

Instructional Manipulations and Age Differences in Memory: Now You See Them, Now You Don't

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The instructions for most explicit memory tests use language that emphasizes the memorial component of the task. This language may put older adults at a disadvantage relative to younger adults because older adults believe that their memories have deteriorated. Consequently, typical explicit memory tests may overestimate age-related decline in cognitive performance. In 2 experiments, older and younger adults performed a memory test on newly learned trivia. In both experiments, age differences were obtained when the instructions emphasized the memory component of the task (memory emphasis) but not when the instructions did not emphasize memory (memory neutral). These findings suggest that aspects of the testing situation, such as experimental instructions, may exaggerate age differences in memory performance and need to be considered when designing studies investigating age differences in memory.

One of the most consistent findings in the cognitive gerontology literature is that younger adults outperform older adults on most explicit or direct memory tasks (Light, 1996; for a rare exception, see Craik, Byrd, & Swanson, 1987). Explanations for these differences vary, but most models view age-related decline as more or less inevitable (e.g., Johnson, Hashtroudi, & Lindsay, 1993; Just & Carpenter, 1992; Salthouse, 1996; Zacks, Hasher, & Li, 2000). In doing so, these models fail to consider aspects of the testing situation that can have a substantial effect on performance.

This article examines one aspect of the testing situation that may contribute to age differences in memory: the instructions that typically precede memory tests. In particular, people are typically told that the task is a *memory* test, or that their *memory* will be tested, or that they need to *remember* information. This is important because older and younger adults have very different reactions when confronted with a memory testing situation. Several studies in social cognition have demonstrated that older adults believe

they will perform more poorly on memory tests than do younger adults (Cavanaugh, 1996; Cavanaugh & Green, 1990; West & Berry, 1994). As well, older and younger adults differ in their perceptions of how much control they have over their performance on memory tasks (Lachman, Bandura, Weaver, & Elliot, 1995; Miller & Lachman, 1999).

Whereas traditional decline theories suggest that age differences in memory are unavoidable, these social–cognitive studies suggest that decreasing the salience of the memory component of a task may reduce age differences. Therefore, the main goal of the current study was to determine whether manipulating the use of the word *memory* in the instructions preceding a memory task would impact memory performance. We hypothesized that when the instructions emphasize memory, as they typically do, age differences should appear. By contrast, when the instructions de-emphasize memory, these age differences may diminish or disappear.

Evidence in favor of these predictions can be drawn from the implicit memory literature. *Implicit memory* refers to memory for a previous event that is evidenced without explicit referral to that event (Zacks et al., 2000). Implicit memory tests use indirect measures of memory such as repetition priming (word fragment completion, word-stem completion, word and picture naming) with the goal of testing for prior information without the participant's awareness of its relevance. As such, the word *memory* is never a part of the instructional set for an implicit memory test. Although age differences are typically quite robust on *explicit memory* tests (which directly assess memory), age differences on implicit memory tests are either nonsignificant or much smaller (see Fleischman & Gabrieli, 1998, for a review).

An example of this dissociation that is relevant to the current goals of this article comes from Light and Singh (1987). In that

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study, older and younger adults studied a list of words and later participated in a memory test. Those participants who received the explicit memory test were told to use the word stems to help them remember the correct word from the previously studied list; those who received the implicit memory test were told to complete each stem with the first word that came to mind. Significant age differences in memory occurred on the explicit memory test but not on the implicit memory test. Note that the only difference between the two conditions was the *instructions* provided to the participants. The explicit memory instructions included referents to one's memory; the implicit memory instructions did not. Such findings in the implicit memory literature are often attributed to preserved subsystems of memory, underlying brain structure, or both (e.g., Shimamura, 1993; Tulving & Schacter, 1990). It is possible, however, that these findings are additionally tied to the absence of instructions regarding memory preceding implicit but not explicit memory tests.

The implicit memory literature is not the only methodology that has demonstrated significant effects of instructional manipulations. Explicit memory tests are also subject to instructional manipulations. For example, several studies report a reduction in or an elimination of age differences in recall and recognition performance when *incidental memory* instructions are provided to participants relative to when *intentional memory* instructions are provided (see Kausler, 1991, and Perlmutter & Mitchell, 1982, for reviews). Intentional memory instructions, which are more traditionally used, inform participants at the beginning of the experiment to expect a memory test at some point during the session. On the other hand, incidental memory instructions do not mention the upcoming memory test in the general instructions but rather give the memory test without warning. Note that both types of memory tasks are explicit memory tests—participants are aware that their memory is being tested. However, incidental memory instructions do not inform participants about the memory task until the encoding phase is completed.

In a relevant example, Mitchell and Perlmutter (1986) told younger and older participants that they would be completing a word-judgment task. Participants performed either shallow (Is the word in uppercase or lowercase letters?) or deep (Is the word animate or inanimate?) orienting tasks on two lists of words (Mitchell & Perlmutter, 1986, p. 87). After the judgment task was finished, participants completed a free-recall test of the word lists. Participants receiving incidental memory instructions were not aware until just before the recall test that their memory for the words would be tested; participants receiving intentional memory instructions knew at the outset of the study that their memory would be tested. Significant age differences in recall occurred under intentional memory conditions but not under incidental memory conditions (Mitchell & Perlmutter, 1986). As well, in a review of relevant experiments at the time, Perlmutter and Mitchell (1982) found that when standard intentional memory instructions were provided, statistically significant age differences in recall emerged 100% of the time and age differences in recognition emerged 71% of the time. However, when incidental memory instructions were provided, statistically significant age differences in recall occurred in only 27% of the experiments and age differences in recognition never occurred.

