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Effects of Aging on Source Monitoring: Differences in Susceptibility to False Fame

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Older adults were less likely than young adults to spontaneously recollect the source of familiarity for previously read nonfamous names. Older adults were more likely to call old nonfamous names *famous* when subsequently encountered in a fame judgment task. Poor source monitoring by the elderly could not be accounted for by inability to recognize earlier read nonfamous names when specifically asked to do so. Both source-monitoring errors and recognition memory performance were based on attributions made about the experience of familiarity. Elderly subjects most prone to making familiarity errors recalled fewer items on a verbal learning task and were less likely to chunk information into semantic categories as it was recalled. This finding suggests that a decline in the tendency to spontaneously organize and integrate information underlies the poor source monitoring observed.

There is an increasing body of evidence indicating that older adults are less able than younger adults to recollect the source of information (e.g., Cohen & Faulkner, 1989; Hashtroudi, Johnson, & Chrosniak, 1989; McIntyre & Craik, 1987; Rabinowitz, 1989). A decline in memory for source could have serious implications. One can compensate, to some extent, for the frequently observed decline in the ability to recall names or appointment times by making notes to oneself and marking a calendar. However, compensating for the effects of a decline in memory for source may be harder. Having a name or some fact pop into mind without being able to recollect its source could make a person hesitant to act on that information. This could account for the cautiousness that Botwinick (1984) proposed to be a concomitant of the aging process.

Misattributions about the source of information could also lead the older adult to respond less adaptively in certain situations. For example, a message gained from an unreliable source might later come easily to mind and, because of its familiarity, be accepted as true. Conscious recollection of the source of the message would be necessary to oppose its unconscious influence. Similarly, telling a story once might have the unconscious influence of making that story later come more easily to mind, increasing the likelihood of its being retold. However, conscious recollection of having previously told the story could oppose this unconscious influence of memory and allow one to avoid repetition. Koriat, Ben-Zur, and Sheffer (1988) have demonstrated that older adults are more likely than young adults to repeat themselves in list recall. They seemed less able than the young to engage in recall while monitoring what was being recalled. Less aware of the source of item familiarity, older adults were less likely to inhibit a response where appropriate.

Memory for source typically has been measured by directly asking people to report the source from which a given item or piece of information was gained (e.g., Cohen & Faulkner, 1989; Hashtroudi et al., 1989; Johnson & Raye, 1981; McIntyre & Craik, 1987; Rabinowitz, 1989). By instructing people to report source, the researcher is assessing subjects' optimal level of source monitoring, a level that might rarely be achieved when spontaneous monitoring of source is implicitly required as part of some ongoing task. People cannot always rely on someone directly asking them how they know what they know.

We examined effects of aging on spontaneous source monitoring by using a task that is in some ways similar to that of avoiding repeating oneself. We used a fame judgment task that was developed to measure unconscious influences of memory (e.g., see Jacoby, Kelley, Brown, & Jasechko, 1989; Jacoby, Woloshyn, & Kelley, 1989). The task enables one to measure the degree to which conscious recollection of source serves to oppose an effect of gains in familiarity. In our study, people were required to read a list of names that they were told were nonfamous. Subjects read the list under the pretense that we were interested in their ability to correctly pronounce names, but the list actually served as a means of increasing the familiarity of nonfamous names. Those old nonfamous names were then mixed with new famous and new nonfamous names and presented for fame judgments.

Conscious recollection that a name had been read in the list of nonfamous names was important for the fame judgment task. If a person recollected that a name had been read in that list, the name could be called *nonfamous* with certainty. Without such conscious recollection, previously reading the name was expected to increase its familiarity and make it more likely to be mistakenly called *famous*. That is, reading a name in a list

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of nonfamous names was expected to have an opposite effect on fame judgments when the source of the familiarity was not recollected compared with when it was recollected. When the source of familiarity was recollected, old nonfamous names should be less likely to be mistakenly called famous than should new nonfamous names, whereas when source was not recollected, old nonfamous names should be more likely to be mistakenly called famous than should new nonfamous names. This means that differences in fame judgments of old and new nonfamous names can be used to examine the effects of aging on source monitoring. We expected our older subjects to be less likely than the young to spontaneously recollect source and, consequently, to be more likely than the young to make familiarity errors by mistakenly calling old nonfamous names famous.

Questioning the source of information requires an act that is separate from using that information for some ongoing task. For example, Jacoby, Woloshyn, and Kelley (1989) found that the familiarity of names produced by their prior presentation was misinterpreted as fame by their sample of young adults. When names were read under conditions of divided attention, recognition of those names was greatly reduced, but subjects were more likely to mistakenly judge the names to be famous. This effect occurred whether subjects were distracted during the initial reading of the names or during fame judgments. Thus, one can effectively manipulate conscious recognition of an event without disrupting the sense of familiarity that the event will subsequently engender. So, when monitoring one's own performance, one is essentially engaged in the dual tasks of using memory and of interrogating the source of the memory that is being used.

