Self-enhanced False Memory across the Life Span

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Abstract

Objectives: The role of self in veridical memory has been extensively studied, but what is the role of self in false memory development across the life span? The current study examined the impact of self-reference on associative false memory in children, younger adults, and older adults, and further investigated possible mechanisms concerning how self-reference might impact false memory in different age groups.

Method: Combining a self-reference manipulation with the Deese/Roediger-McDermott (DRM) paradigm, children, younger adults and older adults encoded DRM word lists as paired with their own name, another person's name, or a red square. Later their true and false recognition memory as well as recollection and familiarity were measured.

Results: A self-enhanced false memory effect was found in all age groups. That is, participants generated more false memories in the self-reference condition relative to the other-reference and neutral conditions. Furthermore, when examining its underlying memory mechanisms, we found that self-reference mainly increased false recollection in younger adults but facilitated familiarity of critical lures in older adults.

Discussion: Although self-reference increases false memory in both younger and older adults, the underlying mechanisms are different in that older adults have more self-relevant false familiarity while younger adults generate more self-relevant phantom recollection. The current study also has implications for eyewitness reports, suggesting that the self-relevance of memory may be one relevant factor to consider when evaluating potential risk factors of false memory.

Keywords: Self-reference, False Memory, Development, Recollection, Familiarity

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The proper function of memory can guide people's various behaviors in daily life such as how to get home and which food one should avoid. However, when memory is false, it can lead to severe consequences such as providing inaccurate eyewitness testimony (Johnson, 2006). People encode information as either related to *oneself* (e.g., victims) or related to *others* (e.g., bystander witnesses), and both self-relevant or other-relevant memories could serve as evidence at court. Hence it is crucial to understand how the *self* might impact the formation of false memory, especially across the human life span, since children, younger adults and older adults are all potential eyewitnesses/victims and age has been found to be one of the most important predictors of individual variability in false memory (Ceci, Papierno, & Kulkofksy, 2007).

The role of the self in false memory has recently received rapid empirical interest, although the role of the self in true memory has been extensively examined since the 1970s (e.g., Rogers, Kuiper and Kirker, 1977). Over the past decades, the self has been found to enhance accurate memory when referencing information in relation to oneself (e.g., to judge if a word can describe oneself) compared to referencing the information to others (e.g., to judge if a word can describe others) (Klein, 2012; Symons & Johnson, 1997). Theories of the self and memory propose that the self can facilitate the organization of information leading to better memories, and thus it functions like a binding mechanism in memory that unites information associated to the self (Klein & Loftus 1988; Sui & Humphreys, 2015). For example, after children saw objects paired with their own images or others' images, they remembered more stimuli-self associations than stimuli-other associations (Cunningham, Brebner, Quinn, & Turk, 2014). Our recent study also found that young *adults* showed higher stimuli-self associative memories than stimuli-other associative memories (Wang, Otgaar, Howe, & Cheng, 2021).

Despite the well-established beneficial effect of self-reference on true memory, recent research has shown a self-enhanced false memory effect that self-reference can surprisingly increase susceptibility to false memory formation (Ozdes, et al., 2021; Rosa & Gutchess, 2013; Wang, Otgaar, Howe, & Zhou, 2019; Wang et al., 2021). In Rosa and Gutchess's (2013) study, young and older participants rated adjectives for self-descriptiveness on a 9-point scale and later their memories for the studied adjectives (e.g., *angry*) as well as non-presented adjective lures (e.g., *furious*) were measured. Results found that high self-descriptive words led to higher false alarms of the lures than low self-descriptive words. More recently, Wang and colleagues (2019) combined a self-referencing manipulation with a typical false memory paradigm, the Deese/Roediger–McDermott paradigm (DRM; Deese, 1959; Roediger & McDermott, 1995), where lists of associated words (e.g., *sound, piano, sing, radio, band*) were presented to induce false memory for related but non-presented lures (i.e., *music*). They presented participants with the DRM associated words together with their own name or the name "Trump" or "Adele", and found that the self-referencing condition led to higher false recognition rates of non-presented lures than the other-referencing condition.

One possible explanation for why self-reference increases both true and false memories might be a shared mechanism by the self and false memory. The self is considered as a highly organized construct that can facilitate the organization of studied information (Klein & Loftus 1988; Symons & Johnson, 1997). For example, "sound" and "piano" can be better remembered when people organize them as concepts related to a common theme "music". Coincidentally, relational processing between items can also foster the creation of false memories according to spreading activation theories of false memory (Howe et al., 2009; Roediger, Balota, & Watson, 2001). That is, when participants encode DRM lists in relation to oneself, the self might easily trigger the shared concepts of DRM lists -- the critical lures -- in the memory network, leading to a higher chance of falsely remembering the critical lures.