Instructional manipulations have also eliminated group differences in performance on tasks other than memory tasks and for

groups other than those based on age. For example, Steele and his colleagues (Steele, 1997; Steele & Aronson, 1995) have demonstrated that group differences between African American students and Caucasian students on a verbal subtest of the Graduate Record Examination (GRE) were significant when participants were instructed that the measure of interest was the student's *abilities*. No performance differences were observed on the identical test when the participants were instructed that the measure of interest was the *psychological processes* underlying the GRE. Steele (1997) labeled this phenomenon "stereotype threat" because using words like *abilities* and *intelligence* evoked negative stereotypes about race and intelligence that created different testing situations for the two groups of participants. Given that for older adults *memory* may be a negative word, and that negative stereotypes about age and memory are quite prevalent in our society (Kite & Johnson, 1988; Ryan, 1992; Ryan & Kwong-See, 1993), this research suggests that the magnitude of age differences should be heightened with instructions emphasizing memory and reduced with instructions de-emphasizing memory. Consequently, manipulations of instructions preceding a memory test in a manner consistent with Steele's manipulations may result in similar findings: age differences when the instructions emphasize memory but smaller or nonexistent age differences when the instructions are memory neutral.

Although research on implicit memory, incidental memory, and stereotype threat have been very different in terms of theoretical conception, goals, and explanations, each has demonstrated that group differences in performance can be obtained or eliminated depending on instructional manipulations. The experiments reported in this article examined the relationship between manipulations of the instructions preceding an explicit memory test and the resultant age differences in performance. The idea was that instructions emphasizing memory might create an environment in which age differences would be enhanced because they create different testing situations for older and younger adults. To this end, we varied the instructions for completing an explicit memory task in the present study such that they either emphasized the memorial component of the task or they did not. We predicted that older adults would perform worse than younger adults when memory-emphasis (ME) instructions were used. This finding would replicate a substantial portion of the explicit memory literature, which typically uses such instructions (see Craik & Jennings, 1992, and Zacks et al., 2000, for reviews). By contrast, we predicted that when the instructions were memory neutral (MN) the testing situation would be more equitable and age differences would diminish. Consistent with the literatures on implicit memory and on incidental versus intentional memory, our predictions centered around between-groups differences in performance.

In Experiments 1 and 2, older and younger adults completed a memory task that was preceded either by traditional instructions (ME instructions) or by nontraditional instructions (MN instructions). Participants read a series of trivia statements, learned whether each was true or false, and were either distracted or not distracted while learning this information. We included the distraction manipulation because a substantial amount of research suggests that, relative to younger adults, older adults are differentially affected by dividing attention (see Kramer & Larish, 1996, for a review). We thought it possible that the instruction manipulation would influence the effects of distraction as well, such that the combination of memory instructions with distraction would be

particularly disruptive to older adults. During the test phase, participants saw both old and new statements and gave each statement a truth rating on the basis of their memory. As it happened, our instructional manipulation was not particularly effective in influencing the distraction effects. Nonetheless, the same instructions had rather dramatic effects on comparisons between the two age groups tested.

Experiment 1

The task in Experiments 1 and 2 was to learn the truth value (true vs. false) of each of a series of trivia statements such as "About 4 hours are required to boil an ostrich egg." During the learning phase, participants read each statement and then, for some statements, received feedback that the fact was true or false. During the test phase, old and new statements were presented, and participants rated each on the basis of input information as true, false, no information, or new. Accuracy of true versus false judgments was the main dependent variable. The task was a variation of a task developed by Gilbert and his colleagues (Gilbert, Krull, & Malone, 1990) to study how people come to believe that an assertion is true or false.

This task was ideal for examining the effect of instructional manipulations on age differences in memory for two reasons. First, it is a task that tests memory directly, or explicitly, and older adults typically perform worse than younger adults on direct memory tasks (e.g., Light, 1996). Second, the task can be framed so as to emphasize, as is ordinarily the case, or de-emphasize, as we do here, its memory component. Before they were presented with the materials to be learned, older and younger participants were given either ME instructions or MN instructions. The key manipulation was whether the instructions emphasized the memorial components of the task, as is the case in traditional explicit memory tasks, or did not. We predicted that older adults would perform worse than younger adults on the memory task when it was preceded by the ME instructions. Moreover, we predicted that there would be no age differences when the same memory task was preceded by the MN instructions.

Method

Participants. Forty-eight younger adults and 48 older adults participated in this experiment. Younger adults were Duke University undergraduates who received course credit for their participation. Older adults were volunteers from the Duke University Center for the Study of Aging and Human Development and were paid \$5. One older adult's data were lost as the result of a computer error. A second older adult was excluded from analyses because his vocabulary score fell 2.5 standard deviations below the mean vocabulary score for his age group. Two additional older adults were tested to replace these participants. Younger adults (M age = 19.54 years, range = 17–24) had an average of 13.50 (SD = 1.47) years of education and a mean score of 24.64 (SD = 7.36) on the Extended Range Vocabulary Test (ERVT), Version 3, from the Kit of Factor-Referenced Cognitive Tests (Educational Testing Service, 1976). Older adults (M age = 69.38 years, range = 61–75) had an average of 16.47 (SD = 2.18) years of education and a mean score of 33.74 (SD = 8.99) on the ERVT. Older adults had significantly more years of education, $F(1, 94) = 61.42$, $MSE = 3.47$, $p < .0001$, and significantly higher scores on the ERVT, $F(1, 92)^1 = 28.81$, $MSE = 67.56$, $p < .0001$.

