010). There is now growing interest in how cultural experience shapes cognition, particularly with respect to self-related cognition (e.g., Chiao et al., 2009; Han et al., 2013; McKone et al., 2010; Zhu, Zhang, Fan, & Han, 2007). In two experiments, we compare bias in recognition of self-owned versus other-owned objects in Western and Asian participants, and show that ownership-related cognitive biases differ substantially across these broad cultural categories.

1.1 Interdependent and independent self-construal

Markus and Kitayama (1991; 2010) describe the self as a fundamental schema that organises and regulates mental processes and behaviour, both explicitly and implicitly. As such, the self attunes the individual to the environment and stores patterns of behaviour for interacting with it. Cultural experience shapes the representation of self, and this results in cultural differences in tasks involving self-related cognition (Markus & Kitayama, 2010).

Cross-cultural research has highlighted the relevance of independent and interdependent patterns of self-construal for cognition (for reviews, see Heine & Ruby, 2010; Markus & Kitayama, 2010). Independent self-construal, which is emphasised in Western cultures, represents the self as distinct and different from others, with cognition and behaviour reflecting this strong self-other separation (Markus & Kitayama, 1991). Interdependent self-construal, typically valued in East Asian and South Asian cultures, represents the self in terms of interconnectedness with others, especially close others such as family (Markus & Kitayama, 1991).

It is important to note that particular individuals within Western and Asian cultures vary in the extent to which their self-representation is independent or interdependent

(Markus & Kitayama, 1991). Nevertheless, broadly classifying cultures as 'Western' and 'Asian' has proved useful for examining differences in general patterns of self-representation (e.g., Masuda & Nisbett, 2006; see Kitayama & Uskul, 2011 for review), and this is the approach we take in this paper. This enables identification of overarching patterns in the way differences in self-representation affect cognition, which can be followed by more fine-grained investigations.

1.2 The self-reference effect in memory

Cultural differences have been shown for the self-reference effect in memory (Huff, Ligouri, & Gutchess, 2015; Huff, Yoon, Lee, Mandadi, & Gutchess, 2013). Generally, participants in self-referential memory paradigms first evaluate sets of words with reference to the self or another person (Klein, 2012). Across both Western and Asian cultures, performance on surprise recognition or recall memory tests is generally superior for self-associated words compared with words associated with a stranger (Kuiper & Rogers, 1979; Symons & Johnson, 1997; Zhu & Zhang, 2002; Zhu et al., 2007). In Western participants, a self-association advantage remains across different other-referents, although the magnitude of the effect can be weaker when the self is contrasted with a close, familiar other such as the mother (Symons & Johnson, 1997; Zhu & Zhang, 2002; Zhu et al., 2007; cf. Bower & Gilligan, 1979). This is consistent with a strong self-other differentiation even for highly self-relevant others. In contrast, Chinese participants display comparable memory performance for both self- and mother-referenced words, both of which are recognised better than words related to a non-close other (Zhu & Zhang, 2002; Zhu et al., 2007). This is consistent with a dominance of interdependent self-construal in Chinese participants in which the self is strongly connected with close others.

Behavioural differences between cultures in self-referential memory are reflected in variations in neural activity in the medial prefrontal cortex (MPFC; Zhu et al., 2007), an area implicated in self-referential processing (Kelley et al., 2002; Northoff et al., 2006). Zhu et al. (2007) showed that in Western participants, MPFC activity was greater when judging how words related to the self, compared with both the mother and a stranger. Chinese participants, by contrast, showed comparable MPFC activity for self and mother judgments compared with stranger judgements (Zhu et al., 2007). Thus, there is converging behavioural and neural evidence for cultural variation in self-referential processing.

1.3 Perceptual self-association effects

The close equivalence of self- and mother-associated stimuli in memory tasks for Asian participants does not hold across all cognitive processes. Recently, Sui, He, & Humphreys (2012) introduced a paradigm showing enhanced perceptual matching speed for self-associated stimuli. Participants learn to associate simple geometric shapes with the self or others (e.g., "The triangle is you; the square is your mother."). In a subsequent task, participants made speeded judgements of whether shape-label pairs (e.g., square/you) matched the previously learned associations. A sample of UK college students showed faster response time and higher sensitivity to self-match pairs than to mother-match pairs or stranger-match pairs. Sui, Sun, Peng, and Humphreys (2014) later reported comparable self-over-mother bias in a sample of Chinese participants, in contrast to the self-mother equivalence in the self-referential memory performance reported by Zhu et al. (2007).

This disparity suggests the manifestation of cultural differences in self-related cognition depends on how the self-other distinction is operationalised in a task, and as a consequence, which cognitive processes the task engages. In typical word-based self-referential memory tasks (see Klein, 2012, for review), including Zhu et al.'s (2007), self- and other-referenced stimuli are words rich in semantic content, which must be explicitly evaluated with respect to self and others. In contrast, the perceptual matching task used by Sui and colleagues (Sui et al., 2012, 2014) requires simple speeded match/mismatch judgements, and the self- and other-relevant stimuli (geometric shapes) contain little inherent semantic content. Thus, one possibility is that the self-over-mother distinction in the perceptual matching task reflects a basic, low-level self-other differentiation common to both independent and interdependent self-construal. Cultural differences in self-related processing may emerge when a task involves higher-level semantic processing. More work is needed to determine the extent and nature of cultural differences in self-related cognition.

