

# False Remembering in the Aged

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**ABSTRACT**—*Researchers studying human memory have increasingly focused on memory accuracy in aging populations. In this article we briefly review the literature on memory accuracy in healthy older adults. The prevailing evidence indicates that, compared to younger adults, older adults exhibit both diminished memory accuracy and greater susceptibility to misinformation. In addition, older adults demonstrate high levels of confidence in their false memories. We suggest an explanatory framework for the high level of false memories observed in older adults, a framework based on the theory that consciously controlled uses of memory decline with age, making older adults more susceptible to false memories that rely on automatic processes. We also point to future research that may remedy such deficits in accuracy.*

**KEYWORDS**—*memory; aging; memory accuracy*

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“As I told you, my mother is visiting this weekend and staying for two weeks. You agreed.” Faced with an “I told you . . .” claim of this sort, one might wonder if one is being confronted with a false memory or, perhaps, a fraudulent attempt to create one. Are older adults more vulnerable to such mundane attempts to create false memories? As evidenced by warnings from the Federal Bureau of Investigation’s Web site (Federal Bureau of Investigation, n.d.), there is a host of serious fraudulent schemes directed at older adults that rely on memory deficits that sometimes accompany old age. In this article, we describe results suggesting that older adults are more susceptible to such scams than are younger adults.

We begin by considering a common complaint about the memory performance of older adults: the repeated telling of stories. The greater tendency of older adults to unknowingly repeat stories can be understood in terms of a dual-process model of memory (Jacoby, 1999). According to such a model, repetition of a story has two effects, one of which is to “strengthen” or increase the familiarity of a story, making it more likely to be repeated. This automatic, habit-like influence of

memory is opposed by “recollection,” a more consciously controlled use of memory that allows unwanted repetition to be avoided by recollecting the specific prior telling of a story.

These two forms or uses of memory are illustrated by an experiment (Jacoby, 1999) whose results demonstrate that older adults are vulnerable to an ironic effect of repetition. In a first phase of that experiment, young adults and older adults (aged 65 and over) were presented with a list of words that they were instructed to read. Words in this list were presented one, two, or three times, with repetition intended to mimic the repeated telling of a story. Next, participants heard a list of words that they were told to remember for a subsequent memory test. For that test, participants were instructed to respond “yes” only if a word had been heard earlier and were correctly warned that the test would also include words that they had read earlier and should be rejected.

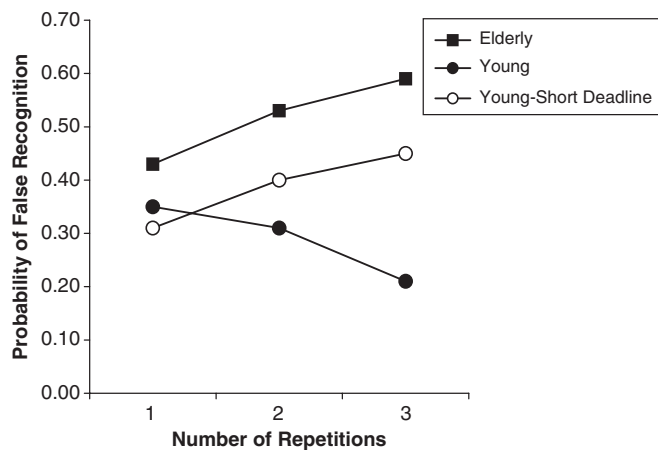
As Figure 1 shows, younger adults’ false recognition of earlier-read items declined with increasing repetition. However, for older adults, the opposite pattern held, as repeated reading had the ironic effect of increasing the probability of falsely recognizing earlier-read items as having been heard. Thus, older adults were less able to counter an increase in the familiarity of a repeated item with a specific memory (recollection) of its prior occurrence, making them vulnerable to false memories. Younger adults forced to respond quickly also showed an ironic effect of repetition, exhibiting more false memories for repeated items. This elevation in false memories with repetition for younger adults, who presumably have intact recollection, suggests that recollection, in addition to being vulnerable to aging, may be slower than the more automatic processes that support familiarity.