Using the DRM paradigm, the self-enhanced false memory effect has only been investigated in younger adults so far. It is unknown whether such self-enhanced false memory effect can extend to older adults or children. Thus, the primary goal of this study was to examine the developmental trend of self-related false memory from children to older adults. Memories can be retrieved in terms of two distinct processes: *recollection* that refers to consciously remembering specific details (e.g., time, location, sensory details) and *familiarity* that designates the sense of knowing the occurrence of past experiences but without recalling any details (Yonelinas, 2002). Research found that self-reference increased the false recollection of critical lures but not familiarity in younger adults (Ozdes et al., 2021; Wang et al., 2021). That is, self-referencing boosts the phantom recollection of "seeing" critical lures. To understand the developmental trend of self-related false memories across the human life span, a key question is to examine the proportionate contribution of recollection vs. familiarity of critical lures in different age groups.

Rosa and Gutchess (2013) proposed that self-referencing might increase false memory in older adults via increasing fluency-based familiarity as familiarity is linked to elevated false memory levels (e.g., Thapar & Westerman, 2009). Compared to younger adults, older adults (> 60 years old) are found to over rely on familiarity as their recollective memory declines when making recognition judgements (Anderson et al., 2008), which can possibly boost the formation of false memory in older adults

(Devitt & Schacter, 2016). Indeed, some research has shown that older adults are more susceptible to false memories of critical lures than younger adults in the DRM paradigm (Norm & Schacter, 1997; Dennis, Kim, & Cabeza, 2007). According to spreading activation theories (Howe et al., 2009; Roediger et al., 2001), presenting related items can activate the lure concepts in the associative memory network during encoding. During retrieval, older adults might overly rely on familiarity to make a recognition judgement, hence they tend not to reject the lures even if they cannot recall specific contextual details of the lures.

For children, the relative contribution of recollection and familiarity to false memory is not so clear. A wealth of research has demonstrated the so-called developmental reversal of false memory, that is, younger adults exhibit more associative false memories than children in the DRM paradigm (Brainerd et al., 2008; Otgaar et al., 2016), but only limited research has examined whether such development trend is driven by the development of false recollection or familiarity. Brainerd, Holliday, and Reyna (2004) examined the contribution of recollection and familiarity in the DRM false memory in children of 7, 11, and 14 years old. They found that familiarity remained consistent across the above age range, but false recollection increased significantly as age increased. Lyons, Ghetti, and Cornoldi (2010) examined age differences in false recollection and familiarity from children to younger adults, but using different false memory paradigms. They also found that there was an increase of recollection-based false memory from children to younger adults, while familiarity-based false memory remained stable from childhood to adulthood.

So far, the general message is that false recollection increases from children to younger adults while false familiarity increases from younger adults to older adults.

However, at present, it is unclear how the self might impact false recollection or familiarity in different age groups. The second goal of the present study was to address this issue. From a practical perspective, this is interesting as eyewitness (mis)identification could be due to either recollection or familiarity. For example, research has shown that recollection can predict identification accuracy under certain circumstances (Palmer, Brewer, McKinnon, & Weber, 2010). Meanwhile, other research shows that age is a crucial factor impacting identification performance (Colloff, Wade, Wixted, & Maylor, 2017). Understanding how the self would impact the contributions of recollection and familiarity to false recognition among different age groups might shed light on the developmental mechanisms of eyewitness memory.

We presented children, younger adults, and older adults with DRM lists appearing together with either their own name (i.e., self-reference condition) or another person's name (i.e., other-reference condition), or a red square (i.e., an extra control condition). During the study phase, participants were asked to remember the words and which source (self, other, or a red square) the words appeared together with. In a follow-up recognition task, they were asked to recognize the words as presented or not using the Remember/Know paradigm to measure recollection and familiarity (Jacoby & Yonelinas, 1995; Yonelinas, 2002). Because the self-reference effect on true memory has been consistently observed in all age groups (Cunningham et al., 2014; Gutchess, Kensinger, Yoon, & Schacter, 2007), we expected that the classical self-reference effect on true memory would be replicated in all age groups. That is, self-referencing would lead to higher true recognition rates than the other-referencing and neutral conditions. Based on the proposed shared mechanism between the self-reference effect and false memory, that is relational processing or gist extraction, which can enhance false memory formation (Brainerd et al., 2008; Wang et al., 2019), we also expected a self-enhanced false memory effect across all ages such that self-referencing would result in the highest false memory rates while false memory rates in the other-referencing and neutral conditions would not differ. However, another possibility was that the self-enhanced false memory effect might not be observed in older adults because false memory levels of older adults are found to be quite high among all age groups (Schacter, Koutstaal, & Norman, 1997; Devitt & Schacter, 2016), which might be a ceiling for any effects from the self-referencing manipulation. Finally, as false recollection increases from childhood to young adulthood while false familiarity increases from young adulthood to older adulthood (Anderson et al., 2008; Lyons et al., 2010), we hypothesized that self-referencing might impact false recollection and familiarity differently in different age groups.

