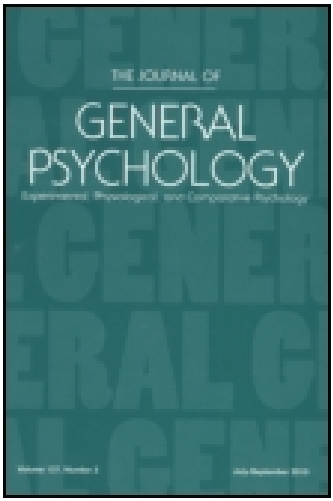

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Influences of Age, Performance, and Item Relatedness on Verbatim and Gist Recall of Verb-Noun Pairs

Julie L. Earles [a] , Alan W. Kersten [a] , Jennifer M. Turner [b] & Josephine McMullen [b]

[a] Department of Psychology , Florida Atlantic University

[b] Department of Psychology , Furman University

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Influences of Age, Performance, and Item Relatedness on Verbatim and Gist Recall of Verb–Noun Pairs

JULIE L. EARLES
ALAN W. KERSTEN
Department of Psychology
Florida Atlantic University
JENNIFER M. TURNER
JOSEPHINE McMULLEN
Department of Psychology
Furman University

ABSTRACT. Age differences in adults' memory for performed actions (e.g., wave hand) are sometimes smaller than age differences in memory for nonperformed phrases. In this study, we examined the conditions under which performance reduces age differences in recall. Younger and older adults performed or read verb–noun phrases that were either related (e.g., actions performed in a kitchen) or unrelated. Performance did not reduce age differences in recall of the exact verbs and nouns used to describe an action, but performance did reduce age differences in memory for the gist of related actions. Older adults especially had difficulty recalling the exact verb used to describe the action. These results suggest that older adults may have better memory for actions than is revealed by tests of verbatim recall. They may remember performing the action but not remember the exact words used to describe the action.

IT HAS BEEN SUGGESTED that age differences in adults' memory for performed phrases (e.g., break stick) are sometimes smaller than age differences in memory for nonperformed phrases (Kausler & Lichty, 1988; Nyberg, Nilsson, & Bäckman, 1992). In such studies, participants perform or read (but do not perform) a series of brief action phrases, and they are later asked to recall the action phrases. Bäckman and Nilsson (1984, 1985) suggested that there were no age dif-

This research was supported by a Research and Professional Growth Grant from Furman University.

Address correspondence to Julie L. Earles, Department of Psychology, Florida Atlantic University, Boca Raton, FL 33431-0991; e-mail: jearles@fau.edu.

ferences in memory for performed items, in contrast to large age differences in memory found for nonperformed items. Most studies, however, have indicated that younger adults have better memory for performed actions than do older adults (e.g., Earles, 1996; Earles & Coon, 1994; Earles & Kersten, 1998; Kausler & Hakami, 1983).

Age differences are, in fact, not always smaller for performed items than for nonperformed items. Earles (1996) found no evidence that age differences in memory for performed cognitive activities (e.g., psychometric tests of intelligence) and performed brief actions (e.g., wave hand) were smaller than age differences in memory for nonperformed items. Our purpose in the current study was to examine the conditions in which performance reduces age differences in recall.

Recall Differences

Verbatim and Gist Recall

One important variable that may influence age differences in the effects of performance is the specificity of recall. McDowd and Botwinick (1984) reported that age differences were smaller for gist recall than for verbatim recall of nonperformed items. Thus, age differences are larger when participants are required to recall the exact words presented at encoding.

The difference between verbatim and gist recall may be larger for performed than for nonperformed items. Participants may recall performing the action but not recall the specific words used to describe the performed action. In the current study, this inability to recall the specific words for a performed action was hypothesized to occur more often for older than for younger adults. Thus, it was predicted that age differences would be smaller for performed items than for nonperformed items when gist rather than verbatim recall was required.

