Influence of Age and Culture on Self-Reference Effect

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Angela Gutchess, Advisor

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Wanbing Zhang

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Brandeis University
Waltham, Massachusetts

By Wanbing Zhang

Self-reference has been found to facilitate general and source memory for both young and older adults. However, most studies done on self-reference effect have been focused on Western populations for whom the self is considered an independent and distinct entity. Little is known about how self-reference, as a potential mnemonic strategy, would work for people with an interdependent self-construal (such as East Asians), particularly with age. In this study, we investigated the effect of self-reference on memory for both younger and older adults in two types of cultures: individualistic (represented by Americans) and collectivistic (represented by East Asians). Because the self should serve as a less salient memory cue in collectivistic cultures, we expected that self-referencing would be a less effective strategy for younger and older adults in East Asian culture. Consistent with previous studies, self-referencing benefited source memory disproportionately more than other encoding conditions relative to general memory. We also found that younger and older people in both cultures benefited equally from self-referencing, indicating self-reference as a strategy can be applied across cultures.
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Introduction

Relating information to the “self” leads to better recall of information from memory. The so-called self-reference effect is a mnemonic strategy that has been well-investigated in both younger and older adults (Rogers, Kuiper, & Kirker, 1977; Mueller, Wonderlich, & Dugan, 1986; Symons & Johnson, 1997; Glisky & Marquine, 2009; Gutchess, Kensinger, & Schacter, 2010; Gutchess, Kensinger, Yoon, & Schacter, 2007; Hamami, Serbun, & Gutchess, 2011). However, most studies of the self-reference effect have focused on Western populations, for whom the self is considered an independent and distinct entity (Markus & Kitayama, 1991). Little is known about how self-reference would work for people with an interdependent self-construal, such as East Asians. In this study, we are interested in how differences in the self concept could potentially alter the effect of self-referencing, and how this affects cultural groups of different ages. Past research has found substantial evidence for the existence of the self-reference effect, its maintenance with age, and the adoption of different values of the “self” by Western and East Asian cultures. Each of these topics will be reviewed separately.

Self-Reference Effect

Among all kinds of mental representations, the concept of the “self” is a unique one. The image of the self is usually viewed as more important, positive, and superior (Jones, Sensenig & Harley, 1974) than the image of others. Early studies demonstrated that thinking about how relevant an adjective is to the self results in better memory compared to other types of processing such as structural, phonemic or semantic (Rogers, Kuiper, & Kirker, 1977; Hamami, Serbun, & Gutchess, 2011). Later studies found that relating information to the self made it more
memorable than relating it to other people (Kuiper & Rogers, 1979). For example, thinking about if oneself would buy a box of tissues would result in better general (recalling seeing a box of tissue before) and detailed (remembering how exactly it looks) memory of the tissue than thinking about whether another person, such as Bill Clinton, would buy the tissues (Hamami, Serbun, & Gutchess, 2011). However, there are inconsistencies in the literature in comparisons of self and a close other (someone the participant feels intimate with, such as a parent or relationship partner). In some cases, memories formed in relation to the close other were as strong as memories formed in relation to the self (e.g., Bower & Gilligan, 1979; Ferguson, Rule, & Carlson, 1983; Hamami, Serbun, & Gutchess, 2011), but in other cases self supports superior memories compared to close others (Gutchess et al, 2007).

Self-reference has been demonstrated to be effective for all kinds of memory targets such as trait words (Gutchess, Kensinger, Yoon, & Schacter, 2007; Glisky & Marquine, 2009) or photographic images (Serbun & Gutchess, 2010). Evidence coming from neuroimaging studies suggests that processing of subsequently remembered self-relevant information activates medial prefrontal cortex (mPFC) and posterior cingulate cortex (PCC) (Macrae, Moran, Heatherton, Banfield, & Kelly, 2004). This pattern of neural activity is not seen in other types of memory which typically activate the hippocampus, considered to be an explicit memory center, rather than medial prefrontal cortex. Taken together, the evidence indicates that the concept of self can activate elaborative processing and deeper-level organization of information in memory (Klein & Loftus, 1988).