Method

Participants

One-hundred and one participants (aged 8-79) were tested in the study, including 29 children, 35 younger adults and 39 older adults. The current study followed the sample size in our previous similar study (Wang et al., 2019) that tested at least twenty-nine participants in order to detect the self-reference effect within one group. Post-hoc power analysis indicated that the power of the current study was 0.94 based on the current sample (N = 101). Data of two older adults were excluded because they were not able to reject new items; that is, they accepted 60% or more unrelated new items as old. Table 1 shows the final sample composition. Chi-square test indicated that there was no statistically significant difference on gender ratio across the three groups, $\chi^2 = 0.29$, Cramer's $V = 0.05$, $p = .87$. Child participants were recruited from the fourth grade at Longshi primary school in Jinggangshan city, China. Younger adult participants were college students from Fudan University, Shanghai, China. Older adults were recruited from a college program for senior citizens at Fudan University and all passed the Mini Mental State Exam (MMSE; Folstein, Folstein, & McHugh, 1975). The study was approved by the Ethical Review Committee at the Faculty of Psychology and Neuroscience at Maastricht University and by the Institutional Review Board at Fudan University.

Materials

Fifteen DRM word lists that were used in previous research (Wang et al., 2019) were involved in our study. Each DRM list contains 12 words (e.g., *boy, beautiful, dress, doll*) that are all related to a non-presented critical lure (i.e., *girl*). DRM lists were pseudo-randomly assigned to the three reference conditions based on the backward association strength (BAS), which measures the average probability that the studied items can elicit the critical lure. All the DRM lists were tested and measured BAS before (see Wang et al., 2019). The BAS was matched across the self-reference condition (5 lists, *Mean* BAS = 0.19, *SD* = .04), the other-reference condition (5 lists, *Mean* BAS = 0.20, *SD* = .04) and the neutral-reference condition (5 lists, *Mean* BAS =0.20, *SD* =.03), $F(2, 12) = 0.09$, $p = .91$. The recognition list contained 15 critical lures (one per list; e.g., *girl*), 45 studied items (three items per list; e.g., *boy, cute, braid*), and 20 unrelated items (e.g., *fish*). The studied items within each list were presented in the order of their associative strength to the critical lure, from the highest associate to the least associate, and the studied items in the recognition test were from the 1^{st}, 6^{th}, and 10^{th} position of each list (see Wang et al., 2019).

Design and Procedure

The study was a 3 (Age Group: children vs. younger adults vs. older adults) × 3 (Reference: self vs. other vs. neutral) mixed design, with Age Group as a between-subjects factor and Reference as a within-subject factor. All participants were tested individually in a quiet and isolated room. The study consisted of two phases, a study phase and a recognition phase.

As Figure 1 shows, in the study phase, participants first filled in basic demographical information including their own name. Then the DRM words appeared one by one together with either their own name (self-reference condition) or the name "Li Ming" (a frequently used name in Chinese textbooks; other-reference condition, Wang et al., 2019), or the DRM words appeared together with a red square (neutral-reference condition). "Li Ming" was used in the other-reference condition as our previous study showed that it was an effective other-reference name similar to other celebrity names, and meanwhile, it was familiar to all age groups. Participants were asked to remember the words and to which source they appeared together with (self, Li Ming, or red square). The DRM words were shown list by list, and the items within a list appeared with the same source (see Figure 1). The experiment was separated in 5 blocks with each block containing three BAS matched lists (a self-referential list, an other-referential list, and a neutral-referential list). The sequence of the lists within a block was randomized. Participants completed some filler questionnaires irrelevant to the study in a 5-minute break after the study phase.

Around 5 minutes after the study phase, participants' memories were tested using a recognition task. Words were shown at the center of the screen and participants were asked to respond by clicking the "Remember" (in Chinese "记得"), "Know" ("知道"), or "New" ("新词") button below the tested word. If the word was new, they clicked the "New' button. If they recognized the word was old, they clicked either "Remember" or "Know": when they could recall specific details such as font, size, etc., they clicked the "Remember" button; and when they identified the word as old but could not recall specific details, they clicked the "Know" button (Yonelinas & Jacoby, 1995; Yonelinas, 2002). Participants went through three practice trials to ensure that they understood the instructions.

Results

True Recognition Rates

"Remember" and "Know" responses were combined together to calculate the overall recognition response rate (see Norm & Schacter, 1997; Yonelinas, 2002). We first examined false alarms of unrelated items to test if there was a response bias. A one-way ANOVA on false alarms of unrelated items showed a main effect of Age Group, F (2,98) = 4.40, partial η^2= 0.08, p = .02. Post-hoc analyses with Bonferroni correction revealed that older adults (M = 0.18, 95%CI [0.13, 0.22]) had statistically more response bias than younger adults (M = 0.11, 95%CI [0.07, 0.14]) and children (M = 0.10, 95%CI [0.06, 0.14]), ps < .05, the latter two did not differ from each other, $p \approx 1.00$. That is, older adults were more likely to say "yes" during recognition in general.