Although there is some controversy about the nature of the deficit (e.g., Wickens, Braune, & Stokes, 1987), researchers have often found that older adults are particularly disadvantaged in dual-task settings (e.g., Plude & Hoyer, 1986). Consequently, older adults might be less likely than younger adults to monitor source even when the older adults could report source if directly asked to do so. A more complete picture of memory-related deficits suffered by older adults could be gained by observing older adults in a situation that required spontaneous monitoring of their own performance to avoid errors.

Effects of aging on source monitoring might not always reflect an inability of the elderly to recognize a name as having been read in the earlier list if specifically asked to do so. That is, we assumed that there would be multiple bases for recognition judgments (e.g., Mandler, 1980). To check this possibility, we gave subjects a test of list recognition for nonfamous names from the list they had read earlier after they had made fame judgments. Old nonfamous names that had not been presented for fame judgments were mixed with new nonfamous names and presented for a test of list recognition. In comparing the two age groups, we expected that the older subjects would show some decrement in recognition memory but that this decrement would not directly account for the probability that a subject would make a familiarity error in the fame judgment task. This pattern of results could be taken as demonstrating that, perhaps because of difficulties in dividing attention (e.g., Craik & Byrd, 1982), older subjects would be particularly unlikely to monitor the source of name familiarity while engaged in the fame judgment task. To extend results beyond this paradigm, we also examined the relationship between our measure of source monitoring and the older subjects' performance on standardized clinical tests of verbal and nonverbal memory.

Method

Subjects

The subjects were 24 young adults (14 women and 10 men), ranging in age from 18 to 24 years (M age = 19.5), and 24 older adults (14 women and 10 men), ranging in age from 63 to 80 years (M age = 71.2). The young adults were students in an introductory psychology course and served in the experiment for course credit. The older adults were community-dwelling residents in the Hamilton, Ontario, area who responded to newspaper advertisements. Mean years of education for the young and elderly subjects were 13.1 (SD = 0.41) and 12.3 (SD = 3.84) years, respectively, and were not reliably different between groups, $t(46) = 1.02$, *ns*. Neither self-report interview data nor neuropsychological evaluations revealed nonnormative levels of physiological or cognitive functioning among the older adults. None of the subjects were paid for their participation, but the elderly were reimbursed for transportation expenses.

Materials

Sixty famous and 80 nonfamous names served as materials for the experiment. The famous names were selected with the criteria that most people would recognize the name as famous but would probably be unable to specify what the named person did to attain fame. The famous names were correctly identified as famous by 60%–70% of age-matched subjects who had participated in pilot testing and in earlier studies using the same paradigm. The use of famous names for which people were generally unable to specify the achievement of the named person was meant to make people reliant on the familiarity of famous names when making fame judgments. Examples of famous names are Roger Bannister, Minnie Pearl, and Christopher Wren. Nonfamous names were matched with the famous names on the following characteristics: length of first and last names; sex, indicated by the first name; and the nationality of origin of the last name. Examples of nonfamous names are Sebastion Weisdorf, Valerie Marsh, and Adrian Marr.

The famous and nonfamous names were organized into three list formats so that across formats, each nonfamous name represented each possible combination of conditions. For each list of names, the presentation order of names was random, with the restriction that not more than three names of one type (e.g., famous or nonfamous) could be presented before the presentation of one name of each of the other types.

Procedure

There were four phases to this experiment. In the first phase, subjects were presented with a series of famous and nonfamous names and were asked to make fame judgments. These data provided a baseline for subjects' ability to discriminate between the types of names. In the second phase, subjects were asked to read a series of nonfamous names so that these names would seem familiar when encountered in subsequent phases. In the third, or test, phase, subjects were presented with another test of fame judgment. This time, however, some of the nonfamous names were selected from those that had been read in Phase 2, thus requiring subjects to discriminate between the familiarity due to fame and the familiarity due to previous presentation. In the fourth phase, subjects were asked to distinguish between the as-yet-unused names that had been read in Phase 2 and a new set of nonfamous names that served as foils. These data would allow us to compare source monitoring with recognition memory performance. Names for the first three phases were presented consecutively by means of an Apple computer interfaced with a Zenith monitor.

