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BRIEF REPORT

Specific- and Partial-Source Memory: Effects of Aging

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Normal aging can be associated with impairments in *source memory* (recollecting an event's context). This study examined the effects of aging on *specific*-source memory (e.g., remembering which of 4 people spoke a word) and *partial*-source memory (e.g., remembering the gender of the person who spoke the word). When young and older adults were matched in terms of old–new recognition, age-related deficits were observed on both specific- and partial-source recollection. When the groups were matched on partial-source performance, no disproportionate specific-source impairment was seen. The results suggest that aging does not differentially affect specific- versus partial-source memory.

There has been considerable interest amongst memory researchers in characterizing the nature of the memory impairments associated with normal aging. Whereas evidence suggests that various aspects of memory decline with increasing age, it has become clear that some features of memory can be affected more than others. One area that has received particular attention is memory for contextual details, such as the source of remembered information (e.g., Ferguson, Hashtroudi, & Johnson, 1992; Glisky, Polster, & Routhieaux, 1995; Glisky, Rubin, & Davidson, 2001; Henkel, Johnson, & De Leonardis, 1998; Johnson, De Leonardis, Hashtroudi, & Ferguson, 1995; McIntyre & Craik, 1987; Multhaup & Balota, 1997; Schacter, Kaszniak, Kihlstrom, & Valdiserri, 1991; Schacter, Osowiecki, Kaszniak, Kihlstrom, & Valdiserri, 1994).

For example, McIntyre and Craik (1987) reported that older adults had greater difficulty remembering the source of trivia facts than did younger adults. The older adults were also impaired at remembering the facts themselves, however, making it difficult to determine whether source memory was disproportionately affected by aging. This issue was addressed by Schacter et al. (1991), who found that when older adults listened to different speakers who were reading out statements in blocks, their later memory for the source of the statements was disproportionately impaired relative to memory for the statements themselves. This result has since been replicated in numerous subsequent studies, which have sought to understand the factors and conditions that might play a significant role in the source memory difficulties often experienced by older adults (Ferguson et al., 1992; Glisky et al., 1995, 2001; Henkel et al., 1998; Mitchell, Johnson, Raye, Mather, & D'Esposito, 2000; Rahhal, May, & Hasher, 2002; Schacter et al., 1994).

Although many studies of source memory concentrate on instances in which people remember the precise source of a word or fact, it is evident that recollection can often vary in specificity, with some events remembered vividly and others more vaguely (Dodson, Holland, & Shimamura, 1998; Johnson, Hashtroudi, & Lindsay, 1993). In situations where the specific source cannot be recollected, it might be possible that other contextual details surrounding the event could be diagnostic of the source. For example, when attempting to remember which of two people told you a particular story, you might have a specific memory of the person reciting the story to you or, alternatively, you may remember sufficient social category information about the person (e.g., gender, race, age) to guide recollective strategies in differentiating him or her from the alternatives (Allport, 1954; Macrae & Bodenhausen, 2000; Srull & Wyer, 1989). In many situations, such partial recollection of contextual details will be sufficient to identify the specific source of the story.

Little work has been undertaken to examine whether, in the absence of specific-source information, older adults might remember partial categorical information about the source of a piece of information. One line of relevant evidence suggests that older adults are affected more than younger adults by manipulating the similarity of possible sources (Bayen & Murnane, 1996; Ferguson et al., 1992; Johnson et al., 1995). This might imply that older

