Published in final edited form as:

Curr Dir Psychol Sci. 2015 June ; 24(3): 170–176. doi:10.1177/0963721414563730.

Memory avoidance by older adults: When 'old dogs' won't perform their 'new tricks'

Dr Dayna R. Touron¹ [Associate Professor of Psychology]

University of North Carolina at Greensboro

Abstract

Learning often involves a transition from responding based on an effortful initial strategy to using a faster and easier memory-based strategy. Older adults shift strategy more slowly compared to younger adults. I describe research establishing that age differences in strategy shift are impacted not only by declines in older adults' learning, but also by a volitional avoidance of memory retrieval. I also discuss the factors that influence older adults' memory avoidance, including age differences in understanding the available strategies' relative efficiency, accuracy, and effort, as well as age differences in the preference for a consistent strategic approach. Last, I consider the implications of memory avoidance for older adults' everyday functioning. This research demonstrates that volition and choice must be taken into account when studying cognitive performance and aging.

When learning to read, children sound out the phonemes within each word, whereas skilled readers recognize words instantly by sight. When I drive to a new place, I follow a map or GPS until I have the turns memorized. We streamline everyday tasks by replacing an early and effortful approach with one that takes advantage of experience and memory. New memory-based skills are developed and utilized throughout our lifetimes. This begs the question, are 'old dogs' as able to acquire and execute 'new tricks'?

Early perspectives reasonably focused on older adults' ability to acquire new information. Substantial evidence documents age-related declines in acquisition, particularly when older adults are asked to bind or associate different pieces of information together (Kausler, 1994; Naveh-Benjamin, 2000). Age differences in strategy transitions were therefore typically attributed to a memory deficit, where older adults fail to use retrieval strategies until they have gained the information needed for memory retrieval (e.g., Jenkins & Hoyer, 2000; Touron, Hoyer, & Cerella, 2001).

In this paper, I will demonstrate that declines in the use of memory strategies are impacted not only by changes in older adults' reduced *ability* to learn information, but also by their *volitional avoidance* of retrieval. This finding represents a departure from exclusively bottom-up mechanistic explanations of strategy shift, where learning determines strategy use, by also acknowledging top-down metacognitive determinants on strategy choices (see Logan, 1988, and Rickard, 1998, for a broader consideration of this issue). I will also

¹Address correspondence to Dayna R. Touron, Department of Psychology, 296 Eberhart Bldg. PO Box 26170, The University of North Carolina at Greensboro, Greensboro, NC 27402-6170, d_touron@uncg.edu. Phone: 336-937-5794 Fax: 336-334-5066.

discuss factors that influence older adults' reluctance to use memory strategies, and will consider the implications of memory avoidance for older adults' everyday functioning. This research typically relies on strategy self-reports. After each trial, participants report which strategy they just used. Strategy reports allow us to precisely track strategy transitions and are validated by comparisons to behavioral measures such as response times and eye movements (e.g., Touron, Hertzog, & Frank, 2011).

Memory performance versus utilization

Older adults do not proceed to use memory strategies after having learned the information required for memory use. This pattern occurs in various laboratory tasks. I will particularly concentrate on findings from the noun-pair lookup task (Hertzog & Touron, 2011; Hertzog, Touron, & Hines, 2007; Hines, Touron, & Hertzog, 2012; Touron, 2006; Touron & Hertzog, 2004a; Touron & Hertzog, 2004b; Touron & Hertzog, 2014; Touron, Swaim, & Hertzog, 2007). In the noun-pair task, participants must initially search a lookup table full of noun-pairs (i.e., dog-spoon) to determine whether a target noun-pair matches a pair in the table or is a rearrangement of pairs in the table (i.e., dog-potato). Over time, participants learn the pairs and are able to respond using retrieval. Discrepancies between older adults' memory ability and memory strategy use have also been shown in alphabet arithmetic (Touron & Hertzog, 2009) and alphabet verification (Frank, Touron, & Hertzog, 2013) tasks that are characterized by shift from computation to memory retrieval of problem solutions, as well as in tasks that embed novel phrases within reading passages (Rawson & Touron, 2009). In each case, older adults continue to 'compute' after the material is memorized, such as by continuing to calculate known answers to the equations, or continuing to rely on initial but incorrect interpretations of the novel phrases.