Older adults were expected to have particular difficulty remembering the specific verb used to describe an action. This difficulty in remembering specific verbs was expected because many different verbs can be used to describe the same action (Huttenlocher & Lui, 1979; Kersten & Billman, 1997). For example, some verbs refer to the outcome of an action, others refer to the particular motions involved in that action, and still others refer to the instruments used to carry out the action (Behrend, 1990). Thus, if an older adult was asked to perform the phrase "pinch clothespin" at encoding, he or she might later remember performing that action but might not remember if the specific verb that was used referred to the outcome (e.g., "open"), the action (e.g., "squeeze"), or the instruments involved (e.g., "pinch," in other words, to hold something between the fingers).

In contrast to verbs, a particular noun tends to be strongly preferred as the label for a particular object (Rosch, Mervis, Gray, Johnson, & Boyes-Braem, 1976). As a result, in this study participants were expected to have little difficul-

ty remembering which noun was used to describe the object involved in an action. Thus, when a participant has some memory for performing an action and is unable to recall the specific words used to describe the action, he or she is likely to be able to reconstruct the noun but not the verb.

Item Relatedness

Another possible factor that may be important in determining age differences in activity memory is the interrelatedness of the items. When a person performs an action, the action is often performed within a series of related actions. Engelkamp, Zimmer, and Mohr (1990) and Helstrup (1989), however, found an effect of relatedness on memory for nonperformed items but not for performed items. Helstrup (1996) did find effects of relatedness on both performed and nonperformed items when items were closely integrated within a story. Thus, performed actions may need to be well integrated within a context in order for memory to be enhanced by item relatedness.

Craik and Jennings (1992) suggested that when contextual cues are highly related to to-be-remembered items, older adults benefit more from these cues than do younger adults. Earles, Smith, and Park (1994) found that recall of nouns was improved by the supportive context of a sentence at least as much for older as for younger adults. Park, Smith, Morrell, Puglisi, and Dudley (1990) found that when context was well integrated with pictures that were to be remembered, this context improved the memory of older more than younger adults. Thus, for nonperformed items, providing contextual cues that are related to items that are to be remembered can reduce age differences in recall. This reduction in age differences may occur because the participants do not need to rely on self-generated memory strategies.

As with nonperformed items, item relatedness may be important to age differences in memory for performed items. Norris and West (1993) compared age differences on two lists of actions, one that could be categorized easily into four groups (i.e., actions with the face, hands, legs, and torso) and one list that contained items that did not fall into distinct categories. They found that older adults recalled organizable actions better than they recalled unorganizable actions, whereas there was no effect of organization on recall by younger adults. Thus, item relatedness improved the memory performance of the older adults.

In the present study, we examined the possibility that item relatedness may influence the effects of performance on age differences in recall. The participants were given either items that were related (e.g., actions that could be performed in a kitchen) or items that were unrelated (e.g., one item from a kitchen and one from an office). Younger adults often show no benefit from organization of performed actions. Therefore, it was expected that the older adults' memory would benefit more from item relatedness than would the younger adults', especially when items were performed. Older adults may depend on the structure provided by item relatedness.

When Does Performance Reduce Age Differences?

We hypothesized that performance would reduce age differences in memory when older adults were not required to recall the exact words used to describe an action, because older adults remember the action itself better than the words used to describe the action. If the older adults did remember performing an action, they were then expected to have more difficulty reconstructing the specific verbs from the phrases than the specific nouns, because many verbs can be used to describe the same action. We also hypothesized that performance would reduce age differences when items were related. The older adults were expected to benefit from item relatedness when they attempted to recall performed actions because they need the additional structure provided by relatedness, whereas the younger adults were not expected to benefit from relatedness.

Method

Participants

The participants were 48 undergraduate students from Furman University (18–25 years old) who received course credit, and 48 community-dwelling older adults (60–80 years old) who were paid $10 for their participation. Participant characteristics are shown in Table 1. The older adults had significantly more years of education than did the younger adults, $F(1, 94) = 5.56$, $MSE = 28.17$, $p < .05$, and significantly higher vocabulary scores, $F(1, 94) = 6.19$, $MSE = 104.17$, $p < .05$. There was no significant age difference in self-ratings of health, $F(1, 94) = 2.36$, $MSE = 1.50$, $p > .05$. The older adults, however, reported taking significantly more medications than did the younger adults, $F(1, 94) = 37.73$, $MSE = 88.17$, $p < .05$.