*Self-Reference and Aging*

Memory is one of the cognitive abilities that are most likely to decline with age (Salthouse, 2004). Would older adults be as responsive to self-referencing as younger adults? Recent
research seems to suggest so—memory retrieval increased to the same extent for younger and older adults after using self-referencing strategies (Mueller, Wonderlich, & Dugan, 1986; Glisky & Marquine, 2009; Gutchess et al., 2007, Gutchess, Kensigner, & Schacter, 2010).

Hamami, Serbun, and Gutchess (2011) discovered that self-reference can not only facilitate item retrieval in general, but also the memory for details of the corresponding items for both younger and older adults. Older adults who were asked to relate a visual object (e.g., a pair of shoes) to themselves better remembered seeing this object before (general memory, e.g., seeing a pair of shoes) and were also more likely to reject an object that is similar but not exactly same as the old object (specific memory, e.g., judging another similar pair of shoes as “new”). Considering that people become less capable of remembering details as they age (Koutstaal & Schater, 1997), self-reference may help to compensate for some of the age-related decline in memory specificity. Furthermore, culture also influence memory specificity. Westerners seemed to adopt an object-based feature analysis while East Asians tended to adopt a context-based feature analysis, which led to better specific memory in Americans than East Asians (Millar et al, 2013). However, participants from both cultures performed equally well in general memory. It will be introduced later how culture may influence self-reference as well.

Hamami et al. (2011) also found that self-reference can enhance source memory across the life span. Source memory refers to the memory for the context in which information was encountered previously. How was the weather when I met my brother? Did I read that news in the New York Times, or hear it from my friend? When we try to answer questions like this, we are utilizing our source memory. This type of memory is especially prone to the influence of age, compared to memory for items (Johnson, Hashtroudi, & Lindsay, 1993). In the Hamami et al. (2011) study, adjectives were initially processed under one of the three conditions: 1) how much
does it describe you; 2) how commonly is it used in everyday life; 3) was it was displayed in upper case. During retrieval, another group of new words was shown along with the previously studied words and the participants judged whether or not they had seen the word before, and, if so, under what condition (self, commonality, or case judgement). The result shows that semantic processing (self and commonality) led to better source memory than shallow processing (case judgement). In particular, if a word is remembered under self-referential condition, participants were not only better at telling the old word from new words, but also better at recalling the condition under which the word is encoded, compared to words remembered under the other two conditions. This enhancement induced by self-referencing was seen in both older and younger adults, even though younger adults out-performed older adults in recognition tasks overall.

Self-Reference and Culture

Self-reference seems to be a robust effect that facilitates various types of memory for both younger and older adults. However, it is noteworthy that great majority of these studies were conducted with Westerners. This is a concern because the concepts of self differ across cultures (Markus & Kitayama, 1991). The most striking differences between the concepts of the self are found between individualistic cultures and collectivistic culture. Western cultures tend to favor an individualistic view of the self, which encourages independence and personal success (Markus & Kitayama, 1991). The self is viewed as distinct from others and independent, which provides fertile soil for self-reference to take effect. In contrast, collectivistic cultures in East Asian such as Chinese and Taiwanese cultures value connectedness and integration of the self with others. The self is considered meaningful only when it becomes a harmonious part of the community (Markus & Kitayama, 1991).
Self-referencing has been investigated cross-culturally. Wagar and Cohen (2003) found that it took longer for Asian-Canadians (born in Asian countries but raised in Canada), but not Euro-Canadians, to recognize traits that described the self, compared to traits that described a best friend. Another study found that thinking about one’s mother works as effectively as thinking about oneself in enhancing subsequent memory for Chinese participants (Sui, Zhu, & Chiu, 2007). The above evidence implies that for East Asians, the concepts of self and other people may share a greater amount of overlap than for Americans. These styles of thinking about the self are pervasive and may considerably influence memory for self-relevant information (Zhu & Zhang, 2002).