To illustrate these patterns, Figure 1 compares changes in memory test accuracy (right panel) with changes in memory retrieval use (left panel) over training in the noun-pair task. Memory tests present the target noun-pair but no lookup table, so participants are required to use the memory retrieval strategy. Older and younger adults are equivalent in test accuracy after 35 repetitions of each noun-pair, but older adults are less likely to use retrieval throughout the task (Touron & Hertzog, 2004b).

This distinction between older adults' memory ability and memory strategy use is also apparent when examining strategy use across trials for specific noun-pairs. Following the accurate retrieval of a pair in a memory test, older adults are more likely to revert to using the scanning strategy for that pair. Separate research required participants to first pre-learn noun pair matches to a criterion, and older adults were particularly likely to revert back to scanning when the task began (Touron & Hertzog, 2004b). These findings demonstrate that older adults do not use memory retrieval even after they can retrieve successfully, and indicate that older adults are reluctant to use the memory retrieval strategy. Following the earlier driving example, this would be similar to an older adult continuing to rely on a map or GPS after having traveled a route many times and knowing it well. What factors might lead to such a choice?

Even more compelling evidence for the claim that older adults are *choosing* effortful strategies over retrieving comes from studies that test the flexibility of older adults' strategic behavior. Simple interventions can reduce age differences in memory use. When older adults are offered a modest cash incentive to retrieve in the noun pair task, they do so considerably more often compared to those given standard task instructions or only instructions to retrieve (see Figure 2; Touron, Swaim, & Hertzog, 2007). In a separate study using a computation task, older adults used memory more often with modest incentives as well as with retrieval instructions (Touron & Hertzog, 2009). Older adults can promptly increase their memory use when they are motivated to do so, underscoring that strategy use reflects choice rather than just ability. Thinking back to our driving example, an older adult who used a GPS for well-learned routes might rely on memory instead if a per-use fee were instated by their GPS. We might ask, then, what perceived toll do older adults avoid paying when they are reluctant to rely on their memories?

Task and strategy mental model

Given that older adults' strategy transitions involve choice, what factors might these choices take into account? Decisions about whether (or not) to shift strategy from an initial strategy to memory retrieval should reflect a participant's understanding of the relative costs and benefits of these strategies.

Strategies often differ in their level of accuracy and efficiency, as well as expended effort. Strategy shift might be costly if the required effort to memorize is substantial or if accuracy suffers. The primary benefit of strategy shift is improved efficiency. Expectations about the relative effortfulness, efficiency, and effectiveness of available strategies are elements of the mental model one has for the task. This mental model is constructed during the task instructions, but also updated with task experience. Critically, optimal strategy choices depend on having developed an accurate mental task model. That is, the person must understand the strategies' costs and benefits to have a good mental model of the task.

For the noun pair task, a correct mental task model includes realizing that memory retrieval is considerably more efficient than scanning and that memory retrieval is similarly accurate to scanning after moderate training. Expended effort is more difficult to objectively measure, but should also play a role in strategy choice. In the driving example, one's mental model would include how much time it takes to input their destination versus proceeding without the GPS, how well they already know the route, and how effortful the drive would be while using the GPS versus their memory. I will discuss how the mental task model contributes to older adults' memory avoidance by considering each of these elements (effort, efficiency, and accuracy) in turn.

First, manipulating the relative *effort* required by the available strategies alters older adults' strategy choices (Touron & Hertzog, 2004a). Memory retrieval is chosen more often by older adults when the set of noun-pairs to be memorized is smaller, and less often with the memory set is larger. Likewise, older adults choose memory retrieval more often when the set of pairs to be scanned (i.e., the lookup table) is larger and less often with the scan set is smaller. Young adults are less affected by the size of memory or scan set. Self-rated effort

also relates to strategy choice. Older adults tend to judge memorization to be more effortful compared to young adults' ratings, even with manipulations (such as pre-learning of noun-pairs) that improve or equate older and younger adults' speed and accuracy of memory use (Touron & Hertzog, 2004b).