False memories have also been studied using a paradigm initially reported by Deese (1959) and later revived by Roediger and McDermott (1995). In the Deese-Roediger-McDermott (DRM) paradigm, participants are first exposed to a list of semantically related words, such as *bed, rest, pillow*, etc. These words are all related to a central theme word (e.g., *sleep*), termed the critical lure, which is itself never presented. When later tested, however, participants often falsely recall or recognize the critical lure as an item that had been presented.

Several investigators have tested older adults in the DRM paradigm, with the evidence suggesting that in many cases older

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**Fig. 1.** Probability of falsely recognizing an item that had been read as one that had been heard. Participants read words one, two, or three times. They then heard a list of words and were given a recognition test with instructions to endorse only items that had been heard and to reject earlier-read words. Results showed that older adults' (filled squares) probability of false recognition of earlier-read words increased with repetition whereas younger adults' level of false recognition (filled circles) decreased with repetition. Younger adults made to respond quickly (unfilled circles) showed a pattern of data similar to that of older adults, being more likely to falsely endorse earlier-read items that had been repeated.

adults are more likely to report false memories for the critical lure than are younger adults (e.g., Norman & Schacter, 1997). Interestingly, manipulations that reduce false memories in younger adults are either partially or wholly ineffective for older adults. For example, McCabe and Smith (2002) demonstrated that warning younger adults about the nature of the DRM paradigm prior to study significantly reduced false recognition of the critical lure. Older adults exposed to the same manipulation exhibited approximately half the reduction in false memories evident for younger adults. In addition, when both groups were warned prior to a recognition test, only younger adults showed a substantial reduction in false memories.

Older adults' eyewitness memory may also be susceptible to striking inaccuracies. For example, Karpel, Hoyer, and Togli (2001) had older and younger adults view a slide sequence depicting a theft and later administered a questionnaire about the theft. Several questions contained misleading information suggesting the presence of items that were never shown (e.g., "Did the thief pick up the glue . . . in front of the can of Coke?" when a can of Coke was never shown). When tested on their memory for the slide sequence, older adults were more likely to falsely recognize suggested items than were younger adults. They also showed higher levels of confidence for falsely remembered, suggested items and reported more vivid details for suggested items than younger adults did (see Kelley and Sahakyan, 2003, for a similar pattern of inaccuracy and overconfidence in older adults).

Taken together, these data suggest that older adults exhibit higher levels of false memories than younger adults do and that older adults' subjective experience of memory (in the form of

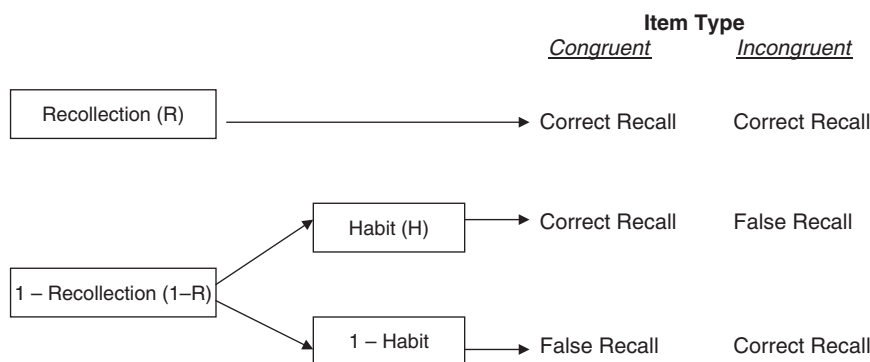
confidence judgments) is less well attuned to their actual level of accuracy. In the next section, we discuss an explanatory framework for age-related differences in memory accuracy.

## A DUAL-PROCESS MODEL OF MEMORY AGING

As noted previously, age-related differences in memory accuracy can be explained by a dual-process view of memory. This view suggests that older adults' greater susceptibility to false memories reflects a diminished ability to recollect specific events. A by-product of this reduced recollection is that easily accessible information may be mistakenly regarded as a memory (Jacoby, 1999). For example, Hay and Jacoby (1999) describe the case of an elderly math professor who, after attending a conference, was unable to locate his return airline ticket. He purchased another one and, arriving home, phoned his wife to pick him up at the airport. She responded that she would be unable to do so because he had driven their only car to the conference! The professor's action slip reflects a failure to recollect having driven to the conference along with a reliance on his usual habits that accompanied flying, such as calling his wife when he arrived at the airport.