1.4 Owned objects as extensions of the self

Object ownership paradigms provide a useful tool for investigating how the self structures cognition (Constable et al., 2014; Cunningham, Turk, Macdonald, & Macrae, 2008), and how cultural experience might shape this. In human society, objects are pervasively associated with the self and others via ownership. It has been proposed that self-owned objects are incorporated into the self-representation as part of an *extended self* (Belk, 1988, 2014), and thus self-related cognitive biases extend to these objects (Beggan,

1992; Kim & Johnson, 2012, 2015). If this is so, differences in self-construal should modulate ownership-related cognitive effects. The processing of self-owned objects in Western participants shows evidence of the strong self-other distinction associated with independent self-construal (Constable, Kritikos, & Bayliss, 2011; Cunningham et al., 2008; Maddux et al., 2010). If cultural experience shapes self-representation, we should find ownership-related effects consistent with interdependent self-construal in cultures where this representation is favoured.

Research on 'endowment effects' associated with ownership has already suggested that cultural differences in self-representation shape ownership-related cognition. The endowment effect refers to the tendency to value self-owned objects more than other-owned or unowned objects (Kahneman, Knetsch, & Thaler, 1991; Thaler, 1980), and is very robust in Western samples (Maddux et al., 2010; for review, see Morewedge & Giblin, 2015). Maddux et al. (2010), however, showed weaker endowment effects in East Asian compared with Western participants. This is consistent with the reduced emphasis on positive self-distinction (over and against others) associated with interdependent self-construal (Kitayama, Markus, Matsumoto, & Norasakkunkit, 1997; Norasakkunkit & Kalick, 2002).

Additionally, Chinese participants display endowment effects of comparable size for self-owned and mother-owned items, and the magnitudes of self- and mother endowment effects are both predicted by MPFC activity (Feng, Zhao, & Donnay, 2013). Zhao, Feng, and Kazinka (2014) further demonstrated endowment effects for friend-owned, lover-owned, mother-owned objects with Chinese participants, but there was no endowment effect for acquaintance-owned items. This is consistent with an interdependent self-construal for Chinese participants, where self-related cognitive biases extend to close others who are represented as strongly interconnected with the self.

1.5 Ownership effects in recognition memory

Ownership effects also emerge in tasks that do not necessarily require deliberate self- or other-referential judgements or evaluative processing. Numerous studies demonstrate a memory advantage even for transiently and arbitrarily self-owned versus other-owned items in Western participants (Cunningham, Brady-Van den Bos, & Turk, 2011; Cunningham et al., 2008; Turk et al., 2013; Van den Bos, Cunningham, Conway, & Turk, 2010). In these paradigms, participants view a series of objects sequentially and allocate them to one of

two baskets based on cues (e.g., a colour border around object). The task description states that one basket belongs to the participant and the other to a different person (real or imaginary). On a subsequent surprise recognition memory test, recognition performance is superior for objects allocated to the self-owned basket compared with the other-owned basket. Additionally, self-owned and other-owned objects evoke differential MPFC activity both during initial assignment of objects to owners (Kim & Johnson, 2012) and when the objects reappear later (Kim & Johnson, 2014).

The self-owned advantage is particularly noteworthy because it is not strictly necessary for participants to attend to the ownership status of the objects at the encoding phase. The task description informs participants that one basket belongs to them and the other belongs to another person, but they can ignore this fact and successfully sort the items into appropriate baskets based entirely on visual cues (e.g., allocate objects with a blue label to the blue basket). Thus, processing the objects in a self-referential way is unnecessary to perform the task at both the encoding stage and during the recognition memory test. This raises two possible, and not mutually exclusive, sources of the self-owned memory advantage in this paradigm. One is that participants spontaneously and consciously engage in deliberate self- and other-referential semantic processing during the object allocation task, in excess of the minimum task requirements. The other is that, as a result of the description of the baskets as self- and other-owned, assigning an object to the self-owned basket implicitly and unconsciously associates it with the self and enhances its representation in memory.

Importantly, Turk et al. (2013) have shown that dividing attention during the object allocation stage can abolish the self-owned memory advantage, which suggests that the processing underpinning the self-owned advantage requires cognitive resources beyond those needed to merely allocate the objects correctly. This seems most consistent with the notion that the self-owned advantage arises from resource-intensive conscious, deliberate semantic processing. Given that the clearest evidence of cultural variability in self-related cognition comes from tasks involving deliberate semantic or evaluative processing (e.g., Maddux et al., 2010; Zhu et al., 2007), we would expect equivalent effects to emerge for the self-owned memory advantage. Neuroimaging studies, however, suggest that although both word-based and ownership-based tasks are related to mPFC activity, they nevertheless evoke qualitatively distinguishable patterns of activity in this region (compare Kelley et al.

2002 and Turk, van Bussel, Waiter, & Macrae. 2011). This suggests that self-referential processing in the ownership task is not directly equivalent to word-based paradigms. Thus, it represents a means to develop a more nuanced picture how cultural difference manifest in self-related processing.

2. Experiment 1

Investigating ownership-related memory biases in non-Western participants may shed light on the nature of the self-owned bias in recognition memory, and on the conditions under which cultural differences in self-related cognition emerge. Given that both Western and Asian participants have shown advantages for self-related stimuli relative to stranger-related stimuli in other paradigms (Zhu et al., 2007), we expect that both these groups will show better recognition memory performance for self-owned objects compared with stranger-owned objects. Western participants, with primarily independent self-construal, should also show a self-owned advantage compared with close others. If the self-owned advantage is affected by cultural experience, Asian participants should show reduced or absent distinction in memory performance between self-owned and close-other-owned objects. To test this, in Experiment 1 we adapted the shopping task used by Van den Bos et al. (2010). Participants with Western and Asian cultural backgrounds allocated virtual objects to a self-owned or other-owned basket. The identity of the 'other' was either a stranger or a close and familiar other (closest friend or mother). Close friend and mother were chosen as 'close others' for comparability with previous studies (Feng et al., 2013; Sui et al., 2012; Zao et al., 2014; Zhu et al., 2007). It is likely that participants have a longer-standing relationship with their mother compared with a close friend, but given the voluntary element of friendship participants may represent their closest friend as more intimate than their mother, especially in an undergraduate population. We therefore included both of these referents to test the generalisability of any close-other related effects.