More specifically, in the first phase of the experiment, 20 famous and 20 nonfamous names were presented for a subject-paced test of fame judgment. This test provided baseline data for each subject with respect to his or her general ability to discriminate between famous and nonfamous names. Although one may think that looking at subjects' ability to distinguish between the new famous and the new nonfamous names presented during Phase 3 might be sufficient to determine baseline levels of discriminability, the possibility existed that the young and old subjects would use different strategies to protect themselves from making familiarity-based errors. For example, the older subjects may have become more cautious than the young. Thus, comparing performance on Phase 1 provided an opportunity to assess discriminability and report bias prior to our introducing the potential for source confusion. Comparison of baselines taken during Phase 1 with those taken during Phase 3 also allowed us to determine whether older and young adults responded differentially to the change in task demands that the test phase provided.

When introduced to the fame judgment task, subjects were told that the famous names that were to be presented for test were not names of extremely famous people such as Pierre Trudeau or Marilyn Monroe. Subjects were also told that they would not be asked to describe what a named person had done to become famous. These instructions were meant to encourage subjects to use familiarity as a basis for their fame judgments.

Subjects indicated their fame judgment for each presented name by pressing one of two large keys, a key at their right hand marked *famous* and a key at their left hand marked *nonfamous*. Each decision, as well as the time to make that decision, timed from the onset of the presentation of a name, was recorded by the computer and subjected to a log transformation prior to analysis. After a decision had been made by pressing a key, the name that had been tested disappeared from the screen and was replaced by the message "Press center key when ready." Pressing the center key resulted in removal of that message from the screen and presentation of the next name in the list for its test. This sequence continued until all names in the list had been presented. None of the names used in Phase 1 were used in subsequent phases of the experiment.

In the second phase of the experiment, subjects were instructed to read aloud each of 40 nonfamous names presented at a rate of 2 s per name. Subjects were told that we were interested in the speed and accuracy with which they could pronounce the names and that their pronunciation of names was being recorded. Although a microphone was placed on top of the monitor to make the instructions more credible, neither pronunciations nor latencies were actually recorded. Subjects were correctly informed that all of the names that were to be presented in this phase of the experiment were nonfamous.

In the third phase of the experiment (the test phase), subjects were presented with 40 famous and 40 nonfamous names for a test of fame judgments. All of the famous names were new, not earlier presented in the experiment. Of the nonfamous names, 20 were new names and 20 were old names that had been read in the list of nonfamous names. The procedure for the test of fame judgments was the same as that used in the first phase of the experiment, with the exception that subjects were informed that some of the nonfamous names had been presented once before in the experiment and some were new. Thus, recognizing a name as having been read in the list of nonfamous names could not be the sole basis for judging it to be nonfamous.

In the final phase of the experiment, a test of list recognition was given. The 20 nonfamous names that had been read during the second phase of the experiment, but that had not been presented for fame judgments in the third phase of the experiment, served as old names for the test of list recognition. Old and new nonfamous names were randomly intermixed and typed on a sheet of paper. Subjects were asked to circle the nonfamous names that they had read in the earlier phase of the experiment.

List formats were constructed such that across formats, each nonfamous name represented each possible combination of conditions. That is, names that served as new nonfamous names presented for fame judgments with one combination of study and test lists (format) served as old nonfamous names in another format, names presented for fame judgments in the first phase in one format were presented in the third phase for fame judgments in another format, and so on. This use of formats ensured that differences among conditions or phases of the experiment could not be due to differences among the particular names that were used.

Additional Neuropsychological Testing

All of the older subjects were administered an abbreviated battery of neuropsychological tests to screen for atypical performance and to determine the relationship between the fame judgment task and more traditional clinical measures.

The California Verbal Learning Test (CVLT; Delis, Kramer, Kaplan, & Ober, 1987) served as a test of verbal memory. There is a high degree of convergence between the CVLT and the more traditional Wechsler Memory Scale–Revised (WMS–R; Wechsler, 1987). The CVLT, however, provides more information on which to assess learning strategies (Delis, Cullum, Butters, Cairns, & Profitera, 1988) and overcomes some of the psychometric problems that plague the WMS–R (e.g., Loring & Papanicolaou, 1987).

For the CVLT, subjects are presented with a list of 16 words that fall into four taxonomic categories, and they are given five study and five test trials to examine their learning of those words. For each study trial, words are presented in the same order, with words from the different categories being randomly intermixed. After the fifth test trial, subjects are given one study and one test trial on a distracter list of 16 words that also fall into four taxonomic categories. Two of the categories used to construct the second list are the same as those used to construct the original list. After the test of recall for the distracter list, subjects are given a test of recall for the original list. After a delay with interpolated activity, they are given a final attempt to recall the test words, followed by a test of recognition. The recognition memory test includes all 16 items from the original study list plus 28 foils. The different types of foils were words from the distracter list, words that were never presented but were from the same categories as list words, words that were phonemically similar to the list words, and words that were totally unrelated to the list words. The CVLT produces several scores. In this study, we examined the total score, which is the total number of items recalled over the five learning trials, and the cluster score, which indicates how much subjects organized items into categories as they recalled them.