TABLE 1
Participant Characteristics

	Younger		Older	
Item	*M*	*SD*	*M*	*SD*
Age (years)	19.04	1.18	70.23	6.78
Education	13.58	1.09	14.67	2.99
Vocabulary	31.77	3.23	33.85	4.82
Health	3.54	0.80	3.29	0.80
Medications	0.33	0.69	2.25	2.05

Note. Education = number of years of education. Vocabulary = number correct out of 40 on the Shipley (1986) vocabulary test. Health = participants' ratings of health on a scale of 1 (*poor*) to 4 (*excellent*). Medications = number of prescription medications currently being taken.

Materials

Half of the participants received four lists of related items, and half received four lists of unrelated items (see Appendix). For the related items, each of the four corners of a room simulated a different context: a kitchen, a dressing room, an office, and a tool shop. There were 16 verb–noun phrases that could be performed in each context. For example, in the kitchen, participants were asked to polish a fork and stack plates.

Thus, there were four lists of 16 related actions, one list for each context. The participant moved to a different corner of the room for each list. For example, the participant sat in the kitchen corner for the kitchen list and the office corner for the office list. Thus, both the list construction and the encoding environment contributed to the relatedness of the related items.

The unrelated items were presented in a neutral room that was furnished with a large table and eight chairs. The four lists of 16 unrelated action phrases were formed by mixing the items from the four lists of related actions. Each unrelated set of actions contained four verb–noun pairs from each related set of actions. The items in each list were presented in the same randomly selected order for all participants.

The participants performed a distractor task between presentation and recall. This task was performed in a waiting room that contained a small table and one chair. The distractor task was the Letter Comparison task developed by Salthouse and Babcock (1991). Participants received pairs of letter strings that were made up of three, six, and nine letters. They were asked to write an *s* on a line between the pairs if they were the same, and a *d* on the line if they were different. Participants were given 30 s for the task.

Procedure

The participants were tested individually. Half of the participants received the four lists of related verb–noun pairs in the context room, and half received the four lists of unrelated verb–noun pairs in the neutral room. The participants were instructed to remember the items for later recall. The order of list presentation was completely counterbalanced. Thus, there were 24 presentation orders for the related items and 24 for the unrelated items.

Each participant performed two lists of action phrases and read, but did not perform, the other two lists. For 12 presentation orders (chosen at random from the 24 possible orders), the participants performed the first and third lists and read the second and fourth lists. In the other 12 presentation orders, the participants read the first and third lists and performed the second and fourth lists. When an action required an object, that object was handed to the participant by the experimenter. Each action phrase was presented to the participants on a card for 10 s.

After the presentation of each list, the participant was taken to the waiting

room, where he or she performed the distractor task for 30 s. Half of the participants (chosen at random) for each combination of presentation order and performance order were then taken to the room where they had encoded the word pairs (i.e., participants who had encoded the items in the context room were taken back to the context room, and those who had encoded the items in the neutral room returned to the neutral room), and half were taken to the other room (i.e., participants who had encoded the items in the context room were taken to the neutral room and vice versa). The participants were then given 3 min to recall the items from the list. None of the objects that were used for the actions were present in the room during recall.

Results

Verbatim Recall

The data were originally scored for verbatim recall. Thus, an item was scored as correct if the participant recalled both the exact verb and the exact noun from the action phrase. An item was also scored as correct if the participant recalled both the noun and verb but changed the tense of the verb. Some participants changed the phrases into the past tense. The mean number of pairs from both lists recalled by younger and older adults in each condition are reported in Figure 1.