2.1 Method

2.1.1 Participants.

Students enrolled in an undergraduate psychology course at a large Australian university were given the opportunity to voluntarily complete the experiment during class in computer labs over three days, and 267 participated and provided data. The study was approved by the University of Queensland ethical review process and complied with the

Declaration of Helsinki. After application of predetermined inclusion criteria (see below), 140 Western participants (98 females, 42 males) aged 17 to 53 years (*M* = 21.45, *SD* = 5.99) and 61 Asian participants (47 female, 14 male) aged 19 to 37 years (*M* = 20.52, *SD* = 3.32) were included in the analyses. Preliminary checks indicated that gender did not vary as a function of cultural group. We report the results with South, East, and Southeast Asian participants included in the Asian group. Excluding South Asian participants did not alter the pattern of results.

In the final sample, 86% of Western participants reported living in Australia for 10 years or more, and 7% reported 1 year or less (*M* = 18.36 years, *SD* = 7.82 years). Only 18% of Asian participants reported at least 10 years' residence and 63% reported 1 year or less (*M* = 4.32 years, *SD* = 6.88 years). In the mother condition, 87% of Western participants and 88% of Asian participants reported being in contact with their mother at least weekly (in-person or electronically). In the close friend condition, 86% of Western participants and 71% of Asian participants reported being in contact with their closest friend at least weekly.

2.1.2 Procedure & Stimuli.

Testing occurred in groups across 16 sessions supervised by an experimenter (the class tutor) and stimuli were presented using E-Prime 2.0 software (Psychology Software Tools, Pittsburgh, PA). Participants received initial instructions before completing an object allocation task, a recognition memory test, exploratory questionnaires, and demographic questions. Demographic questions assessed age, gender, ethnicity, home country, previous country of residence, and amount of contact with the close other (if applicable).

Initially, each participant was instructed to imagine either someone they had never met named John, their closest same-gender friend, or their mother. The type of imagined other was randomly assigned for each participant, but, for ethical reasons, participants were given the option to opt-out being selected to think about their mother. In the close friend and mother conditions, participants were asked to indicate their friend's/mother's favourite hobby, television show, and music to facilitate engagement with the task.

In the object allocation task, participants sorted each of 100 objects into red and blue baskets belonging to themselves and the other (stranger, close friend, or mother). Baskets were positioned to the left and right of the screen. Before the task began, participants were informed they would complete a shopping task in which they would place objects in baskets that belonged to them and the other. The colour corresponding to the self and the side on

which the baskets appeared was randomised for each participant. Half the objects were allocated to the participant (self-owned) and half to the other (other-owned). To achieve this, the program randomly allocated one of three 50-object lists to be self-owned, other-owned, or unowned (used later in the surprise recognition memory test). This item set was used in a previous study (Van den Bos et al., 2010), and contained objects typically available in United Kingdom shopping centres. Each set was matched for item type (e.g., fruit, appliances).

On each trial, an object appeared in the centre of the screen for 1,500 ms, after which a red or blue border appeared around the object for a further 1,500 ms (see Figure 1). Participants' task was to assign the object to the appropriate basket with a key press based on the coloured border. The object remained visible after the key press response to standardise visual exposure. After the time to respond elapsed, the object disappeared and a 500 ms intertrial interval (baskets without any shopping item) preceded the next trial. Trial order was randomised for each participant.

Fig. 1. Object allocation phase showing participant's and other's basket and allocation cue surrounding object.

In the surprise recognition memory test, each object from the allocation task appeared in random order on a blank background, along with 50 new objects as foils. Items were presented on a blank background. Participants had 1,500 ms in which to indicate they did or did not recognised the object from the allocation task, by responding on the keyboard with the O (recognise) and P (do not recognise) keys. After the participant responded or the time elapsed, a blank 1,000 ms intertrial interval preceded the next trial.

2.1.3 Inclusion Criteria

Participants were included in the analyses if they met the following predetermined criteria: (a) at least 95% accuracy in the object allocation task, (b) at least 66% of responses made in time for the recognition memory test, (c) ethnicity reported and classifiable as

either Western or Asian, and (d) willing to be randomly assigned to any condition (i.e., did not opt out of the mother condition). Criteria (a) and (b) were adopted to ensure that participants in the final sample had attended adequately to both the allocation task and memory test. Participants were classified as Western if they reported their ethnicity as Caucasian, White, or from Western Europe (e.g., Scottish). Participants were classified as Asian if they reported their ethnicity as Asian or as a specific South, Southeast, or East Asian nation. Five participants listed their ethnicity as 'Australian'. Each of these participants listed English as their only known language and Australia as their country of birth so they were included in the Western group in the analysis (exclusion of these participants did not affect the pattern of results). Four Western and two Asian participants were excluded for opting out of the mother condition. The final sample consisted of 201 participants after the exclusion of 66.

2.2 Results

We computed each participant's corrected hit rate for self-owned and other-owned items separately by subtracting false alarm rate from uncorrected hit rate for each condition. Thus, a corrected hit rate of 1.00 represents perfect performance, whereas 0.00 represents guessing (hit rate equals false alarm rate). Table 1 shows uncorrected hit rates and false alarm rates for each group in each condition.

Table 1.

Mean Hit Rates and False Alarm Rates for Asian and Western Participants Experiment 1.