Current Study and Hypotheses

On one hand, thinking about the self during memory encoding has been demonstrated to enhance general and source memory for both younger and older adults in Western culture. On the other hand, self-construal may vary greatly in its significance across cultures, influencing the effects of self-reference. However, little research so far has been done to examine how effectively self-reference can improve the memory of people of different ages across cultures. The current study seeks to fill this gap by exploring how self-reference works for younger and older adults in two cultures: American and Taiwanese.

We hypothesize that 1) in both cultures, younger adults would outperform older adults in both general and source memory; 2) because the self is less salient in Asian cultures, Asian participants may display worse memory for self-relevant words and better memory for other-relevant ones, compared to Americans’ pattern of memory. It is possible that cultural differences will only manifest for source memory, as previous findings suggest impaired memory for details (but not general memory) in East Asians compared to American young adults (Millar et al.,
2013). Compared to general memory that both Westerners and East Asians are good at, source memory may be a more sensitive assay of cultural differences in self-referencing because it has greater potential of enhancement when the correct strategy is adopted; 3) Furthermore, it may be the case that cultural differences in self-referencing in source memory may only emerge for older adults. This is because memory specificity has been shown to decrease with age (Johnson, Hashtroudi, & Lindsay, 1993). As American older adults have been shown to benefit from self-referencing in general and source memory (Hamami et al., 2011), it is possible that age differences only occur in East Asians, as a result of decreased emphasis on the self as well as reduced specificity in memory.

Corresponding to our hypotheses, we expect to see that younger participants in America and Taiwan will perform better on both general and source memory than older adults. Also, there may be an interaction between condition, culture, and memory type within each age group. Taiwanese participants’ performance on self-relevant words would show less of an increase from their performance on other-relevant words, compared to American participants. However, this may only be true for source but not general memory. Additionally, we expect to see a four-way interaction between age, culture, memory condition and memory type. For American older adults, we propose that self-referencing will increase source memory as well as general memory compared to the Taiwanese older adults, whose source memory may benefit less from self-referencing. Our predicted pattern of data is depicted in Figure 1.

Evidence collected from this study will provide us with more knowledge about how self-reference as a mnemonic strategy works, as well as how human cognition and aging can be affected by our social environment. If our hypotheses are supported, it will become clear that the strategy of self-referencing does not benefit everyone equally. We predict that people from
collectivistic cultures who tend to be less self-focused might not benefit as much from the strategy as people from individualistic cultures. This might be particularly true for older adults, and for information that requires memory for specific details. Correspondingly, other-reference (remembering things in relation with a close other) could be an equivalent or even better choice for those in collectivistic cultures. We will assess the benefits of other person-referencing by comparing to a non-human control condition.
Method

Participants

Twenty-four younger adults (age 18-25) and twenty-four older adults (age 65-90) were recruited in America from Brandeis University and the local community using flyers and e-mails. Similarly, twenty-four younger adults (age 18-25) and twenty-four older adults (age 65-90) were recruited by our collaborator in Taiwan using the same methods. Demographic information are summarized in Table 1. Older adults were screened for impairments to cognitive orientation using the Mini Mental State Exam (MMSE) (Folstein, Folstein, & McHugh, 1975). Data from older adults failing to earn at least a 26 on the MMSE were excluded from the study. Taiwanese younger adults were older in age than American younger adults, $t(46) = -2.90, p = .006$, and had relatively more years of education, $t(46) = -2.45, p = .018$. Taiwanese older adults were younger in age than American older adults, $t(46) = 4.78, p < .001$, had fewer years of education, $t(46) = 2.69, p = .010$, and lower MMSE scores, $t(46) = 2.99, p = .004$. All participants were given course participation credit or monetary compensation for their time. To ensure the participants have necessary language proficiency to carry out the tasks, American participants had to be native English speakers and Taiwanese participants had to be native speakers of Mandarin Chinese.