The Rey-Osterrieth Complex Figure Test (Osterrieth, 1944; Rey, 1941) was used to assess visual memory. This test yields a copy score, which is a measure of the subject's perceptual organization (e.g., see Binder, 1982), and a recall score, indicating the subject's ability to reproduce the drawing after a 20-min delay. For further discussion of this test, see Lezak (1983).

Table 1
Hit Rate (d') and Report Criterion (β) Values for Three Groups

	Elderly		Young		Young2	
Phase	d'	β	d'	β	d'	β
Baseline						
M	1.72	1.90	0.99	1.88	1.58	1.96
SD	0.62	1.13	0.56	1.22	0.91	1.28
Test						
M	1.73	2.14	0.96	1.86	1.53	1.89
SD	0.62	1.24	0.62	1.16	1.03	1.18
Recognition						
M	1.63	2.51	1.93	2.73	2.20	3.67
SD	0.48	1.25	0.54	0.90	0.62	1.30

Note. Analyses of hit rate and report criterion were based only on the new famous and new nonfamous items presented at test to assess subjects' accuracy and report criterion, excluding the effects of experimental manipulation. Young2 = young control subjects matched on baseline discriminability.

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Results

Age Differences in Accuracy and Criterion Used for Fame Judgments

For all analyses, the significance level was set at .05, with the magnitude of the significant effects indicated by eta-square (η^2) calculated on the basis of the effect of interest plus the appropriate error term for that effect. In a first set of analyses, performance in the baseline phase was compared with that in the test phase to examine any differences as a function of age in accuracy and in the criterion used for fame judgments. As well as examining the possibility that the older adults might be more conservative in their fame judgments (e.g., Botwinick, 1984), we were interested in whether they would change their response criterion between baseline and test. To address these issues, a signal-detection analysis was performed on the data (see Table 1). For that analysis, the probability of correctly identifying a famous name served as the probability of a hit, and the probability of calling a new nonfamous name famous served as the probability of a false alarm. With these probabilities, scores of discriminability (d') and response bias (β) were computed and submitted to a 2 × 2 analysis of variance (ANOVA), with age (young or old) as the between-groups factor and phase (baseline or test) as the within-group factor.

The analysis of differences in ability to discriminate between famous and nonfamous names showed that the elderly were more accurate in their fame judgments than were the younger subjects ($d' = 1.72$ vs. $d' = 0.99$), $F(1, 46) = 24.12$, $\eta^2 = .34$. Despite careful pilot testing, our famous names were more familiar to the elderly subjects. Later in this article we show that differences in accuracy of discrimination were not responsible for the results of interest.

An analysis was also performed on subjects' response bias, as indicated by beta values (see Table 1). This analysis failed to reveal any significant effects of age or phase of the experiment. The elderly were no more conservative than were the young when making fame judgments, and there was no evidence that either group changed their report criterion when faced with the possibility of confusion among sources of familiarity (test phase) than when not faced with the possibility of that confusion (baseline).

We also examined the time subjects took to decide that a name was famous. An ANOVA included age and sex as the between-subjects variables and phase (baseline vs. test) as the within-subject variable. The men in both age groups tended to respond more quickly than the women, but these differences were not reliable. Decision times, collapsed across sex, are shown in Table 2. The young (1,144 ms) were faster than the elderly (1,619 ms) to make correct decisions for famous names, $F(1, 44) = 13.48$, $\eta^2 = .24$. Interestingly, there was also an Age × Phase interaction, $F(1, 44) = 7.96$, $\eta^2 = .15$, such that the young increased their decision time during the test phase relative to baseline (1,235 vs. 1,144 ms, respectively), whereas the elderly reduced their decision time during the test phase compared with baseline (1,520 vs. 1,619 ms, respectively). So, although age did not affect the report criterion as measured by the overall ratio of hits to false alarms, effects on decision times can be taken as evidence that the younger subjects reacted to the possibility of confusion among sources of familiarity during the test phase by being slower to correctly decide that a name was famous than they had been during the baseline phase of the experiment. In contrast, the older adults were less likely to increase their decision time when they were faced with the possibility of confusion among sources of familiarity.

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Differences in Susceptibility to Familiarity Errors

Our primary interest was in the possibility of age-related differences in confusion among sources of familiarity. We expected the older adults to be more likely than the younger adults to mistake the familiarity of an old nonfamous name read earlier for the familiarity due to the name being a famous one. That is, elderly subjects were expected to be more likely to mistakenly respond *famous* to old nonfamous than to new nonfamous names. In contrast, we expected that younger subjects would be more likely to monitor the source of item familiarity. That is, the young adults were expected to use conscious recollection of having read a name as a way to avoid familiarity errors. If a name was recognized as having been read, it could be called nonfamous with certainty because all of the old names presented at test were nonfamous. The probability of calling a name famous and times for correct fame judgments are displayed in Table 2 for both the baseline and the test phases of the experiment.