Our contention is that the controlled processes necessary to support recollection and overcome habits change with age, rendering habits more influential and older adults more likely to exhibit false memories. We have used procedures to separately measure recollection and automatic influences of memory, such as habits; we illustrate these procedures by describing data reported by Hay and Jacoby (1999). The first phase of their experiment was meant to create habits of varying strength by exposing older and younger adults to pairs of associatively related words (e.g., *organ–music*). During that phase, cue words were paired with two different responses and the probability of pairings was varied. For example, the typical response word *music* appeared with the cue word *organ* on 75% of the trials, whereas, the atypical response *piano* appeared with *organ* on only 25% of the trials. In a second phase, participants studied short lists of word pairs. In some cases, the word pairs had been presented most frequently in the first phase. These *congruent items* can be contrasted with other studied pairs (e.g., *organ–piano*), termed *incongruent items*, that had been shown infrequently in the first phase. Following this study phase, participants were tested on their memory for words presented in the study phase, cued with the first word of the pair (e.g., *organ–\_\_\_\_\_*). Younger and older adults were almost equally likely to report the correct response for congruent items. However, for incongruent items, older adults were more likely than younger adults to falsely recall the most typical response (e.g., *music*).

Results were analyzed with a dual-process model (Fig. 2). According to that model, correct recall of congruent items can result from recollection (R) or from reliance on habit (H) when recollection fails (1-R)—a situation expressed as the equation  $R + H(1-R)$ . In contrast, for incongruent items, reliance on habit



**Fig. 2.** Dual-process model of memory used by Hay and Jacoby (1999). In their experiments, participants first read pairs of words, some of which were presented more frequently (e.g., *organ–music*) than other pairs (e.g., *organ–piano*) to establish habits of varying strengths. For a second phase, participants studied short lists of word pairs and were tested on these pairs, cued with the first word of each pair (e.g., *organ–\_\_\_\_\_*). Two types of items are of interest. *Congruent items* were identical to the pairs presented most frequently and *incongruent items* were consistent with pairs presented less frequently. In this model, correct recall of congruent items occurs because of recollection or, failing that (“1–Recollection”), because of the habit established by presenting pairs frequently. False recall for an incongruent item occurs if one provides the response made most typical by habit and fails to recollect what was studied.

when recollection fails—expressed as  $H(1-R)$ —leads to false recall. These equations allow recollection to be estimated as the difference between correct recall on congruent items and false recall on incongruent items. Analyzing their data using these equations, Hay and Jacoby demonstrated that age differences in memory performance were fully accounted for by a difference in recollection (Fig. 3). Specifically, estimated habit did not differ for younger and older adults. Rather, because estimated recollection was diminished in older adults, they relied on habit more often and produced more false memories.

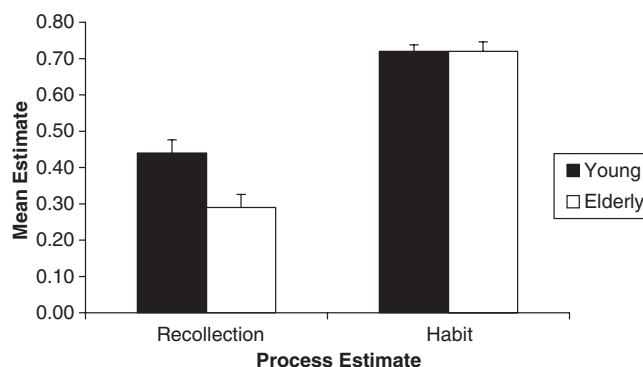
**MULTIPLE PROCESSES OF FALSE MEMORIES**

More recent work has suggested that false memories can sometimes result because misleading information is so potent that older adults skip any further attempt to retrieve and mistakenly accept the misinformation as veridical. That is, older adults may be so “captured” by misleading information that they forgo engaging in recollection. Such deficits might make older adults more vulnerable to “I told you . . .” scams of the sort noted at the beginning of this article. For example, in one scam, a con man attempts to overcharge an older adult for a repair with the claim that “I told you that the repair cost X, and you agreed to pay.” If the older adult is captured by this misinformation and falsely remembers specific details of the fraudulent oral contract, he or she will be victimized.