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adults are relatively spared at recollecting partial-source information, or it may be simply that greater source similarity leads to interference between memory representations, exacerbating a general source deficit in older adults. The main aim of the present experiment, therefore, is to investigate whether partial-source recollection is affected by aging in a similar manner to specific-source recollection. Using a procedure developed by Dodson, Holland, and Shimamura (1998) for separately measuring the different contributions of specific- and partial-source information to recollective memory, we assessed the ability of younger and older adults to remember the source of spoken sentences in circumstances in which memory was equated for the sentences themselves. Additionally, a separate group of older adults were permitted multiple study exposures to the sentences, equating their partial-source recollection performance with the younger adults and allowing the question to be addressed as to whether aging disproportionately affects specific- versus partial-source memory. If this is the case, then it would suggest that older adults are able to integrate some aspects of context in a bound mnemonic representation, even if not sufficiently to permit discrimination of the specific source. If aging impairs both kinds of source memory similarly, however, then it might be that the processes supporting encoding and/or retrieval of contextual representations are reduced to such an extent that discrimination between categories such as gender, or indeed between individual sources, may be hindered.

Method

Participants

Twenty younger adults (9 men, 11 women, mean age = 20.2 years, range = 18–23, mean education = 14.2 years) were recruited for participation through sign-up sheets at Harvard University and were screened for depression and use of psychoactive medication. In addition, two groups of 20 older adults (Group 1: 7 men, 13 women, mean age = 69.5 years, range = 60–76, mean education = 16.8 years; Group 2: 5 men, 15 women, mean age = 70.0 years, range = 60–79, mean education = 15.8 years) were recruited through flyers and newspaper advertisements and were screened for history of alcoholism or substance abuse, treatment for psychiatric illness or degenerative brain disorders, cerebrovascular accident, or recent myocardial infarction. The mean education level of the older adults was significantly greater than that of the younger adults, $F(2, 57) = 6.4$, $p < .005$, precluding an explanation of any putative age-related memory deficits as attributable to level of education. All participants were paid for their involvement.

Procedure

The stimuli consisted of 175 "trivia" sentences, taken from Begg, Anas, and Farinacci (1992) and Law, Hawkins, and Craik (1998), which were designed such that participants would be unlikely to know whether they were true or false (e.g., "Al Capone's business card said he was a used furniture dealer."). Digital recordings were made of 4 speakers, 2 male and 2 female, reading out each of the 175 sentences. The recordings were then edited so that they were approximately matched for amplitude and length. The sentences were divided into 5 sets of 35 items, with the use of the sets counterbalanced so that each set was spoken by each of the 4 speakers and also appeared as new items in the forced-choice test of source memory.

In the study phase, the younger adults and the first group of older adults viewed and heard 140 sentences once each in a pseudorandom order, with 35 spoken by each speaker. The second group of older adults viewed and heard the 140 sentences in 3 repeated study phases, with identical source–sentence pairings but a different pseudorandom sentence order on each occasion. For all groups, no more than 4 consecutive sentences were read by any one speaker. Each sentence was simultaneously heard through headphones and viewed on the monitor screen accompanied by a color photograph of the head and shoulders of the speaker. The 4 speakers were chosen to have clear but not overly distinctive voices, and the photographs corresponding to each speaker were chosen to be fairly similar to each other, with regular hairstyles, few distinguishing facial features, and comparable styles of clothing. Participants were asked to listen carefully to each of the sentences that would follow, paying attention to the intonation and nuances in the speaker's voice, and to try to judge for each sentence whether or not the speaker believed that the sentence was true. No mention was made of a later memory test. Each sentence lasted approximately 4 s, after which the screen went blank. Participants had as long as they wanted to make their judgment, which they indicated by pressing 1 of 2 keys on the computer keyboard.

Following the study phase, participants were given a surprise memory test. One hundred seventy-five sentences were presented on the monitor screen, consisting of the 140 previously studied items randomly intermixed with 35 new items. The sentences were presented on the monitor screen along with color photographs of the 4 speakers. The positions of the speaker photographs in the array were counterbalanced across trials. Participants were told that the test would contain some old sentences, which they had heard earlier, and some new sentences, which they would not have heard earlier. If the participants thought a particular sentence was old, then they were asked to press the keys 1–4 corresponding to the position in the photograph array of the person that they thought spoke the sentence. If they thought a sentence was new, then they were instructed to press the zero key, which was labeled *new*. As in the study phase, there was no time pressure on participants to make their decision.