Results were in line with our expectations. An analysis of the probability of mistakenly responding *famous* revealed no main effects for age or type of name. However, there was a significant interaction between age and old versus new nonfamous names, $F(1, 46) = 13.31$, $\eta^2 = .22$. For the young, old nonfamous names were less likely to be judged famous (0.14) than were the new nonfamous names (0.25), whereas the opposite was true for the elderly (0.20 vs. 0.14).

An analysis of the decision times for correctly rejecting nonfamous names during the test phase of the experiment also revealed a significant interaction between age and type of non-

Table 2
Proportion of Items Called Famous (PF) and Time Spent to Make Correct Decisions (DTs) by Type of Item

	Baseline				Test			
	PF		DT (ms)		PF		DT (ms)	
Item	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Elderly								
Famous	.72	.12	1,619	492	.70	.14	1,520	375
Old nonfamous	—	—	—	—	.20	.17	1,890	613
New nonfamous	.16	.15	1,938	641	.14	.15	1,815	669
Young								
Famous	.57	.13	1,144	331	.54	.16	1,235	338
Old nonfamous	—	—	—	—	.14	.14	1,209	292
New nonfamous	.25	.18	1,407	576	.25	.22	1,355	461
Young2								
Famous	.68	.22	1,394	508	.61	.26	1,403	490
Old nonfamous	—	—	—	—	.10	.12	1,436	412

Note. Young2 = young control subjects matched on baseline discriminability.

famous name, $F(1, 46) = 7.37$, $\eta^2 = .15$. Younger subjects correctly rejected old nonfamous names more rapidly than new nonfamous names (1,209 vs. 1,355 ms). In contrast, the older subjects were slightly slower to correctly reject old nonfamous than new nonfamous names (1,890 vs. 1,815 ms). Even when the elderly made correct decisions about the source of item familiarity, they did not do so with the same efficiency as the young. Perhaps they were less likely to relinquish the possibility of extraexperimental sources of familiarity before correctly deciding that the familiarity was due to their having read the name only a few minutes before. These decision times reflect the greater difficulty experienced by the older adults when having to discriminate between sources of item familiarity.

A potential difficulty for interpreting effects of aging on fame judgments is that the older subjects in this sample were more accurate in discriminating between famous and nonfamous names than were younger subjects. Differences in the tendency to confuse sources of familiarity may in some way be tied to this difference in accuracy of discrimination. To assess this possibility, we first reanalyzed the data using each subject's d' score at baseline as a covariate. Statistically controlling for the baseline differences in this way did not alter the results. The interaction between age and type of nonfamous name did not change, $F(1, 46) = 13.31$, $\eta^2 = .23$.

As a second means of removing the confounding of age and accuracy of discrimination, we selected a new set of famous names such that they elicited the same level of recognition from a normative group of undergraduates as the study set of famous names had elicited from our elderly sample. We then ran an analysis of a second group of young subjects (Young2; $n = 12$), whose mean age was 19.7 years ($SD = 1.5$), following the exact procedures described earlier. Measures of discriminability and bias for the Young2 group are shown in Table 1. Note that the subjects in the Young2 group do not differ from the older subjects at baseline with respect to discriminability (d'), $t(34) = 0.55$, *ns*, or response bias (beta), $t(34) = 0.14$, *ns*. Nonetheless, the pattern of results obtained from the Young2 group was similar to that obtained from our first group of young subjects (see the last three columns of Table 2). An analysis of the probability of mistakenly responding *famous* revealed no main effects for age or type of name (old vs. new), but the interaction between age and type of name was evident, $F(1, 34) = 7.29$, $\eta^2 = .18$. The elderly subjects were more prone to making familiarity errors than were either group of young subjects, and this effect was not due to differences between younger and older adults' general ability to distinguish between famous and nonfamous names.

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Recognition Memory

We expected that young subjects would be better able to recognize the names they had read earlier than would the older subjects (e.g., Horn, Donaldson, & Engstrom, 1981). The probability of correctly circling a name that had been read earlier (a hit) was .62 for the older subjects and .66 for the younger subjects. The probability of circling a new nonfamous name (a false alarm) was .12 and .05 for the elderly and the young, respectively. Signal-detection analysis was performed on these data (see Table 1). The accuracy of list-recognition memory performance was higher for the young ($d' = 1.93$) than for the elderly ($d' = 1.63$) subjects, $t(46) = 2.06$, $p < .05$. The report criterion used for list-recognition judgments by the older subjects (as indicated by beta values) did not differ significantly from that used by the young.