	Asian Participants			Western Participants		
	Stranger Condition	Mother Condition	Friend Condition	Stranger Condition	Mother Condition	Friend Condition
Self-Owned Hit Rate	0.65 (0.16)	0.64 (0.12)	0.66 (0.13)	0.71 (0.17)	0.71 (0.14)	0.72 (0.12)
Other-Owned Hit Rate	0.66 (0.17)	0.64 (0.11)	0.67 (0.14)	0.67 (0.16)	0.70 (0.16)	0.69 (0.12)
False Alarm Rate	0.09 (0.06)	0.10 (0.07)	0.12 (0.09)	0.09 (0.08)	0.08 (0.07)	0.10 (0.09)
n	24	16	21	42	48	50

Note: Standard deviations shown in parentheses.

We submitted corrected hit rates to a repeated measures analysis of variance (ANOVAs) with object ownership (self-owned or other-owned) as a within-participants variable and other identity (stranger, close friend, or mother) and culture (Western or Asian) as between-participants variables. The main effect of object ownership approached significance, with a trend toward higher corrected hit rates for self-owned objects (M = 0.60, SD = 0.17) than other owned objects (M = 0.58, SD = 0.17), $F(1,195) = 3.05$, $p = .083$, $\eta_p^2 = .02$. The main effect of culture was significant, with a higher corrected hit rate for Western participants (M = 0.61, SD = 0.17) compared with Asian participants (M = 0.55, SD = 0.15), $F(1,195) = 4.49$, $p = .035$, $\eta_p^2 = 0.04$. These effects, were, however, qualified by a significant object ownership by culture interaction, $F(1,195) = 6.87$, $p = .009$, $\eta_p^2 = 0.03$. Follow-up comparisons revealed that Western participants showed a significantly higher corrected hit rate for self-owned (M = 0.62, SD = 0.17) items compared with other-owned items (M = 0.59, SD = 0.18), $t(139) = 3.81$, $p < .001$, whereas Asian participants showed comparable performance on self-owned (M = 0.55, SD = 0.15) and other-owned (M = 0.56, SD = .16) objects, $t(60) = -0.67$, $p = .507$. The main effect of other identity ($F(2,195) = 0.10$, $p = .907$), owner by other identity interaction ($F(2,195) = 0.27$, $p = .760$), culture by other identity interaction ($F(2,195) = 0.19$, $p = .830$) and owner by culture by other identity interaction ($F(2,195) = 1.14$, $p = .322$) were nonsignificant. Overall, this pattern suggests Western participants showed a bias in recognition memory accuracy in favour of self-owned items over other owned items, whereas, as a group, Asian participants performed equally for all objects (see Figure 2).

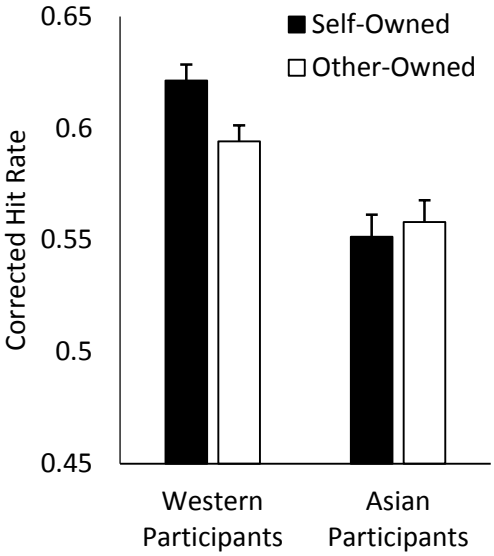

Fig. 2. Corrected hit rates for self-owned and other-owned objects as a function of cultural background. Error bars denote one standard error of the mean difference within each cultural group.

2.3 Discussion

Experiment 1 provides, to our knowledge, the first evidence that cultural background can modulate the effect of object ownership on recognition memory performance. For Western participants, we replicated the self-over-stranger recognition memory advantage reported in previous studies (Cunningham et al., 2008, 2011; Turk et al., 2013; Van den Bos, et al., 2010). Additionally, Western participants also showed enhanced recognition accuracy for self-owned compared with objects belonging to both close others (mother/friend). In contrast, self-ownership did not enhance Asian participants' memory performance, regardless of whether it was contrasted with ownership by mother, close friend, or a stranger. Finally, Asian participants' overall recognition performance was significantly lower than Western participants'.

These results are consistent with cultural differences in self-construal. Western participants' self-owned advantage aligns with an independent self-construal involving strong self-other differentiation. The absence of an ownership-related biasin Asian participants is consistent with an interdependent self-construal, which represents the self as interconnected with, rather than distinct from, others. For the mother and closest friend conditions, this is consistent with previous studies using word-based self-referential memory paradigms (Zhu & Zhang, 2002; Zhu et al., 2007).

There are, however, two important caveats to this interpretation. First, Asian participants showed lower overall recognition memory performance than Western participants, which is not typical of similar self-association recognition memory paradigms involving words (Zhu et al., 2007). This raises the possibility that some aspect of the task made it relatively difficult for Asian participants compared with Western participants. Second, Asian participants showed no advantage self-associated versus stranger-associated objects, whereas Asian participants do show an advantage a self-versus-stranger advantage in other self-association paradigms (Sui et al., 2012; Zhu & Zhang, 2002; Zhu et al., 2007). It is possible that, if the task was more difficult for Asian participants, it was not sufficiently sensitive to detect self-versus-stranger biases in their case.