Results

Response frequencies were recorded for each of 25 cells: 5 possible sources (Male 1, Male 2, Female 1, Female 2, or New) multiplied by 5 possible responses ("Male 1," "Male 2," "Female 1," "Female 2," or "New"). Table 1 shows the aggregated response frequencies for each of the cells generated by the young and older adults. The results were first analyzed using standard methods and then with a multinomial model.

We first examined the comparison between the younger adults and the older adults who had been permitted one study exposure to each sentence. In Table 2, the old–new recognition performance of the young and older adults are presented, expressed as mean (and standard deviation) d' measures, calculated using the correction recommended by Snodgrass and Corwin (1988). As can be seen from Table 2, the groups were equated on old–new recognition, with no significant difference in the ability to distinguish studied sentences from those that were new, $F(1, 38) = 0.06$, *ns*.

The ability of participants to identify the correct source of previously studied sentences was assessed using an average conditional source score, which measures correct source attributions for all items identified as present at study (Murnane & Bayen, 1996). Table 2 shows that although performance of the older adults was significantly above chance level (0.25), $F(1, 38) = 17.5$, $p < .001$, they attributed significantly fewer sentences to the correct source than did the younger adults, $F(1, 38) = 18.7$, $p < .001$. The utilization of partial-source information was defined, in the same way as in Dodson, Holland, and Shimamura's (1998) previous experiments, as the probability of correctly identifying the gender of the speaker of a studied item when participants selected the incorrect source. As such, this measure assesses how much more

Table 1
Response Frequencies of the Younger and Older Adult Groups

Source	Response				
	"Male 1"	"Male 2"	"Female 1"	"Female 2"	"New"
Younger adults: 1 study exposure					
Male 1	308	156	60	67	109
Male 2	142	300	67	73	118
Female 1	42	64	332	160	102
Female 2	60	58	173	285	124
New	8	9	4	4	675
Older adults: 1 study exposure					
Male 1	188	187	100	109	116
Male 2	168	202	107	110	113
Female 1	93	116	204	172	115
Female 2	114	109	141	227	109
New	6	5	9	6	674
Older adults: 3 study exposures					
Male 1	323	226	57	86	8
Male 2	146	372	63	98	21
Female 1	51	92	370	173	14
Female 2	54	93	208	333	12
New	2	1	2	0	695

likely participants are to select the correct gender than the incorrect gender, a score of zero indicating that participants are at chance at choosing a response from the correct gender when they cannot remember the speaker. As can be seen in Table 2, the older adults performed significantly above chance, $F(1, 38) = 28.8$, $p < .001$, but were less likely than younger adults to use partial-source information when their specific-source attribution was incorrect, $F(1, 38) = 17.5$, $p < .001$.

Further analyses of performance on the source memory task were undertaken using a two-high threshold partial-source multinomial model based on the model previously used by Dodson, Holland, and Shimamura (1998), which provides parameter estimates for old–new item detection, specific-source discrimination, and partial-source discrimination. The principal advantage of multinomial models over standard measures is that they allow the separate evaluation of the different underlying factors contributing to task performance: namely, memory processes and various types of response bias (Batchelder & Riefer, 1999). Table 3 presents the parameter estimates for each of the factors contained in the model. The log-likelihood statistic, G^2 (Riefer & Batchelder, 1988), was used to measure the fit of the model to the data, with a low value of G^2 relative to the available degrees of freedom indicating that the model fits the data well. The partial-source model provided good fits to data sets from both age groups: young, $G^2(14) = 14.4$, $p = .42$; older, $G^2(14) = 15.1$, $p = .37$.