Older subjects may have been more likely to make familiarity-based errors simply because they were unable to recognize the previously read words as well as the younger subjects. If this were the case, group differences in source error would be due to poor recognition rather than poor monitoring. To check that possibility, we reanalyzed subjects' fame judgments made during the test phase of the experiment using the accuracy of subjects' performance (d') on the Phase 4 test of name recognition as a covariate. The interaction between age and type of error remained. The older subjects were more likely to call the old nonfamous names famous even when differences in name-recognition performance were removed, $F(1, 46) = 12.28$, $\eta^2 = .21$.

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Individual Differences

Analysis of covariance was used to further examine the relationship between the tendency of the older adults to make familiarity-based errors and other subject and task variables. In each regression equation, the proportion of old nonfamous names called famous was used as the dependent measure, with the proportion of new nonfamous names called famous being entered on the second step to control for overall error rate. In no case was there a significant increase in explained variance due to an interaction between the covariate and the variables of interest. That is, the relationships to be described seem unaffected by subjects' general level of discriminability.

The first factor examined was sex of subject. There was a significant Age × Sex interaction (partial correlation [pr^2] =

.31, $p < .05$), accounting for 10% of the variance in subjects' tendency to make familiarity errors after the main effects of age, sex, and overall error rate had been removed. Men made more errors and tended to be faster when making decisions than did women, so the difference in the tendency to make familiarity errors might reflect a speed–accuracy tradeoff. However, because the sex difference in self-monitoring was not central to this investigation, we do not explore it further here.

As demonstrated earlier, group differences in the false fame effect could not be accounted for by differences in the ability of young and older subjects to recognize old nonfamous names in Phase 4 of the experiment. Nonetheless, poor name recognition might account for variability within the older sample. Restricting subsequent analyses to within-group differences among the older adults, we found a positive relationship ($pr^2 = .36$, $p = .09$) between older subjects' level of d' during Phase 4 name recognition and the tendency to make a familiarity error during test. Recognition d' accounted for an extra 13% of the variance in the tendency to make familiarity errors after the effect of overall error rate was removed. Surprisingly, older adults who were best at recognizing names as previously read in the list of nonfamous names when given a test of list-recognition memory tended as well to mistakenly call old nonfamous names famous when making fame judgments. This result reflects the multiple bases on which individuals make recognition memory decisions and is addressed further in the discussion.

Further analyses assessed whether subjects' performance on the experimental fame judgment task extended to more standardized clinical measures of memory. The ability to copy the Rey-Osterrieth complex figure was negatively related to subjects' tendency to make a familiarity error ($pr^2 = -.21$), as was subjects' ability to reproduce their drawing after delay ($pr^2 = -.18$), but neither accounted for a significant increase in the proportion of explained variance.

Verbal recall, as measured by the total number of items recalled over the five trials of the CVLT, accounted for a significant proportion of explained variance in subjects' tendency to make familiarity-based errors ($pr^2 = -.51$, $p < .02$), as did subjects' ability to cluster items during the recall trials ($pr^2 = -.47$, $p < .05$). The poorer their performance on these tasks, the more likely they were to make the familiarity error. The substantial correlation between clustering and recall ($r = .86$) made it difficult to discern which represents the primary source of variance relative to the memory-for-source effect. We propose, however, that the ability to note the relationship between items during learning trials would facilitate recall just as the ability to attend to the relationship between familiarity and the context in which that familiarity was acquired is necessary to avoid making the fame judgment errors noted herein.

The proportion of hits on the CVLT test of recognition was also negatively related to the tendency of our older subjects to make a familiarity error ($pr^2 = -.50$, $p < .02$). After we controlled for false alarms on CVLT recognition and for overall error rate, this relationship accounted for 25% of the variance in the fame judgment task. Note that the negative correlation between the tendency to make familiarity errors and CVLT recognition memory performance contrasts with the positive correlations between familiarity errors and subjects' ability to recognize the old nonfamous names in Phase 4 of the experiment. Although both tests measured subjects' ability to recognize previously presented material, the basis for recognition memory decisions differed between the two tests.

For the CVLT, most of the foils were selected such that they, as well as the target words, would seem familiar. Only a small number of the foils were totally unrelated to words presented for study, and those foils were almost never falsely recognized. Among the other foils were words that had been presented earlier in the distracter list and that consequently would be familiar, although only words presented in the original list were to be called old. Thus, this test was more like the fame judgment task in that it required subjects to distinguish between sources of familiarity. Elderly subjects who were best able to recollect the context in which items had been originally presented on the CVLT were least likely to be misled by the familiarity of old nonfamous names when making fame judgments. The distinction between recognition judgments and source monitoring is discussed further in the next section.