Design. Age (younger vs. older) and instruction (ME vs. MN) were between-participants variables; item-truth feedback (true vs. false vs. no feedback) and distraction (present vs. absent) were manipulated within participants. Six item types were presented to participants: (a) true items

labeled *true* and presented with no distraction, (b) false items labeled *false* and presented with no distraction, (c) true items labeled *true* and presented with distraction, (d) false items labeled *false* and presented with distraction, (e) true items given no label (no item-truth feedback) and presented with no distraction, and finally, (f) false items given no label and presented with no distraction. As mentioned earlier, the design of the study was identical to that used in Gilbert et al. (1990). In that study, a proportion of items were given no label and all of the items were presented without distraction. To maintain continuity, we opted to keep this item type as part of the experimental design. During the test phase, all of the statements from the learning phase were represented along with a set of new items, half of which were true and half of which were false. The task was to identify each statement as new or old and, if old, as true, false, or presented with no feedback (called "blank"), according to information from the Phase 1 of the task.

Materials. Seventy-two moderately plausible trivia statements (e.g., "About four hours are required to boil an ostrich egg.") were selected from the pool of 1,000 developed by Bacon (1979). The false version of each statement was created by changing one detail from the true statement (e.g., "About six hours are required to boil an ostrich egg."). Bacon considered these items moderately plausible if both the true and false versions of the item were rated as true by 40%–60% of the original sample (see Bacon, 1979, for further details). To ensure that the norms were still timely, we had separate groups of participants from each age group rate a subset of the original items.²

Sixty items were used during the learning phase; 12 served as new items during the memory test. Participants saw each of the 60 statements (half in their true version and half in their false version) once during the learning phase. Of the 60 items, 20 were followed by the word *true*, 20 were followed by the word *false*, and 20 were presented without feedback. All feedback was accurate (true items were labeled *true*; false items were labeled *false*). Of the 20 items in each of the 3 feedback conditions, 16 were critical items and 4 were filler items. For half of the true critical items and half of the false critical items (8 items in each condition), participants were distracted by a tone that signaled the participant to hit a predetermined key on the keyboard.

Six counterbalancing orders were created so that across lists, each critical statement appeared twice as a true item (once with distraction, once without), twice as a false item (once with distraction, once without) and twice as a blank item (both times without distraction). The 12 filler items were identical across each counterbalancing order.

A separate test list was constructed for each of the six versions of the study list. Test lists consisted of the 48 critical experimental items from their corresponding study lists, along with 12 new items. Half of the new items were true and half were false. Test items were presented in a computerized random order that varied for each participant.

Procedure. Because older and younger adults have different optimal times of day (e.g., Intons-Peterson, Rocchi, West, McLellan, & Hackney, 1998; May & Hasher, 1998; May, Stoltzfus, & Hasher, 1993; Yoon, 1997), and because performance at different times of day can influence behavior substantially (Intons-Peterson et al., 1998; May et al., 1993; Yoon, 1997), persons from each age group were tested during their respective

¹ One older adult's and 1 younger adult's ERVT scores were lost as a result of experimenter error. Therefore, the means and analyses of the vocabulary data include data from 94 of the 96 participants.

² Ratings were made on a 7-point Likert scale (1 = *definitely false*; 7 = *definitely true*). The mean plausibility ratings of the true and false versions of these statements were 3.95 (SD = 0.39) and 3.93 (SD = 0.38), respectively. These means were collapsed across age, as older and younger adults' ratings did not differ, $F(1, 69) = 1.36$, $MSE = 0.2491$, $p > .20$. There was no difference in plausibility ratings between the true and false items ($F < 1$) nor any Age (old vs. young) \times Item Type (true vs. false) interaction ($F < 1$).

Table 1
Excerpts From Each Instruction Set in Experiments 1 and 2

Memory-emphasis instructions ^a	Memory-neutral instructions
Learning phase	
"In this experiment, we are interested in how good your <i>memory</i> is"	"In this experiment, we are interested in your ability to learn facts"
"If the word <i>true</i> appears on the screen, you will need to <i>remember</i> that the sentence is true; if the word <i>false</i> appears on the screen, you will need to <i>remember</i> that the sentence is false. . ."	"If the sentence is true, then the word <i>true</i> will appear on the screen; if the sentence is false, then the word <i>false</i> will appear on the screen. . ."
"You will be tested on your <i>memory</i> of this information in phase two"	"You will be tested on this information in phase two"
Test phase	
"You need to <i>remember</i> what followed each sentence by: Pressing "T" if you <i>remember</i> that the word true followed the sentence; Pressing "F" if you <i>remember</i> that the word false followed the sentence. . ."	"You need to respond to each sentence by: Pressing "T" if the sentence was true. Pressing "F" if the sentence was false. . ."