The same statistic was also used to compare the performance of the young and older groups, with a significantly high value of G^2 in this situation indicating that performance of the two groups differed significantly on the parameter under test (Dodson, Prinzmetal, & Shimamura, 1998). Looking first at old–new item detection, the model analyses confirmed that the young (parameter $D = 0.80$) and older ($D = 0.80$) groups were alike in their ability to distinguish old from new sentences, $G^2(1) = 0.01$, $p = .92$. The results of the average conditional source analyses were also confirmed using the multinomial model. With respect to specific-source discrimination, the older adults ($d = 0.07$) were signifi-

Table 2
Performance of the Younger and Older Adults on Old–New Recognition (Expressed as d′ *Measures) and Specific and Partial Source (Expressed as Average Conditional Source Scores)*

Group	Old–New recognition		Specific source		Partial source	
	M	*SD*	*M*	*SD*	*M*	*SD*
Younger adults						
1 study exposure	3.25	1.10	0.51	0.13	0.34	0.13
Older adults						
1 study exposure	3.16	1.07	0.35	0.11	0.16	0.15
3 study exposures	4.77	0.72	0.51	0.22	0.39	0.28

Table 3
Parameter Estimates for the Younger and Older Adults

Parameter	Source			
	Male 1	Male 2	Female 1	Female 1
Younger adults: 1 study exposure				
D	0.80	0.80	0.80	0.80
d	0.27	0.27	0.27	0.27
P	0.47	0.47	0.47	0.47
a	0.31	0.31	0.29	0.29
g	0.34	0.34	0.16	0.16
b	0.18			
Older adults: 1 study exposure				
D	0.80	0.80	0.80	0.80
d	0.07	0.07	0.07	0.07
P	0.23	0.23	0.23	0.23
a	0.26	0.26	0.25	0.25
g	0.21	0.21	0.29	0.29
b	0.19			
Older adults: 3 study exposures				
D	0.97	0.97	0.97	0.97
d	0.24	0.24	0.24	0.24
P	0.44	0.44	0.44	0.44
a	0.19	0.30	0.26	0.26
g	0.29	0.21	0.29	0.21
b	0.30			

Note. D = probability of correct item detection; d = probability of discriminating the correct speaker; P = probability of discriminating the correct gender; a = probability of guessing correct speaker of a detected item; g = probability of guessing correct speaker of an undetected item; b = probability of guessing item is old.

cantly less able to discriminate between the specific sources than the younger adults ($d = 0.27$), $G^2(1) = 59.8$, $p < .001$. Similarly, the recollection of partial-source information was significantly reduced in the older adults ($P = 0.23$) compared with the younger adults ($P = 0.47$), $G^2(1) = 41.3$, $p < .001$.

Turning to comparison of the younger adults and the older adults who had been permitted three study exposures to each sentence, inspection of the aggregated response frequencies in Table 1 suggests that performance of the older adults benefited from the opportunity to study the sentences repeatedly. The results of standard d' and average conditional-source measures confirm this (see Table 2), with old–new recognition even superior to that achieved by the younger adults with one study exposure, $F(1, 38) = 26.5$, $p < .001$. Table 2 shows that the ability of the older adults to attribute sentences to the correct source was also improved, such that there was no significant impairment relative to the younger adults, $F(1, 38) = 0.0$, *ns*. Similarly, performance of the older adults at partial-source recollection also improved from the level achieved with one study exposure. This improvement meant that, just as with specific-source memory, there was no difference in partial-source between the older adults and the younger adults, $F(1, 38) = 0.44$, *ns*.

Further analyses of performance were carried out using the partial-source multinomial model. Perhaps because recognition performance was so close to ceiling level, the model did not provide a satisfactory fit to the data from the older adults with three study exposures, $G^2(13) = 29.4$, $p < .01$. Bearing this caveat in mind, the results from the model were consistent with those from the standard analyses. As can be seen from the parameter estimates presented in Table 3, old–new item detection ($D = 0.97$) was significantly greater than that achieved with only one study exposure by both the older adults, $G^2(1) = 118.0$, $p < .001$, and the younger adults, $G^2(1) = 172.3$, $p < .001$. Specific-source discrimination of the older adults ($d = 0.24$) was significantly better as a result of multiple study exposures, $G^2(1) = 58.2$, $p < .001$, and had improved to the extent that a significant impairment no longer remained relative to the younger adults, $G^2(1) < 1$, *ns*. Partial-source recollection by the older adults ($P = 0.44$) also improved relative to the single-exposure older adult group, $G^2(1) = 36.7$, $p < .001$, resulting in performance that was statistically indistinguishable from the younger adults, $G^2(1) = 1.02$, *ns*.