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Discussion

We found that for our older subjects, reading a list of names that they were told were all nonfamous increased the likelihood that those names would be called famous in a subsequent fame judgment task. In contrast, the young subjects were more likely to recognize the source of familiarity that attended the old nonfamous names and were less likely to make this familiarity-based error. The false fame effect shown by the older adults in our study provides evidence that as people age, there is an increased likelihood that they will become susceptible to confusion among sources of information. The confusion occurred in a situation where monitoring the source of item familiarity was an implicit rather than an explicit task demand.

This false fame effect qualifies as a clear example of memory without awareness. It demonstrates the unconscious influence of memory, an effect of prior experience that is unaccompanied by awareness of that prior experience (e.g., Jacoby, Woloshyn, & Kelley, 1989). The literature on aware and unaware forms of memory is often confounded by uncertainty about whether subjects are truly unaware that the prior presentation of the data bears on the current task (Richardson-Klavehn & Bjork, 1988). This confound may account to some degree for the mixed results with respect to age effects on unaware forms of memory (e.g., Chiarello & Hoyer, 1988; Light & Singh, 1987; Light, Singh, & Capps, 1986). Using our paradigm, however, we can be certain that the false fame effect reflects an unconscious influence of memory produced by prior reading of the nonfamous names. To the extent that subjects had been aware of having read the old nonfamous names when making fame judgments, they would have been less likely, rather than more likely, to call those names famous as compared with the new nonfamous names. In our situation, conscious recollection of an earlier experience serves to oppose influences of that experience that would arise if left unopposed.

The false fame effect would be described by some as a dissociation between aware and unaware forms of memory or a dissociation between recognition memory and memory for source.

Such dissociations are seen as supporting the claim for multiple memory systems that decline differentially with age (e.g., Mitchell, 1989). However, proposing a dissociation between memory systems may not be necessary. One could as easily assume multiple bases for the judgments people make about the experience of remembering (e.g., Atkinson & Juola, 1974; Jacoby & Dallas, 1981; Mandler, 1980). The results of our experiment provide evidence of multiple bases for recognition memory decisions by showing a variable relationship between recognition memory performance and effects on fame judgments. When the test of list recognition was such that decisions could be based on familiarity, there was a small but positive correlation between list-recognition performance and the tendency to make a familiarity error on the fame judgment task. This positive correlation probably results from familiarity being used as a basis for making both decisions.

The use of familiarity as a basis for various decisions can produce apparent contradictions. When making fame judgments, familiarity can be interpreted as an indication that the name is famous. However, for our subjects, that familiarity may have arisen from having encountered a nonfamous name in the context of the experiment. Similarly, when engaged in a list-recognition task, the subject's same sense of familiarity can be interpreted as evidence that the name was read in an earlier list. Reliance on this sense of familiarity can work well as long as there is only one list, or, as in the case of the name-recognition task, one potential source of familiarity. The experience of familiarity itself is a nonanalytic basis for judgments that is open to errors produced by confusion among sources of that experience (e.g., Jacoby & Kelley, 1987; Jacoby, Kelley, & Dywan, 1989). Careful monitoring becomes important only when the task requires subjects to determine how they know what they know.

Although we reported a positive correlation between the tendency to make familiarity-based errors and Phase 4 name recognition, we observed a negative correlation between the tendency to make familiarity-based errors and recognition performance when that performance required subjects to make a distinction between sources of familiarity. For the test of list recognition that is included in the CVLT (Delis et al., 1987), assessing familiarity does not serve as an adequate basis for recognition memory judgments. This is because the foils used for that test could be familiar either because they were related to target words or because they had been presented in a distracter list. Thus, familiarity was not enough. Achieving a good score on that test requires that one do more than acknowledge familiarity; one must also monitor the source of that familiarity. Those who were best able to determine source on the CVLT list-recognition test were also best able to make correct attributions about the source of familiarity that attended the previously read names when making judgments of fame.

We acknowledge that our demonstration of the different bases for recognition memory judgments is weakened somewhat by the fact that the recognition tasks differ in ways other than their requirement for source discriminability. Further work with more carefully controlled materials is required to fully understand the relationship between source monitoring and recognition performance. Nonetheless, it would be hard to argue on the basis of the results reported here that misattributions about the source of item familiarity are simply a function of a reduced ability to recognize the previously presented information. There appeared to be a distinction between the ability to encode, store, and recognize information and the ability to monitor the source of the familiarity that attends that information. This distinction was more apparent among the older adults. These results are compatible with data presented by Rabinowitz (1989) demonstrating that manipulations designed to affect the storage or retrieval of information did not alter the magnitude of an age-related memory-for-source deficit observed in his subject population.