There is evidence that Western participants direct attention to focal objects in a different manner to Asian participants (Han & Northoff, 2008; Ketay, Aron, & Hedden, 2009; Kitayama & Uskul, 2011). For example, in change-detection tasks, Caucasian Americans show an advantage for focal object changes relative to contextual changes, whereas East Asian participants detect contextual changes better than focal object changes (Masuda & Nisbett, 2006; see also Boduroglu, Shah, & Nisbett, 2009). East Asian and Caucasian American participants also show differential neural activity in object processing areas in response to focal objects (Gutchess, Welsh, Boduroglu, & Park, 2006; Goh et al., 2007). These differences suggest that Asian participants engage a relatively holistic attentional strategy, which is more sensitive to context and background information and less focused on central objects, compared with Western participants (Ketay et al., 2009; Kitayama & Uskul, 2011; Masuda & Nisbett, 2001, 2006). In recognition memory for focal objects initially presented on a background scene, East Asian participants compared with Caucasian Americans show a greater recognition decrement when the background at test changes (Chua et al., 2005; Masuda & Nisbett, 2001). Asian participants also spend comparatively less time fixating on focal objects in the study phase (Chua et al., 2005). Additionally, Asian participants can show relatively lower recognition accuracy for objects studied and tested against a blank (black or white) background when presentation time is relatively brief in the study phase (Gutchess et al., 2006; Millar, Serbun, Vadalia, & Gutchess, 2013). We suggest, therefore, that if Asian participants (versus Western participants) in Experiment 1 allocated fewer attentional resources to the focal objects in the object allocation task (i.e., encoding phase), this might account for their lower overall recognition rate.

Additionally, the emergence of self-bias may be contingent on the allocation of sufficient attentional resources to the self-associated object at encoding. This notion is supported by Turk et al.'s (2013) findings that the self-owned advantage was abolished for Western participants under conditions of divided attention. Thus, Asian participants' lack of ownership-related memory bias in Experiment 1 may have been due to insufficient allocation of attention to the focal object. This explanation is particularly relevant given that in the object allocation task participants could attend to the coloured cues around the objects to select the appropriate response button while ignoring the actual objects.

3. Experiment 2

In Experiment 2, we attempted to address the attentional explanation outlined above by encouraging allocation of attention to the objects during the encoding phase. Whereas In contrast to Experiment 1, which required no interaction with the object itself during the object allocation phase, Experiment 2 required participants to 'move' the object across the screen into to the correct owner's bag by holding down the appropriate arrow key. Success on each allocation trial was contingent on moving the object fully into the correct bag, which would end the trial. In addition, to increase power for the other identity manipulation, we included only stranger and mother conditions in Experiment 2. If the more interactive object allocation task successfully encourages attentional engagement with the objects, this may trigger self- and other-referential processing for Asian participants. If so, Asian participants should show a self-owned advantage in the stranger condition and not in the mother condition, consistent with an interdependent self-representation. Western participants should again show a non-specific self-owned advantage.

3.1 Method

3.1.1 Participants

A new sample of 325 participants was recruited in the same manner as Experiment 1. Eleven participants (10 Western and 1 Asian) were excluded for opting out of the mother condition. Thirty-three participants listed their ethnicity as 'Australian,' English as their only known language, and Australia as their country of birth. As in Experiment 1, these participants were included in the Western group, but the same general pattern of results obtains if they are excluded. After application of the inclusion criteria (as in Experiment 1), 171 Western participants (50 male, 120 female, 1 unspecified gender) aged 18 to 45 years (M = 20.64, SD = 4.11) and 74 Asian participants (26 male, 48 female) aged 18 to 29 years (M

= 20.36, *SD* = 1.63) were included in the analysis. We report results with South Asian, East Asian, and Southeast Asian participants included in the Asian group, but exclusion of South Asian participants did not alter the pattern of results.

In the final sample, 90% of Western participants reported living in Australia for 10 years or more, and 4% reported 1 year or less (*M* = 18.33 years, *SD* = 6.35 years). Of the Asian participants, 40% reported at least 10 years' residence and 29% reported 1 year or less (*M* = 8.26 years, *SD* = 8.04 years). In the mother condition, 82% of Western participants and 85% of Asian participants reported being in contact with their mother at least weekly (in-person or electronically).

3.1.2 Procedure & Stimuli

The close friend condition was removed from this experiment. Given that numbers of Asian students are limited, we wanted to maximise power for the mother versus stranger comparison, which has most successfully produced effects in previous studies (Chiao et al., 2009; Sui, Zhu, & Chiu, 2007; Wang et al., 2012; Zhu & Zhang, 2002; Zhu et al., 2007). The name of the stranger was changed from John (Experiment 1) to Lee in an attempt to use a less gender- and culture-specific name. The mother condition was unchanged.

The object allocation task used the same item set as Experiment 1. The basket images were replaced with images of red and blue canvas-style shopping bags. Bags were positioned equidistant to the left and right of the centre of the screen such that they opened towards the shopping objects. Each object appeared centrally for 1500 ms before coloured bars onset above and below it to indicate to which bag it should be moved. Participants used the left and right arrow keys to move the object into the appropriate bag. If participants failed to initiate movement within 2000 ms of object onset or failed to move the object into a bag within 5000 ms of movement initiation, the object would disappear and the trial would end. Objects moved smoothly across the screen such that an uninterrupted movement from the initial position into a bag lasted approximately 1670 ms (exact timing depended on when movement initiation occurred relative to the refresh cycle of the monitor). During the 500 ms intertrial interval, bags remained onscreen with no object present.

The recognition memory test was identical to Experiment 1.

3.2 Results

Corrected hit rates were submitted to a repeated measures ANOVAs with object ownership (self-owned or other-owned) as a within-participants variable and other identity (stranger or mother) and cultural background (Western or Asian) as between-participants variables. Table 2 displays uncorrected hit rates and false alarm rates for each group in each condition.

Table 2.

Mean Hit Rates and False Alarm Rates for Asian and Western Participants Experiment 2.

	Asian Participants		Western Participants	
	Stranger Condition	Mother Condition	Stranger Condition	Mother Condition
Self-Owned Hit Rate	0.67 (0.13)	0.58 (0.14)	0.71 (0.15)	0.72 (0.13)
Other-Owned Hit Rate	0.64 (0.14)	0.62 (0.15)	0.70 (0.15)	0.70 (0.14)
False Alarm Rate	0.11 (0.10)	0.09 (0.07)	0.08 (0.06)	0.08 (0.07)
n	40	34	89	82

Note: Standard deviations shown in parentheses.