Discussion

In the present experiment, using a paradigm in which young and older adults performed equivalently in terms of old–new recognition, significant age-related deficits were observed both in discriminating the specific speaker of a sentence and, if this was unsuccessful, in identifying the gender of the speaker. When older adults were permitted to study each sentence on three occasions, their partial-source recollection improved to the level achieved by the younger adults with one study exposure. Addressing whether a disproportionate impairment in specific-source memory would be evident in such circumstances, results of the analyses using both standard average conditional source and multinomial model measures indicated no difference in specific-source recollection between the younger and older adults.

The impairment in both kinds of source memory observed when older adults were given the same opportunity to study the sentences as younger adults is consistent with previous evidence that source memory is typically disproportionately impaired in aging relative to item memory (Ferguson et al., 1992; Johnson et al., 1995; Schacter et al., 1991, 1994). The multinomial modeling analyses confirm that even when the contributions of old–new recognition and guessing are taken into account, a significant age-related deficit in source memory remains (see also Bayen & Murnane, 1996). In addition to difficulty remembering the specific person who had read out a sentence to them, older adults were also significantly less likely than younger adults to remember the speaker's gender. This finding suggests that older adults have greater difficulty than younger individuals remembering partial categorical details about a source as well as recollecting the source specifically.

These results are consistent with previous studies that have examined the influence of categorical information on source memory in aging. For example, Kausler and Puckett (1981) found that older adults were impaired relative to younger adults when asked to remember the gender of speakers, although item memory for the statements read to older participants was also impaired in this study, making it difficult to ascertain whether the gender memory deficit was disproportionate. Young and older adults performed similarly on item memory in the study by Rahhal et al. (2002), and yet an age-related impairment was observed in recollection of gender information as opposed to other contextual details which, it

was suggested, might be more salient to older adults, such as truth and character. The four speakers used in the present experiments were all younger adults, categorical details of whom might be less salient to older adults than to those in the younger adult group, particularly as the sources were selected to differ little on other factors such as voice tone, hair style, hair color, clothing, and so forth. The speakers might have appeared to the older adults to be more similar to each other than to the younger adult group, meaning that differences between the speakers would be less apparent, and the ability to discriminate between sources at the recollection stage would be reduced.

Evidence from Ferguson et al. (1992) is consistent with the suggestion that perceived similarity of sources may be important. These authors compared source memory performance in conditions where the two possible sources were either both female, with similar voices and style and color of dress, or were of different genders, with different physical appearances, voice tones, and differently colored clothing. Ferguson et al. found that when the two sources were similar, older adults were significantly impaired at source memory, but that when the sources were highly dissimilar, there was no age deficit relative to younger adults (see also Bayen & Murnane, 1996; Johnson et al., 1995). These results suggest that when potential sources differ on multiple factors, such as gender, voice tone, clothing color and style, and so forth, older adults might be able to draw on the salient categorical differences between them to encode and retrieve contextual information that is sufficiently distinctive to allow successful discrimination between alternatives on a later test of source memory. If, however, as in the present experiments, male and female sources are selected to be matched on factors such as voice tone, hair style and coloring, and clothing, contextual representations available to older adults may overlap to such an extent that they cannot later be distinguished as effectively, particularly if the remaining differences between sources are of less salience to the older adults.