Our use of the fame judgment task to measure source monitoring differs from the procedures most often used to assess age-related differences in memory for source. Memory for source is usually assessed by directly asking people to report the source from which information was gained (e.g., McIntyre & Craik, 1987) or the details of one's prior experience with the information (e.g., Rabinowitz, 1989). There is evidence, however, that source-monitoring performance is sensitive to attentional manipulations. Even when people fail to spontaneously monitor the source of information, they may be able to recollect source if directly asked to do so (e.g., Jacoby, Kelley, Brown, & Jasechko, 1989). This attentional factor may be particularly relevant for elderly subjects. They may be less likely than the young to spontaneously monitor the source of information when engaged in another task because of a decline in their ability to divide attention among tasks. Young adults can make the same source-monitoring error, as demonstrated here for the elderly, when they are required to make fame judgments under conditions of divided attention either at study or at test (Jacoby, Woloshyn, & Kelley, 1989). In a similar vein, distraction during testing increases the chance that young subjects will repeat words that were recalled during an earlier test of free recall (Gardiner, Passmore, Herriot, & Klee, 1977), a result that Koriat et al. (1988) have subsequently demonstrated in older adults in the absence of any deliberate attentional manipulation.

A failure to monitor source should not be seen as isolated from other cognitive functions. We found that the poorer our older adults were at monitoring source, the poorer they were at free recall, the poorer they were at clustering words by categories when recalling a categorized list, and the poorer they were on a test of recognition memory that required discrimination among sources of familiarity. This pattern of relationships could be taken as evidence that they had greater difficulty on tasks requiring the ability to organize information and make comparisons among events. Indeed, memory for temporal relations (an aspect of memory for context) can depend on noting relations among items in a list, the same activity required for clustering items during recall. Winograd and Soloway (1985) found more accurate recency judgments for related than for unrelated pairs of words. On the basis of the study-phase retrieval model of temporal coding (Hintzman, Summers, & Block, 1975; Tzeng & Cotton, 1980), they argued that recency judgments depend on subjects being reminded of the earlier item when they encounter the second related item. The search for relationships among events could be seen as a process that occurs during encoding or retrieval and that this process could be differentially disrupted by any factor that disrupts attention.

Amnesic patients, of course, are very poor at recalling or recognizing information to which they have been exposed. Even when they are able to learn isolated new facts, they show a severe deficit, in comparison with normal subjects, in their ability to report the source of those facts. This phenomenon is most apparent in amnesic patients with deficits in frontal lobe functioning (Schacter, 1987; Schacter, Harbluk, & McLachlan, 1984; Shimamura & Squire, 1987). Because the frontal regions of the brain seem particularly susceptible to the effects of aging (e.g., Woodruff, 1982), deficits in memory for source shown by older adults might be related to changes in frontal lobe functioning. Craik, Morris, Morris, and Loewen (1990) have shown that elderly subjects' performance on a direct test of memory for source is correlated with their performance on the Wisconsin Card Sorting Test and on a test of verbal fluency, tasks that are commonly used to measure the level of frontal lobe functioning (e.g., Stuss & Benson, 1986). Although we did not test frontal lobe functions directly in our experiment, we propose that alterations in these functions may serve as a mechanism underlying age-related changes in source monitoring and that this represents an area for further study.

One way of thinking about the results of our experiment is in terms of the contrast between the use of memory as a tool and its use as an object (e.g., Jacoby & Kelley, 1987). By that distinction, memory of an event such as reading a word or a name can be used as a tool to assist in the later perception and interpretation of the same or similar events. When used as a tool, memory for a prior event is incorporated into an ongoing activity rather than being treated as an object for reflection. Conscious recollection requires a different focus of attention and involves an act that is separate from using memory as a tool to help accomplish some present task. Our notion of memory as object is similar to the notion of reflection as discussed by Johnson (e.g., Johnson, 1983).

The treatment of memory as an object of reflection is necessary for accurate source monitoring when making decisions, noting relationships among words that are to be remembered, and so on. As people age, they may be less likely than younger people to treat memory as an object, perhaps because of the change in the focus of attention that is required to go from the use of memory as a tool to its treatment as an object. In accepting this conclusion, however, keep in mind that there was a great deal of heterogeneity in performance among our elderly subjects. The source-monitoring performance of some of our elderly subjects was as good as that of our best young subjects. Also, under conditions such as divided attention at the time of test (see Jacoby, Woloshyn, & Kelley, 1989), young subjects produce a pattern of results similar to that produced by elderly subjects who were poor at monitoring source. Because of the heterogeneity in performance among the aged and the source-monitoring differences across situations even for the young, research effort might be better aimed at effects on memory performance of changes in processing or functioning that are correlated with age rather than the effects of aging per se on an isolated index of memory performance.

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