Materials

The list of adjectives (144 in total, divided into 4 groups for counterbalancing) were selected from Anderson’s (1968) personality-trait words. Mandarin translations were adapted
from Chen et al. (2013), originally drawn from Wang and Cui (2005). For each participant, three of the four groups of words (108 words) are shown at encoding and the other group was used as “new” words that are presented only during the retrieval phase.

**Procedures**

After providing informed consent, the participants completed the computerized memory task, which contains two phases: encoding and retrieval. Tasks were presented in E-Prime (Psychology Software Tools, Pittsburgh, PA). Before any judgments were made, the participants were asked to take a moment and think of a person that they feel close to. They were instructed to refer to this individual as the “Close Other” throughout the study. During the encoding phase, participants viewed 108 adjectives, one at a time, and were asked to judge how well they thought the adjective describes themselves (36 words), a close other (36 words), or dogs (36 words), on a scale of 1 (does not describe at all) to 7 (describes very well). 0 was pressed if the participants do not know the word at all. Each adjective appeared along with its reference target (self, close other, or dogs) on the screen for 7 seconds. The instructions also emphasized that dogs should be considered as a species rather than any particular dog that the participants know. The retrieval phase occurred immediately following encoding. During the retrieval phase, participants were shown 144 adjectives, including all 108 old adjectives shown in the encoding phase and 36 new adjectives. After viewing each word, participants judged whether the word was remembered, and under which condition it was studied (“Was this word related to the self, close other, or dogs”), with keys corresponding to 1 for “the self”, 2 for “close other”, 3 for “dogs”, and 4 for “completely new”. After the memory task, the MMSE was administered. Finally, the participants were compensated and debriefed.
In previous research on the self-reference effect, celebrities such as Bill Clinton (Gutchess et al., 2007), were used to establish a “distant other” condition as a comparison to the self condition. However, we are not using celebrities in this study because knowledge about celebrities could vary across generations and cultures. This may affect the degree of salience that the celebrity has as a cognitive representation across our experimental groups. On one hand, people can relate more to someone of their cohort rather than someone in other generations. On the other hand, different cultures have distinct categories of ingroup and outgroup members. It is hard to find one figure whose social identity is comparable across two cultures. Additionally, compared to commonality, phonemic, and structural (e.g., if the first letter a vowel or capitalized) judgements used in previous work (Rogers, Kuiper, & Kirker, 1977; Wagar & Cohen, 2003; Hamami, Serbun, Gutchess, 2011), using dogs as a species seems to serve as a better condition to compare with the self-reference condition. This is because attempting to assign traits to animals is distinct enough from evaluating people (self and close other) but at the same time can prompt the participants to think about the meaning of the adjective and its applicability to a target.
Results

This study employs a 2 (cultural groups: American vs. Taiwanese) X 2 (age group: younger vs. older adults) X 3 (memory condition: self-, other-, or dog-relevant) X 2 (memory type: source vs. general memory) mixed factorial design, with culture and age as between-subjects variables and memory condition and memory type as within-subject variables. General memory is how likely a previously studied word is recalled as old (reflected in a source judgment of self-, close other, or dogs), and source memory is remembering exactly which judgment was made at encoding (recalling self-relevant words as self, other-relevant words as close other, etc.)

In order to correct for guessing, performance for both types of memory was calculated by subtracting false alarm rate from hit rate. False alarm rate is the proportion of incorrect answers for new items (i.e., mistakenly calling a new lure word “self”, “close other”, or “dogs”). Hit rate is the proportion of correct answers for old items (i.e., calling a previously presented self-related word “self”, a previously presented close other-related word “close other”, etc.) General memory performance is when an old item is called “old” (i.e., when self-, other-, and dog-related words are correctly recalled as one of those three categories rather than as “new”). Unlike general memory, source memory performance is condition-specific. It is how likely a word encoded under a specific condition (e.g., self-relevant) is to be recognized later with the correct source (e.g., correctly recalling that a word was referenced to the self, rather than to the close other or dogs).