Second, older adults use memory more frequently when they are more aware of the *efficiency* (speed of responding) advantage it offers relative to the scanning strategy. This awareness is indexed by the difference between individuals' response time estimates for scanning versus memory retrieval. Failures in the estimation of response times, both for specific trials and when aggregating by strategy, are more pronounced for older adults compared to younger adults. Providing feedback on relative efficiency of the available strategies increases retrieval use by older adults, and more so than by young (Hines, Touron, & Hertzog, 2007). However, providing response time feedback for specific trials does not increase older adults' retrieval use. This suggests that the aggregation of efficiency information into a coherent and correct mental model is impaired with aging (e.g., Touron & Hertzog, 2014).

Third, highlighting that the memory retrieval strategy is as *accurate* as alternative strategies increases older adults' use of memory retrieval. Older adults tend to focus on their accuracy rather than speed in cognitive tasks (Hertzog et al. 1993; Ratcliff et al., 2000; Strayer & Kramer, 1994). Older adults who complete memory tests embedded in the noun-pair task (with no lookup table) use retrieval more frequently on the regular trials (that do include the lookup table). Young adults do not retrieve more when memory tests are taken. As noted earlier, older adults are quite successful in these memory tests, demonstrating higher memory ability compared to their memory strategy use. Apparently, successful memory tests are more salient to older adults than successful retrievals in regular trials, and this enables them to form a better model of retrieval accuracy than they create without tests.

These outcomes implicate memory confidence as a factor in older adults' memory strategy use. Older adults' general rating of memory confidence for the task does correlate with their use of the memory strategy (Touron, Swaim, & Hertzog, 2007; see Lineweaver & Hertzog, 1988, for more general information about aging and memory self-efficacy). Memory confidence can also be examined in detail by using confidence reports that vary in their type and timing. When participants make confidence judgments after memory tests, older adults report lower confidence compared to young. Older adults (but not younger adults) with lower post-test confidence also retrieve less often (Hertzog & Touron, 2011). Another type of confidence judgment derives from the source-activation confusion model (Reder & Ritter, 1992), which posits that strategy selection is driven by an immediate feeling-of-knowing (FOK) when presented with a stimulus. We compared these fast FOKs to a fast strategy choice (reports of high versus low FOK, versus a decision to retrieve or scan on the trial). Older adults' FOKs were high and equivalent to young adult FOKs. However, older adults chose retrieval less often (Hertzog & Touron, 2011). Older adults' FOKs were also less correlated with retrieval use compared to the relationship for young adults. Taken together, these patterns suggest that older adults' avoidance of memory strategies reflect a general lack of memory confidence rather than just specific experience and ability.

All older adults do not show the same degree of memory avoidance, however (Rogers, Hertzog, & Fisk, 2000). In most of our studies, a few older adults use retrieval quite often (and comparable to the typical young adult sample, which is more homogeneous), while many older adults use retrieval a moderate amount and some older adults completely avoid retrieval. To understand these distinct patterns, we conducted an individual differences study that included no manipulations known to increase retrieval strategy use (such as memory tests; Touron & Hertzog, 2006). In this study, a third of the older adults were profoundly memory avoidant with no memory use whatsoever. These participants demonstrated the most errant mental models for the strategies, and also had lower memory self-concept. Using our driving example, older adults should be most likely to regularly rely on maps or GPS for well-learned routes if they don't accurately judge the time and effort it costs them and the true level of their knowledge, or if they have general concerns about their memory ability.

Strategic set and consistency

Older adults' strategy choices might also reflect a preference for adopting a consistent strategic set rather than varying multiple strategic sets across trials. Older adults show less variability in strategy use compared to younger adults. They apparently prefer to shift strategy holistically after they memorize an entire set of items, rather than shifting to retrieval for each item individually following learning (Touron, 2006).