To correct for response bias or guessing, false alarms were subtracted from true recognition rates in order to compare true *memories* across the three age groups (Brainerd et al., 2008; Wang et al., 2019). A 3 (Age Group: children vs. younger adults vs. older adults) × 3 (Reference: self vs. other vs. neutral) ANOVA was conducted on corrected true recognition rates (i.e., correct recognition of studied items). No significant interaction effect was found, F(4, 196) = 0.44, p = .78, partial η^2= 0.009. There was a main effect of Reference, F(2, 196) = 33.76, p < .001, partial

η^2= 0.26. Pairwise comparisons with Bonferroni correction indicated that the self-reference condition (*M* = 0.65, 95%CI [0.62, 0.68]) had higher true recognition rates than the other-reference condition (*M* = 0.51, 95%CI [0.47, 0.55]), $p < .001$, as well as the neutral condition (*M* = 0.58, 95%CI [0.54, 0.61]), $p < .001$; the neutral condition had higher true recognition rates than the other-reference condition, $p = .001$.

There was also significant main effect of Age Group, $F(2, 98) = 13.80$, $p < .001$, partial η^2= 0.22. Post-hoc analyses with Tukey HSD correction showed that younger adults (*M* = 0.66, 95%CI[0.62, 0.71]) had statistically higher true recognition rates than children (*M* = 0.58, 95%CI[0.53, 0.63]), $p = .046$, and older adults (*M* = 0.50, 95%CI[0.45, 0.54]), $p < .001$, while children had higher recognition rates than older adults, $p = .03$. As Figure 1 shows, the results suggest that the self-reference effect on true memory was observed across all three age groups.

False Recognition Rates

False memory was defined as falsely recognizing a critical lure as old. False recognition rates were also corrected for response bias or guessing by subtracting false alarms of unrelated items from false recognitions of critical lures. A 3 (Age Group: children vs. younger adults vs. older adults) × 3 (Reference: self vs. other vs. neutral) ANOVA was conducted on corrected false recognition rates, with Age Group as a between subjects factor. No statistically significant interaction was found between Age Group and Reference, $F(4, 196) = 0.97$, $p = .42$, partial η^2= 0.019. A significant main effect of Reference was found, $F(2, 196) = 9.64$, $p < .001$, partial η^2= 0.09. A main effect of Age Group was also found, $F(2, 98) = 4.99$, $p = .009$, partial η^2= 0.09.

Post-hoc analyses with Bonferroni correction showed that false recognition rates increased significantly from children (*M* = 0.56, 95%CI[0.50, 0.61]) to younger adults (*M* = 0.67, 95%CI[0.62, 0.72]), $p = .01$, and then dropped significantly from younger adults to older adults (*M* = 0.58, 95%CI[0.53, 0.63]), $p = .04$, while children and older adults did not differ statistically on false recognition rates, $p = .80$. These false recognition results in children and younger adults are consistent with the developmental reversal hypothesis. Multiple comparisons among different reference conditions showed that false recognition rates were higher in the self-reference condition (*M* = 0.66, 95%CI[0.63, 0.70]) than in the other-reference condition (*M* = 0.57, 95%CI[0.52, 0.61]), $p < .001$, and neutral condition (*M* = 0.57, 95%CI[0.53, 0.62]), $p = .001$; the latter two conditions did not differ significantly, $p \approx 1.00$. These results indicate that we have found a self-enhanced false memory effect across the three age groups (see Figure 3).

Recollection and Familiarity

To further examine which memory component might drive the self-enhanced false memory effect across different age groups, we conducted analyses on (false and true) recollection and familiarity respectively. Recollection is the rate of "remember" responses, and familiarity is calculated as the rate of "knowing" responses divided by 1 minus the rate of remember responses (Knowing rate/(1 − recollection rate)) (see Wang et al., 2019; Yonelinas, 2002). The self-reference effect is defined as a mnemonic effect resulting from processing information in relation to oneself compared to processing information in relation to *others* (Rogers et al., 1977; Symons & Johnson, 1997). Hence, we compared false recollection and familiarity between the self-reference and other-reference conditions in order to further understand the possible mechanism underlying the self-enhanced false memory effect found here[1].