^a Words are italicized here for ease of interpretation. They were not deliberately emphasized during the actual experiments.

age group's mean optimal time (1:00 p.m.–5:00 p.m. for younger adults, 8:00 a.m.–11:00 a.m. for older adults). Participants were tested individually on an IBM-compatible computer with either a videographics array or super video graphics array monitor. Because the experiment was programmed using Micro Experimental Laboratory software (Schneider, 1988, 1990), the sentences looked identical on both types of monitors. Participants sat at a comfortable distance from the computer (between 35 and 80 cm).

There were three phases to the experiment: a learning phase, a short distractor task, and a test phase. In the learning phase, each participant saw 60 statements, which appeared one at a time for 6 s followed by 2 s of blank screen. After each sentence disappeared, one of three types of feedback followed: one third of the critical items were followed by the word *true*; one third of the items were followed by the word *false*; and one third of the items were followed by a blank screen (i.e., no feedback about the validity of the item was given). Feedback, or the blank screen, was shown for 3 s.

Half of the items followed by the word *true* or *false* (eight critical true items and eight critical false items) were also followed by a distractor. For these items, a 500-Hz tone sounded 750 ms after the feedback information appeared on the screen and lasted 390 ms. Participants were told to respond to this tone by pressing the 7 key as quickly as possible. To ensure that every participant's hands were the same distance from the 7 key, participants were instructed to place their hands on two drawn hands positioned in front of the computer keyboard.

At the end of the learning phase, all participants completed an unrelated distractor task (solving mazes) for 5 min. During the test phase, the 48 critical items along with 12 new items appeared on the computer screen one at a time in random order. Each sentence remained on the screen until the participant responded by hitting one of four response keys (labeled with a sticker denoting its status) on a computer keyboard to indicate whether an item was true (*D* key), false (*C* key), blank (*K* key, which represented no feedback), or new (*M* key). The test phase was self-paced.

At the end of the session, each participant completed the ERVT, a difficult vocabulary test composed of 48 multiple-choice items.

Instructions. Participants received one of two sets of instructions. Participants receiving the traditional ME instructions were told at the beginning of the experiment that it was a memory task and that their memory would be assessed on the basis of their ability to learn and remember new facts. The procedure of Phase 1 was then described completely. Participants were told that they would need to remember whether a statement was true or false or had been followed by a blank screen. Further, they were told they would be tested on their memory of this information in Phase 2 of the experiment. Participants were also informed that previous research had demonstrated that speed of response to the tone is related to memory ability. Therefore, at various times during the experiment, a tone would sound and participants were to press the 7 key as quickly as possible.

The ME instructions for the test phase reemphasized that the experiment was designed to evaluate memory ability. Participants were instructed to rate each sentence as it appeared during presentation by using one of four responses (true, false, blank, or new) and to use their memory of the information acquired in Phase 1 to make these determinations.

The MN instructions de-emphasized the memorial component of the task and emphasized the general learning and knowledge component of the task. That is, the word *memory* was removed from the instructions as much as possible with the restriction that participants were aware that test performance would be based on information presented in Phase 1 (see Table 1 for relevant excerpts).

Participants receiving MN instructions were told at the beginning of the experiment that this task would assess their ability to learn new facts. The procedure of Phase 1 was then described completely. Participants were told that they would need to learn whether a statement was true or false or was followed by a blank screen. Further, they were told they would be tested on this information in Phase 2 of the experiment. Participants were also informed that previous research had demonstrated that speed of response to the tone is related to the ability to learn new facts.

During the test phase, participants receiving MN instructions were told to rate each sentence as it appeared by using one of four responses (true, false, blank, or new) and to use the information acquired in Phase 1 to make these determinations.

Results

Table 2 displays older and younger adults' accuracy scores (percentage correct) for each of the six item types (distracted true items, distracted false items, nondistracted true items, nondistracted false items, nondistracted blank items, and new items) used in the test phase. The percentage correct for new items was at ceiling (older: $M = 97\%$, $SD = 5\%$; younger: $M = 97\%$, $SD = 12\%$), and these items were eliminated from analysis. Because distraction was nested within true and false items only (i.e., there were no distracted blank items), the following analyses examine these items separately from blank items.³

Accuracy for item types that were learned either with or without distraction was analyzed in a $2 \times 2 \times 2 \times 2$ mixed analysis of variance (ANOVA) with age (older vs. younger) and instruction

³ However, if the items are analyzed together in a 2 (age) $\times 5$ (item type) ANOVA, the pattern of findings is the same.

type (ME vs. MN) as between-subjects factors and item truth (true vs. false) and distraction (present vs. absent) as within-subjects factors.⁴ Overall, younger adults were more accurate at remembering the truth status of the statements than were older adults ($M = 59\%$, $SD = 13\%$ vs. $M = 52\%$, $SD = 15\%$, respectively, for younger and older adults), $F(1, 92) = 7.03$, $MSE = 739.41$, $p < .01$. However, this main effect must be examined in light of a higher order interaction of Age \times Instructions, $F(1, 92) = 5.18$, $MSE = 739.41$, $p < .05$, $d = 0.24$.

To better understand this interaction and because we predicted that age differences would occur with ME instructions but not with MN instructions, we conducted simple effects analyses to examine age differences within each set of instructions. When participants were tested under ME instructions, older adults performed worse than younger adults, $F(1, 46) = 12.8$, $MSE = 700.68$, $p < .001$, $d = 1.04$. However, when participants were tested under MN instructions, older adults' performance was not different from younger adults' performance, $F(1, 46) < 1$, $d = 0.07$ (see Figure 1). Further, power analyses ($\alpha = .05$) suggest that if an age effect for the MN instructions did exist, it would take over 500 participants per age group to have a 50% chance of obtaining a statistically significant difference between the groups (Kraemer & Thiemann, 1987).