Although older adults persist in using scanning even after having pre-learned the noun-pairs, as described above, a follow-up study with more extensive pre-learning eliminated the age difference in strategy choice (Hines, Hertzog, & Touron, 2012). Critically, however, older adults still showed a bias toward scanning when *only half* of the pairs in the task were extensively pre-learned. Older adults apparently adopted an overall strategic set of scanning despite the fact that only some of the pairs required scanning, again supporting the interpretation that strategy choice rather than just the degree of learning drives strategy use.

This bias might indicate a behavioral inertia, where older adults are unwilling to deviate from a strategy that has built up a habitual pattern of response. Older adults tend to overuse external task cues and support, such as the noun-pair lookup table, even after they become irrelevant (Spieler, Mayr, & LaGrone, Lindenberger & Mayr, 2014). Failure to shift might be seen as a reasonable compensatory response to declines in task-switching ability (see Mayr, 2001; Terry & Sliwinski, 2012). However, the bias toward a consistent strategy set seems exclusive to switches to a memory strategy. When participants perform a task involving shift to a strategy not based on memory, older adults can be even *more* likely to make strategy transitions than younger adults (Frank, Touron, & Hertzog, 2012). It appears that older adults are specifically biased against using memory strategies, rather than having a more general bias against strategy shift.

Avoidance of memory might be most likely in tasks that involve an overt distinction between strategies. When using memory in reading comprehension (Rawson & Touron, 2009), older adults were able to completely overcome their bias against the retrieval of newly adopted but non-intuitive interpretations of noun-noun combinations (such as bee-caterpillar), in contrast to their more perseverant memory avoidance in other tasks. A critical

distinction here is that interpretation in reading proceeds more automatically and therefore might less likely to engage top-down strategy mechanisms.

Memory avoidance outside the laboratory

Memory avoidance could have important implications for older adults' strategy use and functioning in everyday life. Everyday tasks are quite varied and reasonably demand different levels and types of strategic ability and choice. The real world, also, might not offer helpful prompts to use more effective memory retrieval or encouraging feedback.

We have examined older adults' memory avoidance in everyday tasks using a daily diary approach (Frank, Touron, & Browne, 2013). Participants reported their performance of and strategic approach to twelve everyday tasks in domains such as technology, way-finding, and cooking. Older adults used memory strategies less often for frequently-performed tasks compared to younger adults. Those who reported more everyday memory failures were particularly unlikely to use retrieval. On the other hand, those who utilize internal mnemonics in everyday life reported using retrieval more often. Such everyday failures and successes might drive or otherwise relate to individuals' overall level of memory confidence. This outlook might help to explain the three categories of older adult memory users (avoidant, moderate, and confident) found in our experiments. That is, we may be seeing through the diaries how everyday experiences determine participants' memory confidence and then rates of memory use in the laboratory. Perhaps, in some cases, these life experiences do provide feedback and incentives similar to the manipulations that impact memory use in our tasks.

Potential consequences on late life functioning and well-being

Older adults' avoidance of memory retrieval could be problematic for several reasons. First, memory use might provide cognitive exercise that bolsters memory ability. Second, memory use and success might improve older adults' memory self-concept. Third, memory use might allow older adults to engage in activities that memory avoidance would discourage. For example, profoundly memory avoidant older adults might avoid social situations in which they have to remember names. Given the importance of social networks to trajectories of cognitive aging, such possible consequences should be explored further.

In closing, we should emphasize that we do not discount the existence of age-related declines in associative memory and their role in slowing the shift to memory strategies. However, it is critical to separate cognitive declines from age differences in cognitive strategy use when assessing age differences in cognitive performance, particularly when differences in strategic approach are maladaptive and may be easily remedied. Cognitive aging researchers should continue to establish the impact of memory avoidance on older adults' cognitive task performance and everyday functioning and well-being, and extend laboratory interventions toward real-world applications.

Acknowledgements

This research was supported by a National Institute on Aging grant, NIA R01 AG024485. The author would like to extend particular gratitude to Christopher Hertzog, Georgia Institute of Technology, who collaborated substantially

in this program of research. Thanks go also to my student collaborators, including Jarrod Hines, Elizabeth Swaim, Matthew Meier, Beatrice Kuhlmann, David Frank, and Megan Jordano.