Recollection/Familiarity in False Recognition. A 3 (Age Group: children vs. younger adults vs. older adults) × 2 (Reference: self-reference vs. other-reference) × 2 (Memory Component: recollection vs. familiarity) ANOVA was conducted on false recognition (i.e., erroneous recognition of critical lures). A statistically significant three-way interaction was found, $F(2, 75) = 7.99$, $p = .001$, partial $\eta^2 = 0.18$, suggesting that the interaction coefficients between Age Group and Reference are different for recollection and familiarity. We then conducted subsidiary 3 (Age Group: children vs. younger adults vs. older adults) × 2 (Reference: self-reference vs. other-reference) ANOVAs for false recollection and false familiarity respectively. First, we examined data on false recollection and found a significant interaction between Age Group and Reference, $F(2, 98) = 3.89$, $p = .02$, partial $\eta^2 = 0.07$. As Figure 4 shows, pairwise comparisons with Bonferroni correction revealed that self-referencing increased false recollection significantly relative to other-referencing only in younger adults, $p < .001$, $M_{\text{difference}} = 0.22$, 95%CI[0.12, 0.31], Cohen's $d = 0.85$; self-referencing did not increase false recollection in children ($p = .50$) and older adults ($p = .08$). Then we examined data on false familiarity and found a significant interaction between Age Group and Reference as well, $F(2, 75) = 6.30$, $p = .003$, partial $\eta^2 = 0.14$, however the interaction mode was different from that in false recollection. Intriguingly, as Figure 3 shows, self-referencing did not impact false familiarity in children ($p = .63$), but it decreased familiarity in younger adults, $p = .02$, $M_{\text{difference}} = -0.21$, 95%CI[−0.40, −0.03], Cohen's $d = 0.64$, and increased false

[1] However, we reported all data (including data in the neutral condition) in the Supplementary Materials.

familiarity in older adults, p = .009, $M_{\text{difference}}$ = 0.21, 95%CI[0.06, 0.37], Cohen's d = 0.55.

Recollection/Familiarity in True recognition. Descriptive data can be found in supplementary Table 1. No statistical three-way interaction was found among Age, Reference, and Memory component on true recognition, $F(2, 97) = 0.46$, $p = .63$, partial η^2= 0.009. However, to keep the analysis consistent between false and true recognition results and to illustrate the mechanism of self-referencing on true memories, we reported true recollection and true familiarity data separately. A 3 (Age Group: children vs. younger adults vs. older adults) × 2 (Reference: self-reference vs. other-reference) ANOVA on true recollection revealed no interaction between Age Group and Reference, $F(2, 98) = .48$, $p = .62$. A significant main effect of Age Group was found, $F(2, 98) = 9.96$, $p < .001$, partial η^2= 0.17, with younger adults having the highest true recollection rates. A significant main effect of Reference was found too, $F(1, 98) = 53.08$, $p < .001$, partial η^2= 0.35, with the self-reference condition having higher true recollection rates than the other-referencing condition. These results indicate that self-referencing increased true recollection to a similar extent across the three age groups. A 3 (Age Group: children vs. younger adults vs. older adults) × 2 (Reference: self-reference vs. other-reference) ANOVA on true familiarity showed similar results. No interaction between Age Group and Reference was found, $F(2, 97) = .28$, $p = .76$, partial η^2= 0.006, and no main effect of Age Group was found, $F(2, 98) = 1.38$, $p = .26$, partial η^2= 0.028. Self-referencing increased true familiarity significantly relative to other-referencing, $F(1, 97) = 169.29$, $p < .001$, partial η^2= 0.14. In summary, self-referencing increased both recollection and familiarity for true memories across children, younger adults and older adults.

Discussion

The current study combined a self-referential manipulation with the DRM paradigm to investigate the development of self-referential true and false memory in children, younger adults, and older adults. First, we found that in all age groups, participants had higher true recognition rates in the self-reference condition than the other conditions, which is consistent with previous research (Cunningham et al., 2014; Gutchess et al., 2007) and shows that the self-reference manipulation worked in the current study. More importantly, by examining false memory in children, younger adults and older adults, the current study found a self-enhanced false memory effect across the life span. That is, in all age groups, we found that participants generated more false memories in the self-reference condition than in the other-reference and neutral conditions.

Furthermore, we found that the mechanisms underlying the self-enhanced false memory effect differed across age groups. For children, when their false recollection and familiarity of the critical lures were examined, neither of these memory processes was found to be impacted by self-referencing. Because recollection was calculated as the rate of Remember responses while familiarity was calculated as knowing rate/(1 − recollection rate) instead of the rate of Know responses, we re-analyzed children's Know response rates to rule out the possibility that the above finding was an artifact of using the familiarity formula (i.e., knowing rate/(1 − recollection rate)). However, we did not find the impact of self-reference on Know response rates either ($p = .32$) in children. Statistically, it is possible that overall recognition (i.e., Remember + Know) reaches significance while R and K did not reach significance when examining them separately. This suggests that the overall self-enhanced false memory effect found in children should be a cumulative enhancing effect from both recollection and familiarity. For younger adults, false recollection was increased significantly in the self-reference condition while false familiarity was decreased significantly in the self-reference condition relative to the other-reference condition. The results indicate that self-reference has a significant boosting effect on false recollection and maybe an inhibition effect on familiarity of the critical lures. For older adults, only false familiarity was significantly increased by self-reference, which suggests that the self-enhanced false memory effect in older adults is mainly driven by the enhancement of familiarity of the critical lures.