When older adults were permitted a greater number of exposures to the sentences during the study phase, their partial- and specific-source memory improved to levels where they were statistically no different to the level of performance achieved by younger adults. It could be, therefore, that the older adults were impaired at encoding, or alternatively that they encoded the content and context details adequately but used them less effectively in making retrieval decisions. Evidence from Koutstaal (2003) is consistent with the latter possibility, with older adults showing impairment in intentional but not incidental retrieval of specific perceptual details. These data suggest that when older adults in the present experiment were given additional opportunities to attend to and encode the sentences and their associated contextual information, they were able to create bound representations within long-term memory that adequately integrated the content of the sentences and their context, and which were sufficiently differentiable to permit later retrieval of categorical information about the speaker such as gender, as well as precise contextual information identifying them specifically. As such, no disproportionate impairment in specific- as opposed to partial-source memory was observed.

Previous data have suggested that partial- and specific-source recollection about speakers can in some instances be dissociable. In an experiment involving university students, Klauer and Wegener (1998) found that manipulating stimulus presentation time at encoding affected specific- but not partial-source memory. Similarly, Dodson, Holland, and Shimamura (1998) found that dividing younger adults' attention during retrieval reduced their memory for specific-source information but had less of an effect on memory for partial-source details. These results indicate that the recollection of partial- and specific-source information may make different demands on executive processes such as attention, selection, monitoring, and decision making. Evidence suggests that these processes are largely dependent on the integrity of the frontal lobes (e.g., Shallice & Burgess, 1996) and that interactions between frontal and medial temporal lobe regions in particular are crucial for recollection (Aggleton & Brown, 1999; Shimamura, 1995; Simons & Spiers, 2003). Thus, decline in executive function as a result of frontal lobe degeneration is considered particularly important for explaining the source memory impairments associated with aging (Craik & Grady, 2002; Glisky et al., 1995; Schacter et al., 1991). The data from the present experiment are consistent with this view, suggesting that in aging, the availability of executive resources may be reduced to such an extent that older adults are less able to encode or retrieve contextual representations that are sufficiently distinct to allow discrimination between categories such as gender, or indeed between individual sources themselves.

References

Aggleton, J. P., & Brown, M. W. (1999). Episodic memory, amnesia, and the hippocampal-anterior thalamic axis. *Behavioral and Brain Sciences, 22,* 425–489.

Allport, G. W. (1954). *The nature of prejudice*. Reading, MA: Addison Wesley.

Batchelder, W. H., & Riefer, D. M. (1999). Theoretical and empirical review of multinomial process tree modeling. *Psychonomic Bulletin and Review, 6,* 57–86.

Bayen, U. J., & Murnane, K. (1996). Aging and the use of perceptual and temporal information in source memory tasks. *Psychology and Aging, 11,* 293–303.

Begg, I. M., Anas, A., & Farinacci, S. (1992). Dissociation of processes in belief: Source recollection, statement familiarity, and the illusion of truth. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 121,* 446–458.

Craik, F. I. M., & Grady, C. L. (2002). Aging, memory, and frontal lobe functioning. In D. T. Stuss & R. T. Knight (Eds.), *Principles of frontal lobe function* (pp. 528–540). Oxford, United Kingdom: Oxford University Press.

Dodson, C. S., Holland, P. W., & Shimamura, A. P. (1998). On the recollection of specific- and partial-source information. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 24,* 1121–1136.

Dodson, C. S., Prinzmetal, W., & Shimamura, A. P. (1998). Using Excel to estimate parameters from observed data: An example from source memory data. *Behavior Research Methods, Instruments, & Computers, 30,* 517–526.

Ferguson, S. A., Hashtroudi, S., & Johnson, M. K. (1992). Age differences in using source-relevant cues. *Psychology and Aging, 7,* 443–452.

Glisky, E. L., Polster, M. R., & Routhieaux, B. C. (1995). Double dissociation between item and source memory. *Neuropsychology, 9,* 229–235.

Glisky, E. L., Rubin, S. R., & Davidson, P. S. R. (2001). Source memory in older adults: An encoding or retrieval problem? *Journal of Experimental Psychology: Learning, Memory, and Cognition, 27,* 1131–1146.