References

- Frank, DJ.; Touron, DR.; Browne, KP. Are older adults retrieval reluctant in everyday tasks? A daily diary study. Paper presented at the Metacognitive Self-Regulation Symposium at the 2013 Southeastern Psychological Association Conference; Atlanta, GA. Mar. 2013
- Frank DF, Touron DR, Hertzog C. Age differences in strategy shift: Retrieval avoidance or general shift reluctance? *Psychology and Aging*. 2013; 28:778–788. [PubMed: 23088195]
- Hertzog, C.; Touron, DR. Aging and individual differences in algorithm to retrieval shift with practice. Poster presented at the 2006 Cognitive Aging Conference; Atlanta, GA. Apr. 2006
- Hertzog C, Touron DR. Age differences in memory retrieval shift: Governed by feeling-of-knowing? *Psychology and Aging*. 2011; 26:647–660. [PubMed: 21401263]
- Hertzog C, Touron DR, Hines J. Does a time monitoring deficit influence older adults' delayed retrieval shift during skill acquisition? *Psychology and Aging*. 2007; 22:607–624. [PubMed: 17874958]
- Hertzog C, Vernon MC, Rypma B. Age differences in mental rotation task performance: The influence of speed/accuracy tradeoffs. *Journals of Gerontology*. 1993; 48:150–156.
- Hines J, Hertzog C, Touron DR. A prelearning manipulation falsifies a pure associational deficit account of retrieval shift during skill acquisition. *Aging Neuropsychology and Cognition*. 2012; 19:449–478.
- Jenkins L, Hoyer WJ. Instance-based automaticity and aging: Acquisition, reacquisition, and long-term retention. *Psychology and Aging*. 2000; 15:551–565. [PubMed: 11014717]
- Kausler, DH. *Learning and memory in normal aging*. Academic Press; San Diego, CA: 1994.
- Lineweaver TT, Hertzog C. Adults' efficacy and control beliefs regarding memory and aging: Separating general from personal beliefs. *Aging, Neuropsychology, & Cognition*. 1998; 5:264–296.
- Logan GD. Toward an instance theory of automatization. *Psychological Review*. 1988; 95:492–527.
- Mayr U. Age differences in the selection of mental sets: The role of inhibition, stimulus ambiguity, and response-set overlap. *Psychology and Aging*. 2001; 16:96–109. [PubMed: 11302371]
- Naveh-Benjamin M. Adult age differences in memory performance: Tests of an associative deficit hypothesis. *Journal of Experimental Psychology: Learning, Memory, & Cognition*. 2000; 26:1170–1187.
- Ratcliff R, Spieler D, McKoon G. Explicitly modeling the effects of aging on response time. *Psychonomic Bulletin & Review*. 2000; 7:1–25. [PubMed: 10780018]
- Rawson KA, Touron DR. Age-related differences in practice effects during reading comprehension: Older adults are slower to shift from computation to retrieval. *Psychology and Aging*. 2009; 24:423–437. [PubMed: 19485659]
- Reder M, Ritter FE. What determines initial feeling of knowing? Familiarity with question terms, not with the answer. *Journal of Experimental Psychology: Learning, Memory, and Cognition*. 1992; 18:435–451.
- Rickard TC. Bending the power law: A CMPL theory of strategy shifts and the automatization of cognitive skills. *Journal of Experimental Psychology: General*. 1997; 126:288–310.
- Rogers WA, Hertzog C, Fisk AD. An individual differences analysis of ability and strategy influences: Age-related differences in associative learning. *Journal of Experimental Psychology: Learning, Memory, and Cognition*. 2000; 26:359–394.
- Spieler DH, Mayr U, LaGrone S. Outsourcing cognitive control to the environment: Adult age differences in the use of task cues. *Psychonomic Bulletin & Review*. 2006; 13:787–793. [PubMed: 17328374]
- Strayer DL, Kramer AF. Aging and skill acquisition: Learning-performance distinctions. *Psychology and Aging*. 1994; 9:589–605. [PubMed: 7893430]
- Terry CP, Sliwinski MJ. Aging and random task switching: The role of endogenous versus exogenous task selection. *Experimental Aging Research*. 2012; 38:87–109. [PubMed: 2224951]