As expected, participants performed more accurately without distraction than with distraction ($M = 63\%$, $SD = 17\%$ vs. $M = 48\%$, $SD = 17\%$), $F(1, 92) = 73.38$, $MSE = 285.73$, $p < .0001$. Surprisingly, there was no Age \times Distraction interaction ($F < 2$). Finally, participants remembered the validity of true items better than they remembered the validity of false items ($M = 60\%$, $SD = 18\%$ vs. $M = 53\%$, $SD = 19\%$, respectively), $F(1, 92) = 22.03$, $MSE = 409.99$, $p < .0001$. A marginal Truth \times Instructions interaction, $F(1, 92) = 3.45$, $p = .07$, suggests that the memorial advantage of true items occurred only under the MN instructions. Work in social cognition has commonly shown this advantage for true items (see Gilbert, 1993, for a review), and instructions used in these studies were similar to those used in our MN condition, but not in our ME condition. No other main effects or interactions were significant.

Table 2
Experiment 1: Older and Younger Adults' Mean Accuracy Scores and Standard Deviations (in Percentages) for the Six Item Types Assessed in the Test Phase

Item type	ME instructions (%)				MN instructions (%)			
	Younger		Older		Younger		Older	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
True								
Nondistracted	71	19	60	23	69	17	66	22
Distracted	60	23	46	26	58	18	54	20
False								
Nondistracted	71	19	57	23	51	18	58	25
Distracted	51	21	34	18	44	16	40	19
Blank								
Nondistracted	63	20	66	23	65	18	56	20
New								
Nondistracted	100	2	97	5	93	17	98	5

Note. ME = memory emphasis; MN = memory neutral.

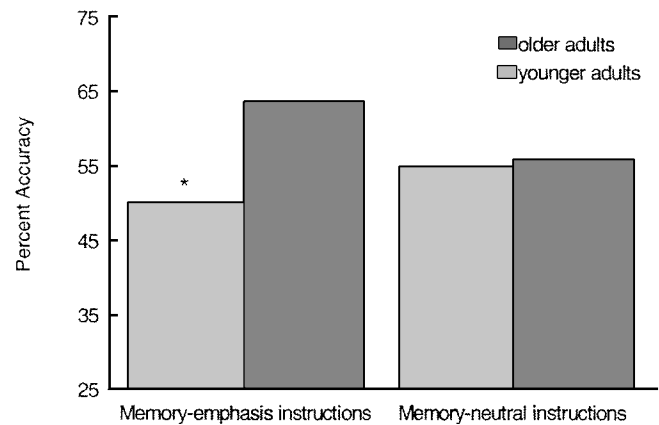


Figure 1. Memory accuracy in Experiment 1 for true and false items as a function of age and instruction type. Asterisk denotes a significant difference ($p < .001$) in accuracy between older and younger adults. Because participants had four options at test, chance responding = 25%.

Blank items (those presented with no accompanying truth information and no distraction) were analyzed separately using a 2 (age) \times 2 (instructions) between-subjects ANOVA. No main effects or interactions were significant. Older and younger adults did not differ in assessing these items ($M = 61\%$, $SD = 22\%$ vs. $M = 64\%$, $SD = 19\%$, respectively), $F(1, 92) < 1$; instructions did not have an overall impact, $F(1, 92) < 1$; and the interaction of Age \times Instructions was not significant, $F(1, 92) = 2.14$, $p = .15$ (see below for further discussion).

Discussion

Younger adults outperformed older adults on a test of memory for truth information when the task used traditional memory instructions. This finding replicates a large body of research that shows age-related differences in performance on explicit memory tasks. However, when the instructions de-emphasized memory, older and younger adults did not differ in their performance on the identical explicit memory test. The lack of age differences on this memory task is in sharp contrast with the large cognitive gerontology literature that consistently demonstrates age differences on direct memory tests.

Although distraction had an overall negative effect on performance, this effect did not differ across age. This finding was initially surprising given that much research supports a general conclusion that distraction influences older and younger adults to different degrees (Kramer & Larish, 1996). However, in the memory literature, when one examines the studies with paradigms similar to the current study (those which examine the impact that distraction at encoding has on recall or recognition performance), the data are mixed and actually favor no differences. That is, distraction at encoding impacts later memory performance for both younger and older adults but often to the same degree (see Anderson, Craik, & Naveh-Benjamin, 1998, for a review).

⁴ Note that inaccurate responses for these types of items were overwhelmingly (89%) a failure to remember the label of the item (true, false, or blank) rather than a recognition error (calling the item new).