The main effect of ownership was nonsignificant, $F(1,241) = 0.24$, $p = .625$. There was a main effect of culture such that Western participants showed higher corrected hit rates ($M = 0.63$, $SD = 0.14$) than Asian participants ($M = 0.53$, $SD = 0.15$), $F(1,241)$, $p < .001$, $\eta_p^2 = .09$. The ownership by other identity interaction was significant, $F(1,241)$, $p = .013$, $\eta_p^2 = .01$, and the ownership by culture interaction was marginally significant, $F(1,241) = 3.04$, $p = .082$. These effects were qualified by a three-way ownership by culture by other identity interaction, $F(1,241) = 7.05$, $p = .008$, $\eta_p^2 = .03$. To follow up the three-way interaction (depicted in Figure 3), separate ownership by other identity ANOVAs were conducted for each cultural group.

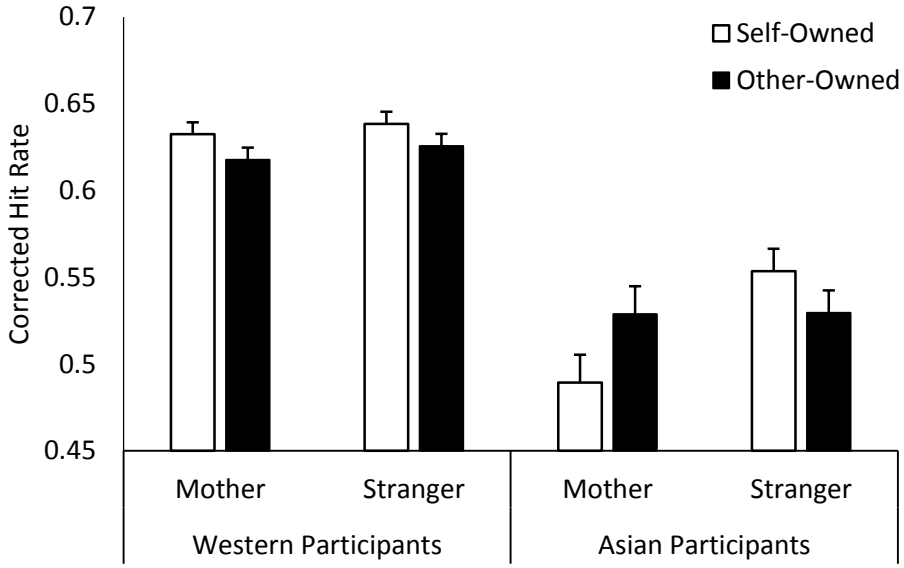

Fig 3. Corrected hit rates for self-owned and other-owned objects as a function of cultural background and other identity. Error bars represent the one standard error of the mean difference for self- versus other-owned items, pooled across other identity for Western participants and within each other identity for Asian participants.

For Western participants, the main effect of ownership was significant, with a higher corrected hit rate for self-owned (M = 0.64, SD = 0.16) versus other-owned (M = 0.62, SD = 0.16) objects, $F(1,169) = 4.11$, $p = .044$, $\eta_p^2 = .02$. The other identity main effect ($F(1,169) = 0.08$, $p = .773$) and ownership by other identity interaction ($F(1,169) = 0.02$, $p = .893$) were nonsignificant. Thus across referent conditions, Western participants showed a consistent self-referent ownership effect.

For Asian participants, the main effects of ownership ($F(1,72) = 0.58$, $p = .451$) and other identity ($F(1,72) = 0.90$, $p = .347$) were nonsignificant, but there was a significant ownership by other identity interaction, $F(1,72) = 9.73$, $p = .003$, $\eta_p^2 = .12$. In the mother condition, planned comparisons (Holm-Bonferonni corrected) revealed that corrected hit rate was significantly higher for other-owned (M = 0.53, SD = 0.16) than self-owned (M = 0.49, SD = 0.15) objects, $t(33) = 2.50$, $p = 0.036$. In the stranger condition, there was a marginally significant trend in the reverse direction, with a higher corrected hit rate for self-owned (M = 0.55, SD = 0.15) compared with other-owned (M = 0.53, SD = 0.16) objects, $t(39) = 1.83$, $p = .075$.

The above analyses suggest Western and Asian participants showed a memory bias of similar magnitude and direction in the stranger condition, but opposite patterns of bias in

the mother condition. To compare these memory biases directly, we computed self-bias scores for each participant by subtracting other-owned from self-owned corrected hit rates and multiplying this by 100. In the stranger condition, self-bias scores for Western (M = 1.28, SD = 9.21) and Asian (M = 2.40, SD = 8.29) participants did not differ significantly, $t(127) = 0.66$, $p = .512$. In the mother condition, Western participants' positive self-bias scores (M = 1.46, SD = 8.44) differed significantly from Asians' negative self-bias scores (M = -3.94, SD = 9.19), $t(114) = 3.06$, $p = .003$.

Finally, we tested whether there was a statistically reliable difference in the pattern of effects between Experiments 1 and 2.[1] We combined participants from the stranger and mother conditions of Experiment 1 with the participants from Experiment 2, and ran a repeated measures ANOVA on corrected hit rate. Experiment, cultural background, and other identity were between-participants factors, and object ownership a within-participants factor. The four-way interaction of experiment by cultural background by other identity by object ownership was significant, $F(1,367) = 7.15$, $p = .008 = \eta_p^2 = .02$. This supports our claim that the new pattern of results that emerged in Experiment 2 can be attributed to the alteration in the object allocation task. In other words, the fact that Asian participants showed a mother-owned advantage in Experiment 2 but not Experiment 1 can be attributed to the modification of the object allocation task (the only way in which these experiments differed).