- Touron DR. Are item-level strategy shifts abrupt and collective? Age differences in cognitive skill acquisition. *Psychonomic Bulletin & Review*. 2006; 13:781–786. [PubMed: 17328373]
- Touron DR, Hertzog C. Distinguishing age differences in knowledge, strategy use, and confidence during strategic skill acquisition. *Psychology and Aging*. 2004a; 19:452–466. [PubMed: 15382996]
- Touron DR, Hertzog C. Strategy shift affordance and strategy choice in young and older adults. *Memory & Cognition*. 2004b; 32:298–310. [PubMed: 15190721]
- Touron DR, Hertzog C. Age differences in strategic behavior during a computation-based skill acquisition task. *Psychology and Aging*. 2009; 24:574–585. [PubMed: 19739913]
- Touron DR, Hertzog C. Accuracy and speed feedback: Global and local effects on strategy use. *Experimental Aging Research*. 2014; 40:32–356.
- Touron DR, Hertzog C, Frank D. Eye movements and strategy shift in skill acquisition: Adult age differences. *Journal of Gerontology: Psychological and Social Sciences*. 2011; 62B:151–159.
- Touron DR, Hoyer WJ, Cerella J. Cognitive skill acquisition and transfer in younger and older adults. *Psychology and Aging*. 2001; 16:555–563. [PubMed: 11766911]
- Touron DR, Hoyer WJ, Cerella J. Age-related differences in the component processes of cognitive skill learning. *Psychology and Aging*. 2004; 19:565–580. [PubMed: 15584783]
- Touron DR, Swaim E, Hertzog C. Moderation of older adults' retrieval reluctance through task instructions and monetary incentives. *Journal of Gerontology: Psychological Sciences*. 2007; 62B: 149–155.

Recommended readings

- Craik, F.I.M., & Salthouse, T.A. (2008). The handbook of aging and cognition (3rd ed.). Mahwah, NJ: Erlbaum. A general overview of current research in cognitive aging
- Lemaire, P. (2010). Cognitive strategy variations during aging. *Current Directions in Psychological Science*, 19(6), 363–369. A general overview of strategies and aging
- Mata, R., Schooler, L. J., & Rieskamp, J. (2007). The aging decision maker: Cognitive aging and the adaptive selection of decision strategies. *Psychology and Aging*, 22(4), 796–810. An examination of age differences in decision strategies.
- Old, S. R., & Naveh-Benjamin, M. M. (2008). Differential effects of age on item and associative measures of memory: A meta-analysis. *Psychology And Aging*, 23104–118. A meta-analysis of age differences in item and associative memory
- Schaie, K., & Willis, S. L. (2011). *Handbook of the psychology of aging* (7th ed.). San Diego, CA, US: Elsevier Academic Press. An comprehensive overview of research and theory in the study of aging.

Figure 1.

Data from Touron and Hertzog, 2004b. The panel on the left shows increases in retrieval use over training with repetition of noun-pair items for younger adults (black) and older adults (red). Retrieval use is plotted by experiment manipulations distinguishing between-subject conditions with or without memory tests, and for the condition with memory tests, tested versus untested noun-pairs (within-subject). The inclusion of memory tests increased retrieval use for both the tested and untested pairs, implicating a general benefit such as increased memory confidence rather than a specific benefit such as additional practice. Retrieval use did not differ for tested versus untested items, underscoring that strategy selection is determined by choice factors rather than exclusively by memory strength. The panel on the right shows memory test performance for the tested noun-pairs in the condition that completed tests.

Figure 2. Data from Touron, Swaim, and Hertzog, 2007, with increases in memory retrieval use plotted over training with repetition of noun-pairs for younger adults (black) and older adults (red). We separate retrieval use by between-subjects conditions that provided either standard task instructions, instructions that the memory strategy is preferred, or instructions that the memory strategy is preferred coupled with modest monetary incentives to use memory.