Henkel, L. A., Johnson, M. K., & De Leonardis, D. M. (1998). Aging and

source monitoring: Cognitive processes and neuropsychological correlates. *Journal of Experimental Psychology: General, 127,* 251–268.

Johnson, M. K., De Leonardis, D. M., Hashtroudi, S., & Ferguson, S. A. (1995). Aging and single versus multiple cues in source monitoring. *Psychology and Aging, 10,* 507–517.

Johnson, M. K., Hashtroudi, S., & Lindsay, D. S. (1993). Source monitoring. *Psychological Bulletin, 114,* 3–28.

Kausler, D. H., & Puckett, J. M. (1981). Adult age differences in memory for sex of voice. *Journal of Gerontology, 36,* 44–50.

Klauer, K. C., & Wegener, I. (1998). Unraveling social categorization in the "Who said what?" paradigm. *Journal of Personality and Social Psychology, 75,* 1155–1178.

Koutstaal, W. (2003). Older adults encode—but do not always use—perceptual details: Intentional versus unintentional effects of detail on memory judgments. *Psychological Science, 14,* 189–193.

Law, S., Hawkins, S. A., & Craik, F. I. M. (1998). Repetition-induced belief in the elderly: Rehabilitating age-related memory deficits. *Journal of Consumer Research, 25,* 91–107.

Macrae, C. N., & Bodenhausen, G. V. (2000). Social cognition: Thinking categorically about others. *Annual Review of Psychology, 51,* 93–120.

McIntyre, J. S., & Craik, F. I. M. (1987). Age differences in memory for item and source information. *Canadian Journal of Psychology, 41,* 175–192.

Mitchell, K. J., Johnson, M. K., Raye, C. L., Mather, M., & D'Esposito, M. (2000). Aging and reflective processes of working memory: Binding and test load deficits. *Psychology and Aging, 15,* 527–541.

Multhaup, K. S., & Balota, D. A. (1997). Generation effects and source memory in healthy older adults and in adults with dementia of the Alzheimer type. *Neuropsychology, 11,* 382–391.

Murnane, K., & Bayen, U. J. (1996). An evaluation of empirical measures of source identification. *Memory and Cognition, 24,* 417–428.

Rahhal, T. A., May, C. P., & Hasher, L. (2002). Truth and character: Sources that older adults can remember. *Psychological Science, 13,* 101–105.

Riefer, D. M., & Batchelder, W. H. (1988). Multinomial modeling and the measurement of cognitive processes. *Psychological Review, 95,* 318–339.

Schacter, D. L., Kaszniak, A. W., Kihlstrom, J. F., & Valdiserri, M. (1991). The relation between source memory and aging. *Psychology and Aging, 6,* 559–568.

Schacter, D. L., Osowiecki, D., Kaszniak, A. W., Kihlstrom, J. F., & Valdiserri, M. (1994). Source memory: Extending the boundaries of age-related deficits. *Psychology and Aging, 9,* 81–89.

Shallice, T., & Burgess, P. (1996). The domain of supervisory processes and temporal organization of behaviour. *Philosophical Transactions: Biological Sciences, 351,* 1405–1411.

Shimamura, A. P. (1995). Memory and frontal lobe function. In M. S. Gazzaniga (Ed.), *The cognitive neurosciences* (1st ed., pp. 803–813). Cambridge, MA: MIT Press.

Simons, J. S., & Spiers, H. J. (2003). Prefrontal and medial temporal lobe interactions in long-term memory. *Nature Reviews Neuroscience, 4,* 637–648.

Snodgrass, J. G., & Corwin, J. (1988). Pragmatics of measuring recognition memory: Applications to dementia and amnesia. *Journal of Experimental Psychology: General, 117,* 34–50.

Srull, T. K., & Wyer, R. S. (1989). Person memory and judgment. *Psychological Review, 96,* 58–83.

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