In terms of main effects, a 2 x 2 x 3 x 2 mixed analysis of variance (ANOVA) shows a main effect of age, $F (1,92) = 80.258, p < .001, \eta_p^2 = .47$. Younger adults ($M = .60$) perform
better than other adults ($M = .32$) overall. General memory performance ($M = .49$) is
significantly better than source memory performance ($M = .43$), $F(1,92) = 26.31, p < .001, \eta^2_p = .22$. We also found a main effect of memory condition, $F(2,184) = 123.20, p < .001, \eta^2_p = .57$,
with self-related adjectives ($M = .56$) better remembered than close-other-related ones ($M = .45$;
$F(1,92) = 159.91, p < .001$), which in turn are better remembered than dog-related ones ($M = .37$; $F(1,92) = 36.58, p < .001$). Figure 2 summarizes the pattern of memory condition x memory

type results for all four culture x age groups.

Memory type was found to interact with memory condition, which indicated that across
age and culture groups, self-referencing benefits source memory disproportionately more than
other encoding conditions relative to general memory, $F(2,184) = 31.418, p < .001, \eta^2_p = .255$
(see Figure 3). There was a marginally significant interaction effect between memory condition,
memory type, and age, $F(2,184) = 2.645, p = .074, \eta^2_p = .028$, such that general memory of older
adults tends to benefit more from referring to close others compared to general memory of
younger adults (see Figure 4). Additionally, the interaction between memory condition, age, and
culture is marginally significant, $F(2,184) = 2.482, p = .086, \eta^2_p = .026$. Taiwanese younger adults
tend to benefit more from self-reference than Taiwanese older adults (see Figure 5). This pattern
was not discovered for American participants.

We were concerned about sampling differences across cultures, because the samples
differed on many variables (see Table 1). To address poorly matched ages for the older adult
samples across cultures, we dropped the 8 oldest American and the 8 youngest Taiwanese older
adult participants. This reduced the sample size to 16. With these subsamples, the interaction
between memory condition, memory type, and age disappeared, $F(2,120) = 1.754, p = .178, \eta^2_p =
.028$, suggesting that the boost in older adults general memory following close-other-reference
could be due to the confounding effect of age. That is, when American and Taiwanese older adults are made equally old, older adults across two cultures no longer show an enhancement in general memory following close-other-referencing. In contrast, the interaction between memory condition, age, and culture became significant and strengthened in effect size, $F(2,120) = 3.387$, $p = .037$, $\eta^2_p = .053$, suggesting that differences in the self-reference benefit for Taiwanese younger compared to older adults may be meaningful to consider in better matched samples.

Contrary to our hypothesis, we failed to find any interaction effects between culture and memory condition, $F(2,184) = .517$, $p = .597$, $\eta^2_p = .046$, which implies that the effect of different referencing target does not differ across cultures. Plus, there was no four-way interaction found, $F(2,184) = 2.663$, $p = .072$, $\eta^2_p = .028$. To investigate the effect of self-reference within each culture, we performed a three-way ANOVA within American and East Asian cultures. From the results shown in Table 2, we can see that the memory performance of participants from both cultures indeed shown the same pattern under the influence of self-referencing.
Discussion

This study examined the effects of self-referencing as a strategy to improve memory of people from different age and cultural groups. Younger adults performed better than older adults in both source and general memory in both cultures, which is typical of cognitive changes with aging and consistent with our hypothesis. In terms of self-referencing effects, our results converge with previous findings that self-referencing benefits source memory more than general memory in both younger and older adults (Hamami, Serbun, & Gutchess, 2011), suggesting that self-referencing as a mnemonic strategy can be used to enhance memory specificity.

We originally predicted that, because East Asian may adopt a less self-centered world view, self-referencing might not facilitate memory as much as it does in Western cultures. However, according to our results, the effect of self-reference extends across cultures, raising self-referencing as a robust and useful strategy under both individualistic and collectivistic contexts.