3.3 Discussion

Western participants showed the same pattern of results as in Experiment 1, that is, there was a recognition memory advantage for self- over other-owned objects regardless of whether the mother or a stranger was the 'other.'

Asian participants again showed a different pattern to Western participants. In contrast to Experiment 1, however, Asian participants in the mother condition showed significantly better memory for *other-owned* (i.e., mother's) objects versus self-owned objects. Additionally, Asian participants trended toward higher recognition performance for self-owned versus other-owned objects in the stranger condition, and this memory bias effect did not significantly differ from Western participants' in magnitude. As in Experiment

[1] We thank an anonymous reviewer for suggesting this analysis.

1, Western participants showed higher overall recognition performance than Asian participants.

The emergence of this pattern in Experiment 2 suggests that self-construal differences do manifest in processing of self- and other-owned objects, but are to some extent dependent on initial allocation of attentional resources to objects. Given that Asian participants still showed a lower overall recognition rate than Western participants, our modification of the object allocation task may have triggered self- and other-referential processing for Asian participants without being powerful enough to abolish fully cultural differences in attentional allocation to focal objects (Ketay et al., 2009; Kitayama & Uskul, 2011; Masuda & Nisbett, 2001, 2006). We return to these points in the General Discussion.

4. General Discussion

Across two experiments we report novel evidence that the ownership status of objects affects memory differently for participants with Western and Asian cultural backgrounds. Western participants in both experiments showed enhanced recognition memory for objects arbitrarily assigned to be the self-owned versus other-owned, regardless of whether the 'other' was a close person (mother, friend) or a stranger. This aligns with an independent self construal which represents the self as distinct from both close others and strangers (Markus & Kitayama, 1991). Asian participants showed no ownership effects in Experiment 1, with no increase in memory for items owned by self over others.

Experiment 2, which was designed to encourage greater allocation of attention to the objects than Experiment 1, replicated the finding that a memory advantage for items owned by self only emerged in Western participants. Further, there was evidence that Asian participants prioritised close other referents over the self, as memory for mother-owned objects was superior to self-owned objects. Broadly, these findings for Asian participants are consistent with an interdependent self construal where close others are represented as interconnected with the self (Markus & Kitayama, 2010). Crucially, however, the manifestation of cultural differences in ownership effects is sensitive to task parameters and possibly interacts with cultural differences in attentional strategies. We discuss this point below before considering further how our findings relate to self-construal theory.

4.1 Top-down Factors Determine Recognition of Items

The critical difference between Experiments 1 and 2 concerned the degree to which participants interacted with objects in the encoding phase. In Experiment 1, each trial consisted of assigning an object to a basket based on a coloured box surrounding the object, and the keypress responses caused no visible change to the object. Although participants were asked to imagine the item going into the basket, it was possible to complete each trial by pressing appropriate key in response to the colour cue without reference to the object itself. Allocation of attention to the object itself would, therefore, depend on the strategy participants applied to the task. In Experiment 2, we encouraged participants to attend to the objects in the encoding phase by requiring them to move the objects across the screen into a bag by holding down a key. This encouraged participants to monitor the object to ensure they moved it fully into the bag, and enhanced the salience of the object by introducing a motion onset. The emergence of a distinct pattern of ownership bias for Asian participants in Experiment 2, but not Experiment 1, suggests that this change in task parameters was effective. Below we consider possible explanations for this.

One possibility concerns cultural differences in attentional strategy. Turk et al. (2013) showed that dividing attention during encoding abolished the self-owned advantage in a Western sample. This suggests that the emergence of such effects depends on sufficient allocation of attention to the object at encoding, and aligns with Humphreys and Sui's (2015) proposed Self-Attention Network (SAN). Humphreys and Sui (2015) suggest that self-associated stimuli rapidly activate self-representations housed in the ventral MPFC, which primes the posterior superior temporal sulcus (pSTS) to respond to self-associated stimuli. A top-down attentional control network can enhance or suppress this bottom-up self-referential activation. Crucially, however, Humphreys and Sui (2015) also suggest that bottom-up responses to self-associated stimuli are not always sufficient to produce self-association effects – top-down allocation of attentional resources to the self-associated stimuli may be necessary.

From this perspective, the evidence suggesting cultural differences in attention to objects is highly relevant (see Kitayama & Uskul, 2011, for review). Behavioural (Chua et al., 2005; Kitayama, Duffy, Kawamura, & Larsen, 2003; Masuda & Nisbett, 2001, 2006) and neuroimaging (Goh et al., 2007; Gutchess et al., 2006) studies suggest that Western participants tend to prioritise processing individual, focal objects in a scene, whereas Asian

participants use a more holistic strategy with greater sensitivity to contextual and background information. Particularly relevant to our results, Gutchess et al. (2006) reported that East Asian participants showed lower recognition accuracy than Western participants for objects presented against a white background when encoding time was brief (2000 ms; Gutchess et al., 2006, footnote 1; see Millar et al., 2013, for similar results). Behavioural performance equalised at longer presentation times (4000 ms), but Western participants nevertheless showed greater neural activity in several areas, including the left middle temporal gyrus, which is important for retrieving semantic knowledge about objects (Gutchess et al., 2006, main experiment). We suggest that in Experiment 1 of our study, Western participants' tendency to allocate resources to processing focal objects enabled a self-owned memory advantage to emerge. In Experiment 1, Asian participants may have allocated fewer resources to processing the objects at encoding, resulting in weaker integration of the object with self- and other-associations introduced by the ownership manipulation. The additional attentional engagement with objects encouraged by the Experiment 2 may have counteracted this default tendency to the extent that a mother-owed bias emerged for Asian participants, although Asian participants' overall recognition accuracy remained lower than Western participants'.