Based on the above findings, we propose that the self might have an enhancing effect on the dominant memory process (false recollection or familiarity) of false memory in each age group. Research on false memory in older adults found that they rely mostly on familiarity to make a recognition judgement (Devitt & Schacter, 2016). Our results found that self-reference further boosted the familiarity process in older adults, leading to higher false recognition rates than the other-reference condition. On the contrary, for younger adults, previous research showed that phantom recollection mainly drives their false memory phenomenon relative to children and older adults (Brainerd et al., 2008; Devitt & Schacter, 2016; Lyons et al., 2010). Here, we further found that self-reference mainly enhanced false recollection in younger adults, which led to the self-enhanced false memory effect in younger adults. For children, their false recollection has been found to be underdeveloped relative to younger adults (Lyons, Ghetti, & Cornoldi, 2010) while they do not show over-reliance on false familiarity like older adults do, which might be the reason that we did not find a specific enhancement of either of the two processes. Note that the older adults in our study were relatively young (M_{age} = 64.68), which might lead to a more conservative estimate of the developmental difference. Future research may use a more aged sample.

It is intriguing that we found that self-reference impacted different memory processes of false memory in younger and older adults. Mechanisms underlying the self-reference effect include relational processing and item-specific processing (Klein, 2012; Symons & Johnson, 1997). We hypothesized that self-reference might increase false memory by increasing relational processing among the DRM items because relational processing could enhance false memory according to the spreading activation theories (Gallo & Roediger, 2002; Howe et al., 2009) while item-specific processing (e.g., distinctive features, pictorial forms) would normally decrease false memory in the DRM paradigm (see Huff & Bodner, 2019; Wang, Otgaar, Howe, Felix, & Smeets, 2018). In our previous research, we found that self-reference could enhance false recollection in younger adults, leading us to conclude a link between relational processing and false recollection (Wang et al., 2019). However, in the current study, self-reference enhanced older adults' false memory via increasing familiarity of critical lures. What is the relationship between relational processing and familiarity? Could relational processing enhance both false recollection and familiarity of critical lures? The current study cannot provide an answer yet, but these are interesting questions to be answered by further research.

The finding that self not only facilitates true memory but also enhances false memory in all age groups is consistent with our previous proposition that cognitive processes that increase mnemonic efficiency (e.g., relational processing, gist extraction) may increase susceptibility to associative false memories (Wang et al., 2019), which reveals the constructive and adaptive nature of our memory system (see Howe, 2011; Schacter, 2012). That is, self-reference can facilitate true memory efficiently, but at the cost of increasing false memories. A growing body of evidence has shown similar findings. Research has shown that deeper levels of processing, survival processing, and people with highly superior autobiographical memories on the one hand exhibit more correct memories but on the other hand lead to higher level of false memories (Howe & Derbish, 2010; Otgaar & Smeets, 2010; Patihis et al., 2013; Rhodes & Anastasi, 2000). More recently, using an episodic specificity induction technique that can enhance true recall of past events, researchers found that such a technique increased false recall of critical lures in the DRM paradigm as well (Thakral, Madore, Devitt, & Schacter, 2019). These findings all together support the adaptive nature of memory.

In conclusion, the current study found a self-enhanced false memory effect across the life span that children, younger and older adults would generate more false memories when processing information related to themselves than when processing information related to others. Furthermore, we examined the mechanism underlying the self-enhanced false memory effect and found that self-reference mainly increased false recollection in younger adults but facilitated familiarity of critical lures in older adults. Besides the above theoretical implications, the current results also have implications for eyewitness reports, suggesting that the self-relevance of memory may be one relevant factor to consider when evaluating potential risk factors of false memory. Further research is needed to examine the role of self in false memory using paradigms with more ecological validity.

Open Access

All data can be accessed at https://osf.io/x6m7k/. The study was not pre-registered.

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Table 1.

Composition of participants in the three age groups.

Age Group	*N*	Gender ratio	Mean Age ± SD	Age Range	Education level
Children	29	51.7% male (*n* = 15)	9.37±0.55	8 - 10	4th grade; primary school
Younger adults	35	45.7% male (*n* = 16)	20.00±2.22	17 - 26	College
Older adults	37	45.9% male (*n*= 17)	64.68±5.89	54 - 79	College
Total	101	47.5% male (n = 48)			

Figure 1. Semantic illustration of the study phase. “Self” stands for participant’s own name. Words shown in the above figure are sample items from DRM lists, e.g., *Garage* and *Truck* are words from the list with critical lure “Car”; *Doll* and *Dress* are words from the “Girl” list; *Candy* and *Sugar* are words from the “Sweet” list. Each DRM list contained 12 items. Each pair was presented for 1500 ms with 500 ms interstimulus interval.