One potential problem exists in interpreting the results of this experiment: Younger and older adults did not differ in their accuracy on blank items, which might have been due to differential reliance on *blank* as a response. To assess this, we created an overall "responding blank" score that was based on the proportion of responses labeled *blank*, regardless of accuracy. For each instruction set, these data were submitted to a one-way ANOVA with age as the lone between-subjects variable. When ME instructions were given, older adults rated more items blank than did younger adults ($M = 41\%$, $SD = 16\%$ vs. $M = 27\%$, $SD = 6\%$), $F(1, 46) = 13.85$, $MSE = 152.59$, $p < .001$. However, when MN instructions were given, older adults and younger adults did not differ in rating items blank ($M = 33\%$, $SD = 12\%$ vs. $M = 32\%$, $SD = 10\%$, respectively), $F(1, 46) < 1$. As well, an analysis of the types of errors participants made demonstrated that older adults were more likely than younger adults to incorrectly label a true or false item *blank* under ME instructions, $F(1, 46) = 18.89$, $MSE = 16.15$, $p < .001$, but not under MN instructions ($F < 1$). These analyses suggest that older adults were more uncertain and used the blank response as a default when ME instructions were given but not when MN instructions were given. It is possible that if the *blank* option was eliminated from the design and participants were forced to label an item *true*, *false*, or *new*, a different pattern of findings regarding the accuracy of true and false items might be obtained. We thought it critical to repeat the present experiment preventing any age differences in reliance on *blank* as a response.

Experiment 2

As in Experiment 1, both ME and MN instructions were used; however, blank items were not included in the learning phase and, thus, the blank response was not an option during testing. Assuming performance is determined by the framing of the task, or the way in which instructions about the task impact older versus younger adults, we expected to replicate the critical pattern seen in Experiment 1.

Method

Participants. An additional 56 younger adults and 56 older adults participated in this experiment. Younger adults (M age = 19.32 years, range = 18–24) had an average of 13.17 ($SD = 1.36$) years of education and a mean score of 25.98 ($SD = 6.85$) on the ERVT. Older adults (M age = 67.80, range 60–74) had an average of 16.05 ($SD = 2.39$) years of education and a mean score of 34.86 ($SD = 7.09$) on the ERVT. Older adults had significantly more years of education, $F(1, 110) = 61.04$, $MSE = 3.79$, $p < .0001$, and a significantly higher score on the ERVT than did younger adults, $F(1, 109)^5 = 45.01$, $MSE = 48.66$, $p < .0001$.

Design. The design of this experiment was a $2 \times 2 \times 2 \times 2$ mixed factorial with age (younger vs. older) and instructions (ME vs. MN) as the between-subjects variables and item truth (true vs. false) and divided attention (present vs. absent) as the within-subjects variables. The orthogonal combination of the two within-subjects independent measures resulted in four separate conditions: true items labeled *true* and presented with no distraction, false items labeled *false* and presented with no distraction, true items labeled *true* and presented with distraction, and false items labeled *false* and presented with distraction. Although distraction did not elicit age differences in Experiment 1 in either condition, it remained in the design because we wanted the two experiments to be identical in both instruction and procedure, with the exception of removal of the blank items.

Materials. The materials used in this experiment were nearly identical to those used in Experiment 1 with the following exceptions. Of the 72

Table 3

Experiment 2: Older and Younger Adults' Mean Accuracy Scores and Standard Deviations (in Percentages) for the Five Item Types Assessed in the Test Phase

Item type	ME instructions				MN instructions			
	Younger		Older		Younger		Older	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
True								
Nondistracted	84	14	78	17	84	14	79	15
Distracted	76	16	73	21	80	16	76	19
False								
Nondistracted	75	17	66	21	77	13	73	22
Distracted	68	17	57	22	67	21	61	20
New								
Nondistracted	98	6	94	9	97	4	94	13

Note. ME = memory emphasis; MN = memory neutral.

items, 52 were used during the study phase; the remaining 20 served as new items during the memory test. Forty of the 52 study items were critical items, and the remaining 12 items served as filler items. Each statement appeared once in each of the experimental conditions, resulting in four separate counterbalancing orders.

A separate test list was constructed for each of the four versions of the study lists. Test lists consisted of the 40 experimental items from the corresponding study lists along with 20 new items. Half of the new items were true and half were false. Test items were presented in a computerized random order that varied for each participant.

Procedure. The instructions and procedures of this experiment were identical to those of Experiment 1 except for differences necessitated by eliminating blank items. During the learning phase of this experiment, half of the critical items were followed by the word *true* and half of the items were followed by the word *false*. During the test phase, the response options were *true* (D key), *false* (C key), and *new* (M key); no *blank* response option was available.

Results and Discussion

Table 3 displays older and younger adults' accuracy scores. Overall, performance in this experiment was higher than in Experiment 1.⁶ Percentage correct for new items was, as before, at ceiling (older: $M = 94\%$, $SD = 11\%$, younger: $M = 97\%$, $SD = 5\%$) and again these items were eliminated from further analyses.

Because we predicted that age differences would occur with ME instructions but not with MN instructions, we conducted planned comparisons, identical to the simple effects analyses in Experiment 1, to examine age differences within each set of instructions. When participants were tested under ME instructions, older adults performed worse than did younger adults, $F(1, 54) = 6.03$, $MSE = 5.10$, $p < .02$, $d = 0.65$. However, when participants were tested under MN instructions, older adults' performance did not

⁵ One younger adult's ERVT score was lost as a result of experimenter error. Therefore, the means and analyses of the vocabulary data include data for 111 of 112 participants.

⁶ As in Experiment 1, inaccurate responses for true and false items were most often (88%) a failure to remember the label of the item (*true* or *false*) rather than a recognition error (calling the item *new*).