Jacoby, Bishara, Hessels, and Toth (2005) used an experimental procedure analogous to false “I told you . . .” claims to model the effects of misleading information on older adults. Their procedure was similar to that of Hay and Jacoby (1999), with the exception that, just prior to a test, a prime word was briefly presented that was either congruent or incongruent (misleading) with what had been studied. Results showed that presenting a

misleading prime word disrupted memory accuracy, with older adults being much more likely than younger adults to mistakenly report the misleading prime as having been studied (i.e., a false memory). In addition, in one experiment, older adults were 10 times more likely to falsely “remember” details of the misleading prime than younger adults were. Using a variant of the model depicted in Figure 2, Jacoby et al. (2005) found that for older, but not younger, adults it was necessary to add a parameter (termed “capture”) that indexed the probability that participants did not attempt recollection. That is, the misleading information was sometimes so powerful for older adults that they neglected any further attempt to remember what had been studied.

The notion of capture is consistent with other theories suggesting that older adults’ memory deficits reflect a breakdown in



**Fig. 3.** Estimated recollection and habit for younger and older adults. Recollection was estimated by subtracting the probability of false recall for incongruent items from the probability of correct recall for congruent items. Habit can be estimated by dividing the probability of false recall on incongruent items by the estimated probability of a failure in recollection. Hay and Jacoby (1999) showed that younger and older adults did not differ on estimates of habit but did differ for recollection.

processes important for ignoring irrelevant information (Hasher & Zacks, 1988). By this model, older adults are susceptible to misleading information because they are less efficient at suppressing such misinformation than younger adults are. Older adults' greater susceptibility to misinformation may also occur because they are less proficient at monitoring the source of misinformation (e.g., Henkel, Johnson, & De Leonardi, 1998). For example, older adults perform more poorly than younger adults do when asked to determine which of two sources (e.g., real vs. imagined events) a memory came from (Henkel et al., 1998).

### IMPROVING MEMORY ACCURACY

For purposes of diagnosis and remediation, it is important to distinguish between different bases for cognitive control (Jacoby, Kelley & McElree, 1999). Cognitive control can be likened to quality control in manufacturing. For example, quality control can be achieved by using inspectors to monitor goods after they have been produced or by increasing the precision of production techniques to meet standards more reliably. Likewise, effective source monitoring could edit out false memories after they come to mind. Alternatively, as with improving production techniques, false memories could be avoided by elaborating on memory cues to constrain retrieval, such that what comes to mind is highly likely to be accurate—an *early-selection* means of cognitive control. We (Jacoby, Shimizu, Velanova, & Rhodes, 2005) have recently found that older adults are less likely to engage in early-selection processes that would help them avoid false memories. Such deficits may reflect deterioration in frontal-lobe functions thought to underlie cognitive control (e.g., Velanova et al., 2003). A goal for future research is to further delineate the precise neural mechanisms involved in controlled retrieval processes such as recollection and to understand how such mechanisms change with age.

Our present research is aimed at reducing older adults' vulnerability to false memories by training retrieval processes. In particular, we train older adults in situations that engender high levels of interference from misleading information and thus require a reliance on recollection to avoid misleading automatic influences of memory (see Jennings & Jacoby, 2003). As an example, we have examined the effects of training in a situation similar to that used by Hay and Jacoby (1999) to examine memory slips. Results have shown that providing feedback regarding the accuracy of responses reduced older adults' likelihood of producing confidently held false memories. We are continuing these initial efforts and are currently examining ways in which processes integral to early selection can benefit from remediation.

### CONCLUSIONS

The data briefly reviewed here suggests that older adults (a) are more prone to reporting inaccurate memories; (b) may be more

susceptible to misinformation; and (c) may be largely unaware of this inaccuracy, as revealed by overconfidence. We do not suggest that these problems only afflict the memories of older adults, as college-aged younger adults exhibit similar patterns of data in some circumstances (e.g., when fast responding is required). Further, there exists great individual variability in older adults' likelihood of exhibiting false memories. However, the evidence does show a pervasive pattern of memory inaccuracy in older adults and sets an agenda for future research to enhance memory in the aged through training and to discover the neural substrates underlying the decline in accuracy. Our hope is that such training and research endeavors will not only help inoculate older adults against scams that prey on memory deficits but also contribute to our understanding of the changes in memory that accompany aging.