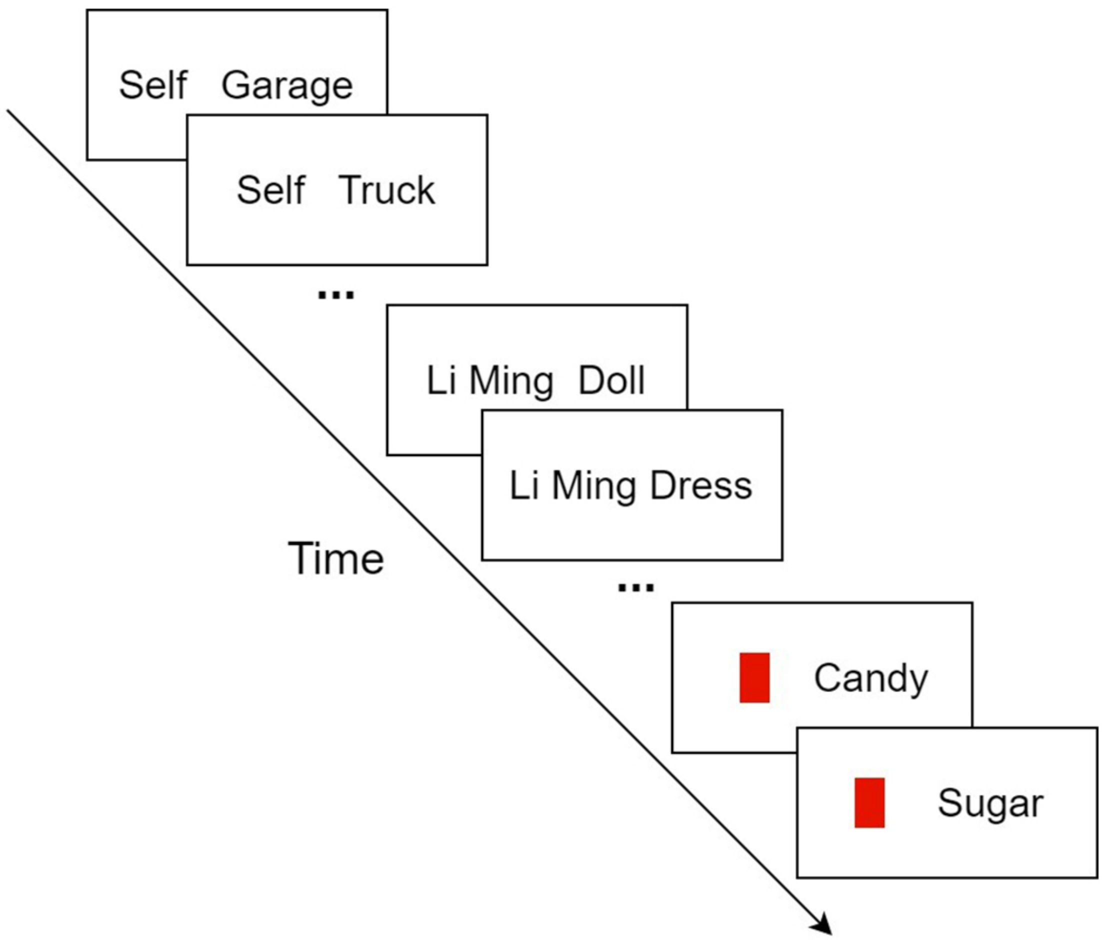

Figure 2. Corrected true recognition rates in the self-reference, other-reference and neutral conditions across children, younger adults and older adults. Error bars denote 95%CIs.