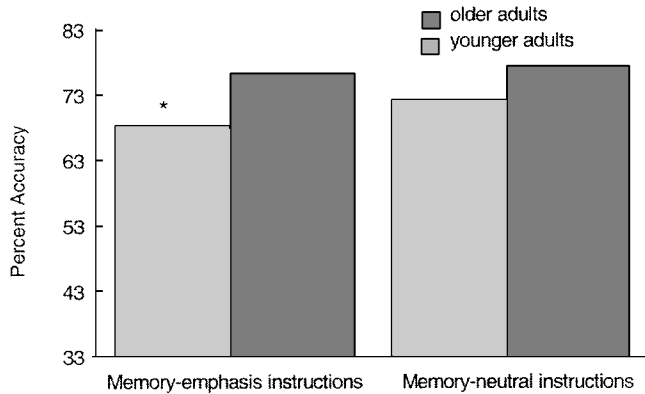


Figure 2. Memory accuracy in Experiment 2 for true and false items as a function of age and instruction type. Asterisk denotes a significant difference ($p < .05$) in accuracy between older and younger adults. Because participants had three options at test, chance responding = 33%.

differ from younger adults' performance, $F(1, 54) = 2.16, p = .15, d = 0.38$ (see Figure 2). Although this effect size is somewhat larger than the effect size obtained for the MN instructions in Experiment 1, power analyses suggest that enough participants were tested to be 80% confident that a statistically significant difference did not exist between the two age groups (see Kraemer & Theimann, 1987). These data indicate that the age pattern obtained in Experiment 1 was not due to a differential bias to use the blank response but instead was representative of performance under different instructions. The older adults were disadvantaged relative to the younger adults when instructions emphasized memory but were not so when instructions de-emphasized memory.

General Discussion

Two experiments assessed whether the framing of a memory task differentially affects the ability of younger and older adults to remember newly acquired information. Both experiments contrasted performance by using traditional memory instructions (which emphasized the memorial nature of the task) and nontraditional instructions (which de-emphasized the memorial component of the task). In Experiment 1, age differences in identification (correctly labeling true items *true* and false items *false*) occurred only when ME instructions were used. This finding was replicated in Experiment 2.

These results suggest the possibility that typical laboratory studies of explicit memory (which use the word *memory* throughout the instructions) may exaggerate true age differences in memory performance. These findings are consistent with other research areas that demonstrate reductions or elimination of age differences on memory tests when the mention of *memory* is decreased or removed from the instructions to participants. For example, age differences on implicit memory tests, tests in which the word *memory* is never mentioned, can be negligible or even absent (see Fleischman & Gabrieli, 1998, for a review). Similarly, age differences on incidental memory tests, in which participants are not informed of the upcoming memory test until immediately preceding the administration of the memory test, are often attenuated or

eliminated relative to differences on identical intentional memory tests (see Perlmutter & Mitchell, 1982, for a review).

Although these data support the above conclusion, they do not address an important, related issue: How do instructions preceding memory tasks influence age differences on memory performance? Several mechanisms that could explain the results of instructional manipulations are discussed below. Although we describe these possibilities in separate sections, respecting the boundaries in the literature, we do not suggest that these potential mediators are mutually exclusive.

Spontaneous and Effective Use of Strategies

In a review of strategy training techniques for older adults, West (1995) pointed out that although older adults can be taught effective memory strategies, they don't spontaneously generate them nearly as often as do younger adults. Bandura (1977, 1986) suggested that when people do not believe they can do well at a task, their ability to use effective strategies for that task is diminished. As mentioned in the introduction, relative to younger adults, older adults believe they will do poorly on memory tests. It follows that they may not use effective encoding or retrieval strategies when they are in situations in which they are very aware their memory is being tested. Additionally, Mitchell and Perlmutter (1986) posited that younger adults, who are often faced with memory tests as part of their educational lives, may use better strategies when they believe they will be taking a memory test than when they do not believe so.

Indeed, similar findings in the incidental versus intentional memory literature are often explained using a production deficiency hypothesis (Craik, 1977). That is, when knowledge of an upcoming memory test is available, younger adults are more likely than older adults to spontaneously use effective encoding strategies, which may lead to age differences in performance. Older adults are capable of using effective strategies but are less likely to spontaneously do so when given intentional memory instructions (Kausler, 1991; Perlmutter & Mitchell, 1982).

With regard to the present experiments, it may be that when presented with instructions that do not emphasize memory, older adults generate and use strategies similar to those used by younger adults to encode the information, and consequently, the two groups perform similarly on a subsequent memory test. However, when told that the task is a memory task, the two cohorts generate different strategies, based on different beliefs, motivation, or other experiential factors, which then lead to differences in memory performance. Future experiments should investigate whether the source of age differences under memory instructions is due to a superiority of younger-adult strategies, a deficiency in older-adult strategies or both.

"Memory" as an Activator of Negative Age-Related Stereotypes

The data in these studies are also quite consistent with research examining the relationship between stereotype activation and performance. Research on stereotype threat (e.g., Aronson, Quinn, & Spencer, 1998; Steele, 1997) suggests that group differences in task performance can be influenced by the wording in the instructions preceding the task. These researchers argue that the use of

negatively stereotypical words in an instructional set may activate that stereotype during task performance. If a participant is a member of the stereotyped group, then this activation contributes to performance (usually resulting in a relatively poor performance); if a participant is not a member of the stereotyped group, then this activation does not contribute to performance (e.g., Aronson et al., 1998). According to this argument, it follows that the quality of the testing environment is equal across groups when a negative stereotype is not activated but is unequal when that stereotype is activated.