Despite the overall tendency for self-referencing to benefit memory across cultures, we found some evidence for a difference in the size of the benefit across age groups in the Taiwanese. Taiwanese older adults showed a tendency to benefit less from self-referencing than Taiwanese younger adults, suggesting that there could be a generational difference between the self-concept of Taiwanese younger and older adults. The fact that this trend becomes stronger after matching the older adults sample by age further support this idea. This could be because younger people tend to adopt a more flexible way of thinking or a more self-centered world view than older adults, but considering that this did not happen to American participants, this trend is
more likely to be caused by cultural differences. Considering the increasing cultural exchange with America and Europe since the beginning of twenty-first century, the younger generation in Taiwan could be exposed to Western culture more than their grandparent’s generation, and thus be more “Westernized” and individualistic in their value system. Notably, American older adults ($M = 15.96$) has more years of education than American younger adults ($M = 14.38$), but Taiwanese older adults ($M = 14.08$) has less years of education than their younger counterparts ($M = 15.54$). Younger Taiwanese could have been exposed to the Western value system through more years of education and therefore were more sensitive to pick up the benefit of self-referencing. Future study can further explore the reason for this effect by matching the younger and older Taiwanese sample by years of education and see if the pattern maintains.

We predicted that because the self is less salient in East Asian cultures, East Asian participants may display worse memory for self-relevant words and better memory for other-relevant ones, compared to Americans’ pattern of memory. Compared to American participants, close other as a reference target did not boost any type of memory for East Asian participants, in contrast to our predictions. This suggests that on a cognitive level, close others in East Asian culture did not lead to an equally deep or deeper level of processing than self, which contradicts what previous literature showed is the case for collectivism on a cognitive level (Zhu & Zhang, 2002; Sui, Zhu, & Chiu, 2007) as well as on a cultural level (Markus & Kitayama, 1991). Perhaps it is due to the development of globalization during the past two decades which further wiped the cultural difference in self construal between East Asia and America. We also noticed that early studies were done mostly in China and the current East Asian data were collected in Taiwan. Even though the two regions share a common cultural origin, Taiwanese could adopt a relatively more individualistic way of thinking due to earlier exposure to Western culture and
less conservative political environment. Whichever is the case, our result implies that the Western vs. Eastern dichotomy is not always, or no longer a good way to categorize self construal. Even though the two cultures may view the self in different ways, the concept of the self is still unique and distinguishable from other people. People originated from one culture may develop diverse view of the self because of regional or generational difference.

Additionally, we expected to see a four-way interaction between age, culture, memory condition and memory type. For American older adults, we proposed that self-referencing would increase source memory as well as general memory compared to the Taiwanese older adults, whose source memory may benefit less from self-referencing. We hypothesized source memory may be a more sensitive assay of cultural differences in self-referencing than general memory, as previous findings suggest impaired memory for details in East Asians compared to American young adults (Millar et al., 2013). We found that source memory did not manifest more cultural difference than general memory largely because there wasn’t any cultural difference to be exaggerated for either source or general memory. Older adults failed to pick up more self-reference effect in source memory than younger adults as expected either, as there was no age x memory type effect.

One obvious limitation of this study is that our samples are not equal in age, years of education, and MMSE score. Back in the early twentieth century, advanced education was less available in Taiwan than in America, which could be the reason why our Taiwanese older adults had less years of education and lower MMSE score. This could then contribute to the overall better performance of American older adults in both source and general memory. Considering that Taiwanese older adults were also notably younger in age and should have suffered from less cognitive decline, the confounding effect of MMSE and years of education could have been
greater than what we found. That is, Taiwanese being younger might have helped to counteract some of the effect of less education and lower MMSE. However, these moving pieces could influence our results in many ways and we cannot draw convincing conclusion without better matching our samples. At this stage, we are striving to collect data from more participants in both sites that are better matched in demographics. Also, the current study did not have a measure of individualism or collectivism, which constrains our ability to monitor the change of self construal across generations. Future studies that investigate self-referencing could consider including this measure to better relate the effect of self-referencing to self construal.