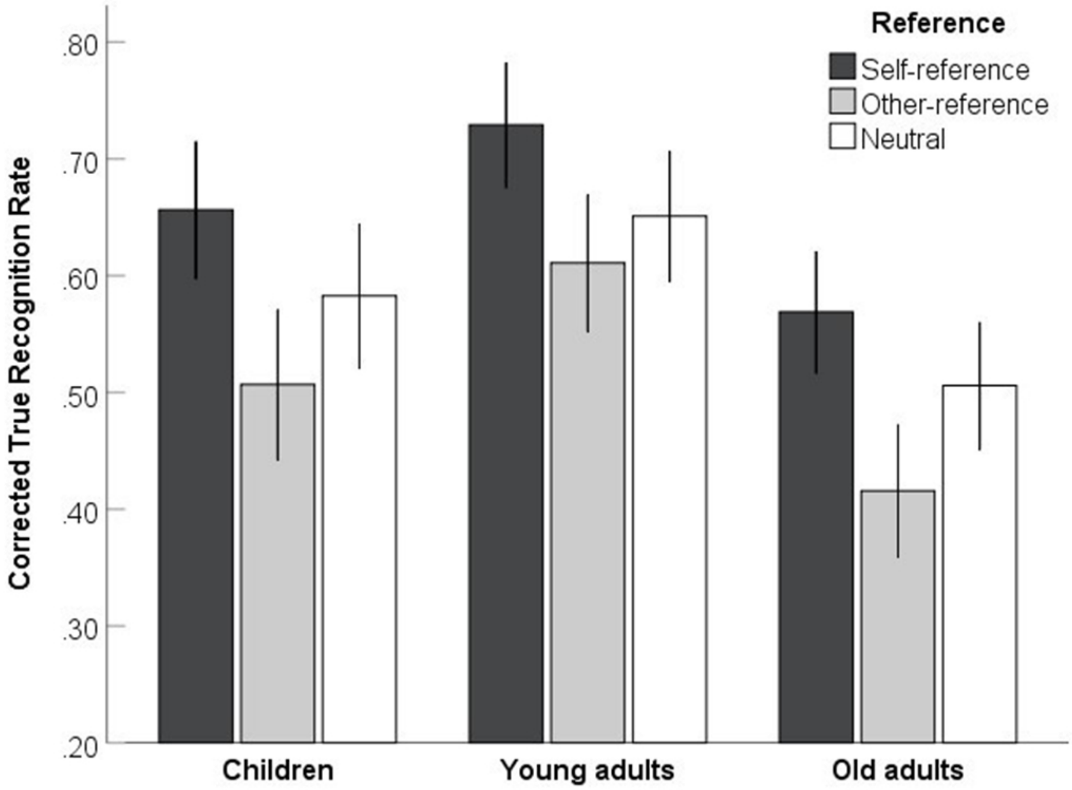

Figure 3. Corrected false recognition rates in the self-reference, other-reference and neutral conditions across children, younger adults and older adults. Error bars denote 95%CIs.

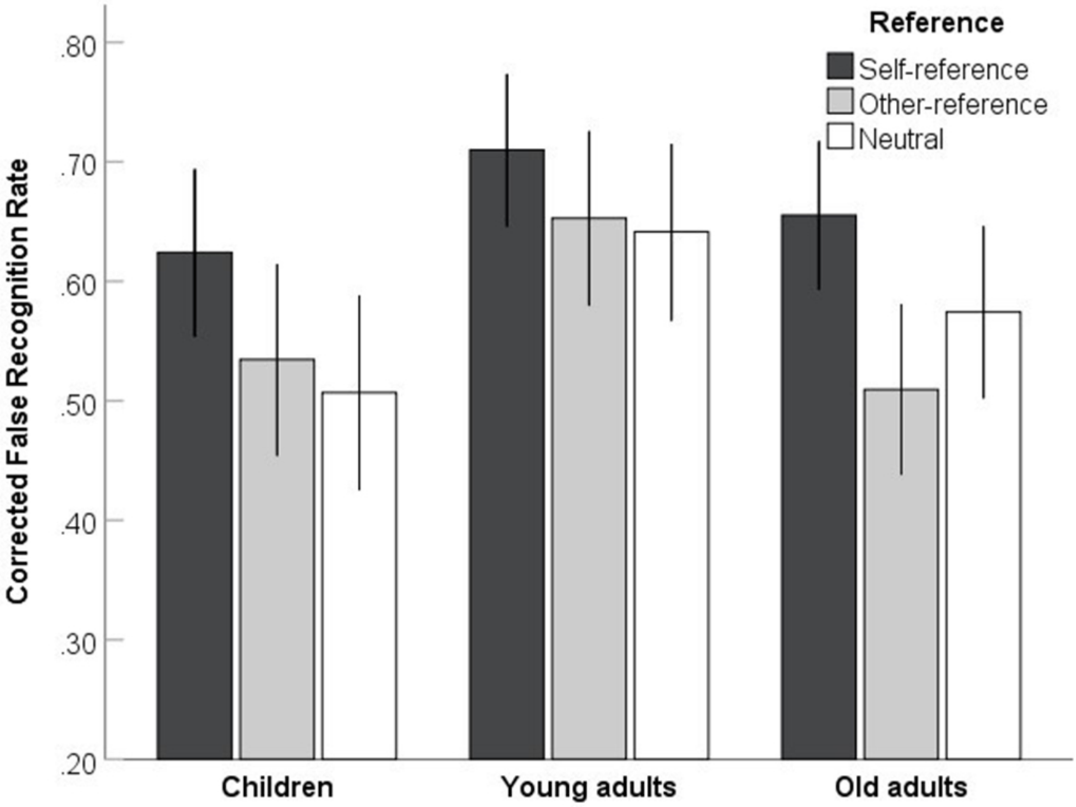

Figure 4. False recollection rate (upper) and false familiarity rate (lower) in self-reference and other reference conditions across children, younger adults and older adults. Error bars denote 95% CIs.