In Western culture, a negative stereotype about aging and memory decline exists (e.g., Ryan, 1992). With respect to the current experiments, the stereotype threat hypothesis predicts that the ME instructions are likely to activate negative stereotypes about aging and memory, thereby creating a different testing situation for older and younger adults. The MN instructions, however, controlled differential stereotype activation and so may have provided a better environment for detecting true differences between the groups. Because we did not measure stereotype activation in the present studies, we cannot determine whether the ME instructions activated negative age-related stereotypes to a larger degree than did the MN instructions. Future studies in which stereotype activation is measured under different instructional manipulations should provide the data needed to support or reject this hypothesis.

Memory Self-Efficacy

The current findings are also consistent with research investigating age differences in beliefs about memory abilities. Self-efficacy research examines the relationship between performance on a task and a person's confidence in their ability to complete the task (Bandura, 1986). The term *self-efficacy* is used to underscore the fact that an individual's performance may vary as the result of personal beliefs about performance ability. Researchers argue that self-efficacy influences motivation, strategy selection and usage, and effort, which subsequently impact performance (e.g., Berry, 1999; Cavanaugh & Green, 1990).

Older and younger adults have different expectations regarding their memory ability. The memory self-efficacy literature has clearly demonstrated that younger adults believe their memories are better than do older adults (see Hertzog, Lineweaver, & McGuire, 1999, for a review). If beliefs about performance affect performance (e.g., Berry, 1999), then it makes sense that younger adults would outperform older adults on a task in which the instructions emphasized memory. For this hypothesis to remain viable within the current context, however, one would need to demonstrate that beliefs about performance in the MN condition were equivalent across age. To assess this possibility, we asked a separate group of 45 older ($n = 25$) and younger ($n = 20$) participants to rate how well they thought their age group would perform on a "test of memory" and to rate how well they thought their age group would perform on a "test of knowledge." Each question was followed by an 11-point Likert scale ranging from 0 (*not well at all*) to 10 (*very well*). We assessed beliefs about knowledge because, as a result of their wording, the MN instructions were likely to be perceived as focusing on learning and knowledge. Planned comparisons demonstrated that when participants predicted their age group's performance on a memory test, older adults rated their abilities significantly lower than did younger adults ($M = 4.88$, $SD = 1.78$ vs. $M = 7.50$, $SD = 1.47$),

$F(1, 43) = 27.88$, $MSE = 2.74$, $p < .001$. However, when participants predicted their age group's performance on a knowledge test, older adults' ratings did not differ from younger adults' ratings ($M = 7.00$, $SD = 1.55$ vs. $M = 6.55$, $SD = 1.76$), $F(1, 43) < 1$. This is the same pattern observed in Experiments 1 and 2: Age differences were found when instructions emphasized memory but not when instructions emphasized learning and knowledge.

These data add credence to a self-efficacy-as-mediator hypothesis. Older and younger adults differ in their beliefs about memory but not in their beliefs about all cognitive abilities. Consequently, instructions focusing on different components of a task might elicit age-related differences in beliefs about performance on that task, which could mediate performance. However, certain limitations to this conclusion are warranted. First, the participants who answered the beliefs questionnaire did not participate in either Experiments 1 or 2. Although generalizations from these data to the population are promising, future research using a within-subjects design (the same participants would answer the beliefs questionnaire and complete the memory task) would more fully test this hypothesis. Second, we assumed that people in the MN-instructions condition viewed the task as a learning and knowledge task. This makes sense given the wording in the instructions, but participants in Experiments 1 and 2 were never asked, post hoc, what they perceived the task to actually measure. Future studies using similar manipulations should assess participants' postexperimental beliefs of what type of test they were taking as a validity check for the manipulation.

Conclusions

The present findings suggest that age differences on at least one explicit, episodic memory task can vary as a function of the instructions that set the context or frame the tasks. Specifically, the data show that emphasizing memory (or not doing so) during the testing situation can impact the detection and size of age differences in memory performance.

Several limitations in the current experiments exist that must be addressed before we can better understand the nature, strength, and generalizability of these findings. First, the ME instructions accentuate the memorial component of the task through repeated use of the words *memory* and *remember*. The memory language used in most laboratory studies may not always be quite so strong. It is important to learn whether more subtle instructional manipulations will create the same effects. Second, our memory tasks and stimuli differed from those typically used in memory research. Our materials were highly salient, novel trivia facts (e.g., "James Garfield had the largest shoe size of any U.S. president"). We chose these materials because they were easily amenable to our intended instructional manipulations. However, it is difficult to know whether memory for less salient information such as simple word lists will demonstrate similar instructional effects, although the incidental memory literature could be taken to suggest so. Additionally, although our paradigm (the truth-judgment task) was ideal for instructional manipulation, it is not one traditionally used in the memory domain. Consequently, it is unclear whether similar instructional manipulations will affect performance on more standard memory tests (e.g., list recall), which typically show age differences. Nonetheless, the generality and extent to which in-

structional manipulations affect the performance of older and younger adults needs further research.

Finally, although we suggest that these manipulations may be creating different psychological environments for older and younger adults under some, but not all, situations, we do not propose that age differences in memory are completely driven by environmental variables. We do, however, believe that situational variables need to be considered when designing studies investigating age differences in performance. These variables are not limited only to wording in instructions; laboratory names, advertisements for recruiting participants, consent forms, and other materials in the laboratory may also contain triggers that could affect experimental findings.

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