Despite all the limitations of this study, the fact that self-referencing strategy led to better memory in both cultural and age groups tells us that what is known to be effective in one culture can potentially work in another culture. However, while applying memory enhancement strategies in different cultures, we must take into account the diversity of each culture and be reminded that one strategy may work well for people from some groups within a culture but not others.
Reference


Table 1.
*Demographic Information of Participants from Both Sites in Mean (Standard Deviation)*

<table>
<thead>
<tr>
<th></th>
<th>American</th>
<th>Taiwanese</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Younger</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>20.46 (2.09)</td>
<td>22.38 (2.48)</td>
</tr>
<tr>
<td>Years of Education</td>
<td>14.38 (1.58)</td>
<td>15.54 (1.72)</td>
</tr>
<tr>
<td><strong>Older</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>78.54 (6.48)</td>
<td>70.33 (5.36)</td>
</tr>
<tr>
<td>Years of Education</td>
<td>15.96 (1.88)</td>
<td>14.08 (2.84)</td>
</tr>
<tr>
<td>MMSE</td>
<td>28.92 (1.18)</td>
<td>27.92 (1.14)</td>
</tr>
</tbody>
</table>
Table 2.
*Effect of Self-Referencing (Memory Condition) within each culture*

<table>
<thead>
<tr>
<th>Culture</th>
<th>Effects</th>
<th>F</th>
<th>p</th>
<th>$\eta^2_p$</th>
<th>Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>American</td>
<td>Mem Condition</td>
<td>66.913</td>
<td>&lt;.001</td>
<td>.593</td>
<td>Self (M=.621) &gt; Close Other (M=.506) &gt; Dogs (M=.424)</td>
</tr>
<tr>
<td></td>
<td>Mem Type*Mem</td>
<td>15.965</td>
<td>&lt;.001</td>
<td>.258</td>
<td>Source: Self (M=0.607) &gt;&gt; Close Other (M=0.459) &gt; Dogs (M=0.374)</td>
</tr>
<tr>
<td></td>
<td>Condition</td>
<td>17.203</td>
<td>&lt;.001</td>
<td>.272</td>
<td>General Self (M=0.635) &gt; Close Other (M=0.553) &gt; Dogs (M=0.473)</td>
</tr>
<tr>
<td>East Asian</td>
<td>Mem Condition</td>
<td>56.510</td>
<td>&lt;.001</td>
<td>.551</td>
<td>Self (M=.497) &gt; Close Other (M=.385) &gt; Dogs (M=.322)</td>
</tr>
<tr>
<td></td>
<td>Mem Type*Mem</td>
<td>17.203</td>
<td>&lt;.001</td>
<td>.272</td>
<td>Source: Self (M=0.496) &gt;&gt; Close Other (M=0.345) &gt; Dogs (M=0.298)</td>
</tr>
<tr>
<td></td>
<td>Condition</td>
<td>17.203</td>
<td>&lt;.001</td>
<td>.272</td>
<td>General Self (M=0.498) &gt; Close Other (M=0.425) &gt; (M=.347)</td>
</tr>
</tbody>
</table>
Figure 1. Predicted results.
Figure 2. Observed results. Recognition accuracy of younger and older adults from American and Taiwanese cultures. In each culture x age group, self-reference benefits source memory more than general memory.
Figure 3. Memory condition x memory type interaction effect. Collapsing across age and culture groups, self-referencing benefits source memory disproportionately more than the other encoding conditions relative to general memory.
Figure 4. Memory Condition x Memory Type x Age interaction effect. General memory of older adults tends to benefit more from referring to close others, compared to general memory of younger adults.
Figure 5. Memory Condition x Age x Culture interaction effect. Taiwanese younger adults tend to benefit more from self-reference than Taiwanese older adults, whereas this age difference is not evident for the Americans.