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### Recommended Reading

- Balota, D.A., Dolan, P.O., & Duchek, J.M. (2000). Memory changes in healthy older adults. In E. Tulving & F.I.M. Craik (Eds.), *The Oxford Handbook of Memory* (pp. 395–409). Oxford, England: Oxford University Press.
- Hoyer, W.J., & Verhaeghen, P. (2006). Memory aging. In J.E. Birren and K.W. Schaie (Eds.), *Handbook of the psychology of aging* (6th ed., pp. 209–232). San Diego, CA: Elsevier.
- Rhodes, M.G., & Kelley, C.M. (2005). Executive processes, memory accuracy, and memory monitoring: An aging and individual difference analysis. *Journal of Memory and Language*, *52*, 578–594.
- Roediger, H.L. (1996). Memory illusions. *Journal of Memory and Language*, *35*, 76–100.
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### REFERENCES

- Federal Bureau of Investigation. (n.d.). Fraud target: Senior citizens. Retrieved March 22, 2006, from <http://www.fbi.gov/majcases/fraud/seniorsfam.htm>
- Deese, J. (1959). On the prediction of occurrence of particular verbal intrusions in immediate recall. *Journal of Experimental Psychology*, *58*, 17–22.
- Hasher, L., & Zacks, R.T. (1988). Working memory, comprehension, and aging: A review and a new view. In G.H. Bower (Ed.), *The psychology of learning and motivation* (pp. 193–225). San Diego, CA: Academic Press.
- Hay, J.F., & Jacoby, L.L. (1999). Separating habit and recollection in young and older adults: Effects of elaborative processing and distinctiveness. *Psychology and Aging*, *14*, 122–134.
- Henkel, L.A., Johnson, M.K., & De Leonardi, D.M. (1998). Aging and source monitoring: Cognitive processes and neuropsychological correlates. *Journal of Experimental Psychology: General*, *127*, 251–268.
- Jacoby, L.L. (1999). Ironic effects of repetition: Measuring age-related differences in memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *25*, 3–22.

- Jacoby, L.L., Bishara, A.J., Hessels, S., & Toth, J.P. (2005). Aging, subjective experience, and cognitive control: Dramatic false remembering by older adults. *Journal of Experimental Psychology: General*, *134*, 131–148.
- Jacoby, L.L., Kelley, C.M., & McElree, B.D. (1999). The role of cognitive control: Early selection versus late correction. In S. Chaiken & Y. Trope (Eds.), *Dual-process theories in social psychology* (pp. 383–400). New York: Guilford Press.
- Jacoby, L.L., Shimizu, Y., Velanova, K., & Rhodes, M.G. (2005). Age differences in depth of retrieval: Memory for foils. *Journal of Memory and Language*, *52*, 493–504.
- Jennings, J.M., & Jacoby, L.L. (2003). Improving memory in older adults: Training recollection. *Neuropsychological Rehabilitation*, *13*, 417–440.
- Karpel, M.E., Hoyer, W.J., & Toggia, M.P. (2001). Accuracy and qualities of real and suggested memories: Nonspecific age differences. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *56*, P103–P110.
- Kelley, C.M., & Sahakyan, L. (2003). Memory, monitoring, and control in the attainment of memory accuracy. *Journal of Memory and Language*, *48*, 704–721.
- McCabe, D.P., & Smith, A.D. (2002). The effect of warnings on false memories in young and older adults. *Memory and Cognition*, *30*, 1065–1077.
- Norman, K.A., & Schacter, D.L. (1997). False recognition in younger and older adults: Exploring the characteristics of illusory memories. *Memory & Cognition*, *25*, 838–848.
- Roediger, H.L., & McDermott, K.B. (1995). Creating false memories: Remembering words not presented in lists. *Journal of Experimental Psychology: Learning, Memory, & Cognition*, *21*, 803–814.
- Velanova, K., Jacoby, L.L., Wheeler, M.E., McAvoy, M.P., Peterson, S.E., & Buckner, R.L. (2003). Functional-anatomic correlates of sustained and transient processing components engaged during controlled retrieval. *Journal of Neuroscience*, *23*, 8460–8470.