An additional possibility is that the objects in the study were more familiar to Western participants compared with Asian participants. We used the same object set as published work showing a self-owned advantage in memory in a computerised implementation of the shopping basket task (Van den Bos et al., 2010), which was itself part of a larger object set that formed the basis of several other studies with this paradigm (Cunningham et al., 2008, 2011; Turk et al., 2013). The objects were from Western supermarkets and comprised primarily of food (packaged and unpackaged), household tools and appliances, stationery, furniture, and apparel. English text and/or branding was discernible on 39 of the 150 objects (26%), and it is plausible that the unlabelled foods in the set are more commonly used by people with Western backgrounds. It is, therefore, plausible that Western participants had greater prior familiarity with the objects, which may have resulted in more efficient processing of the objects relative to Asian participants. This might account for Western participants' higher overall recognition performance.

Additionally, Western participants' relatively efficient processing may have allowed them to form strong self-associations with self-owned objects in Experiment 1 and display a

self-owned advantage in recognition performance. For Asian participants in Experiment 2, the added attentional engagement and longer average presentation time for objects at encoding may have overcome their relative lack of prior familiarity to the extent that a mother-owned advantage arose. If there is a familiarity disadvantage for Asian participants, it would most likely work against this mother-advantage be detectable. We found ambiguous evidence of a self-versus-stranger ownership advantage for Asian participants (see below), and it is possible that removing familiarity differences would allow this advantage to emerge reliably.

4.2 Ownership Effects and Self-Construal

We replicated the memory advantage for self-owned over other-owned objects that has been reported in numerous studies with Western participants (Cunningham et al., 2008, 2011; Turk et al., 2013; Van den Bos et al., 2010). This effect aligns with the general prioritisation of self-related over other-related stimuli in perception (Sui, et al., 2012, 2014), attention (Turk, van Bussel, Brebner, et al., 2011), and memory (Symons & Johnson, 1997; Zhu & Zhang, 2002; Zhu et al., 2007) for Western participants. In addition, we found no evidence that this bias was attenuated even when the 'other' was a more self-relevant person, such as the participant's closest friend (Experiment 1) or mother (Experiments 1 & 2). This is consistent with Markus and Kitayama's (1991) proposal that in cultures that value an independent self-construal, individuals tend to represent the self as distinct from both close and non-close others.

The ownership-related biases shown by Asian participants in Experiment 2 were substantially different from those seen in Western participants. Asian participants who allocated objects to the self and to the mother later recognised other-owned (i.e., mother-owned) objects at a higher rate than self-owned objects, the reverse of the pattern seen for Western participants. This mother-owned memory advantage is consistent with high importance of close others in self-representations in interdependent cultures (Markus & Kitayama, 2010), and with the particular importance of the relationship with the mother during childhood in many Asian cultures (Berndt et al., 1993; Sun & Roopnarine, 1996).

The mother-owned recognition advantage for Asian participants in Experiment 2 differs from word-based self-referential memory studies, which show comparable performance for self- and mother-associated words (Zhu & Zhang, 2002; Zhu et al., 2007). This novel mother-owned memory *advantage* suggests that in some circumstances close-

other-associated stimuli receive the most effective processing, and that the specific context in which self- and other-referential processing occurs can alter the observed effects. In word-based self-referential paradigms with bicultural individuals, culture priming (via culturally-relevant images) can alter the pattern of recognition memory (Sui et al., 2007) and MPFC activity (Ng, Han, Mao, & Lai, 2010) for self, mother, and non-close-other associated stimuli. This shows that the impact of self/other representations on cognition is relatively flexible. In our study, the social context was a 'shopping task' with common food items and other household goods. We speculate that, for Asian participants with interdependent self-construal, this situation may evoke an attentional strategy that reflects deference to the mother's objects and preferences typical of a shopping activity.

When the 'other' was a stranger in Experiment 2, Asian participants showed a trend toward a self-owned advantage, and the magnitude of this effect did not differ significantly from Westerners' bias in the stranger condition. A conservative interpretation of this result suggests that the Asian sample shows no self-owned bias in the case of a stranger, but it would be premature to rule out the possibility of a self-owned advantage. Markus and Kitayama (1991; 2010) propose that the ingroup/outgroup distinction is more prominent in interdependent self-construal. Family members (and most close others) are ingroup members, and the interdependent self is represented in terms of the individual's relationship with these important ingroup members. The self is, however, represented as distinct from outgroup members (Markus & Kitayama, 2010). It would be informative, therefore, to manipulate directly the group membership of the stranger in future studies. Possibly, strong self-owned bias will emerge when a stranger is clearly an outgroup member, whereas bias would be reduced for a clearly ingroup stranger.

It is important to note that our study may does not address possible within-culture variation in ownership effects. Independent and interdependent self-construal varies considerably for individuals within a given culture, and future studies can investigate the extent to which these differences influence the ownership effects we report in the current study. As Kitayama and Uskul (2011) note, cross-cultural differences in behavioural effects often fail to show expected correlations with individual differences in self-construal, whereas the associated neural indicators more reliably show the predicted relationship. Thus, concurrent neuroimaging would be ideal for such an individual differences study.

4.3 Conclusion

We report that ownership elicits cultural differences in self-referential memory effects. The effects, however, depend on the attentional demands of the task. When focal objects are the target stimuli, Asian participants most clearly show self- and other-association effects consistent with interdependent self-construal when top-down attention to the object is encouraged. Western participants show self-bias even when allocation of attention to the object is minimally necessary. Future research can examine the neural indicators of these cultural differences and their relationship to individual differences in self-construal within cultures.

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