A 2 (age: younger vs. older) × 2 (performance: perform vs. read) × 2 (item relatedness: related vs. unrelated) × 2 (retrieval context: same vs. different) analysis of variance (ANOVA) was conducted. The younger adults recalled significantly more verb–noun pairs than the older adults did, $F(1, 88) = 137.20$, $MSE = 27.23$, $p < .001$. The participants recalled significantly more performed items than nonperformed items, $F(1, 88) = 82.44$, $MSE = 10.99$, $p < .001$. The participants who received the related verb–noun pairs recalled significantly more pairs than did those who received the unrelated pairs, $F(1, 88) = 6.13$, $MSE = 27.23$, $p = .015$. There was no significant main effect of retrieval context, $F(1, 88) < 1$, and there were no significant interactions involving retrieval context, all Fs < 1. Because there were no effects of retrieval context, this variable was dropped from further analyses.

As predicted, there was no significant interaction of age and performance, $F(1, 88) < 1$. There was a significant interaction of performance and item relatedness, $F(1, 88) = 4.84$, $MSE = 10.99$, $p = .030$. For nonperformed items, related items ($M = 15.58$, $SD = 7.15$) were recalled significantly better than unrelated items ($M = 12.67$, $SD = 5.18$), $F(1, 94) = 5.23$, $MSE = 39.03$, $p = .024$. For performed items, there was no significant effect of relatedness on memory, $F(1, 94) < 1$. The participants recalled an average of 18.88 ($SD = 6.11$) related items and 18.06 ($SD = 6.13$) unrelated items. The only other interaction that approached significance was the three-way interaction of age, performance, and item relatedness, $F(1, 88) = 3.27$, $MSE = 10.99$, $p = .074$.

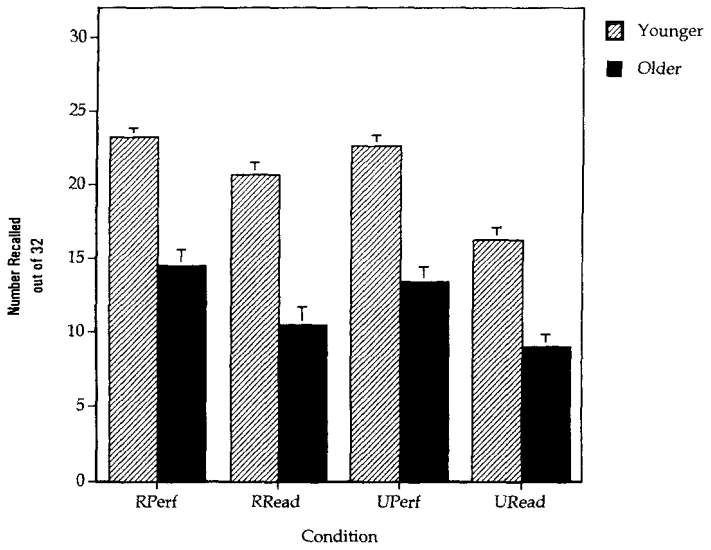

FIGURE 1. Average number of verb–noun pairs from the two lists recalled verbatim by younger and older adults. RPerf = related performed items, RRead = related nonperformed items, UPerf = unrelated performed items, URead = unrelated nonperformed items. The bars represent standard errors.

Gist Recall

The data were also scored for gist recall. The participant was given credit for the item if he or she reported a verb–noun pair that approximated the meaning conveyed by one of the presented verb–noun pairs. The mean numbers of items recalled by the younger and older adults based on this measure are reported in Figure 2.

A 2 (age: younger vs. older) × 2 (performance: perform vs. read) × 2 (item relatedness: related vs. unrelated) ANOVA was conducted. The younger adults recalled significantly more items than the older adults did, $F(1, 92) = 111.41$, $MSE = 23.63$, $p < .001$. The participants who received related items recalled significantly more than those who received unrelated items, $F(1, 92) = 9.81$, $MSE = 23.63$, $p = .002$, and performed items were recalled significantly better than nonperformed items, $F(1, 92) = 186.38$, $MSE = 8.98$, $p < .001$. Unlike verbatim recall, there was a significant interaction of age and performance, $F(1, 92) = 6.15$, $MSE = 8.98$, $p = .015$. There was no significant interaction of age and item relatedness, $F(1, 92) < 1$, but there was a significant interaction of item relatedness and performance, $F(1, 92) = 5.68$, $MSE = 8.98$, $p = .019$.

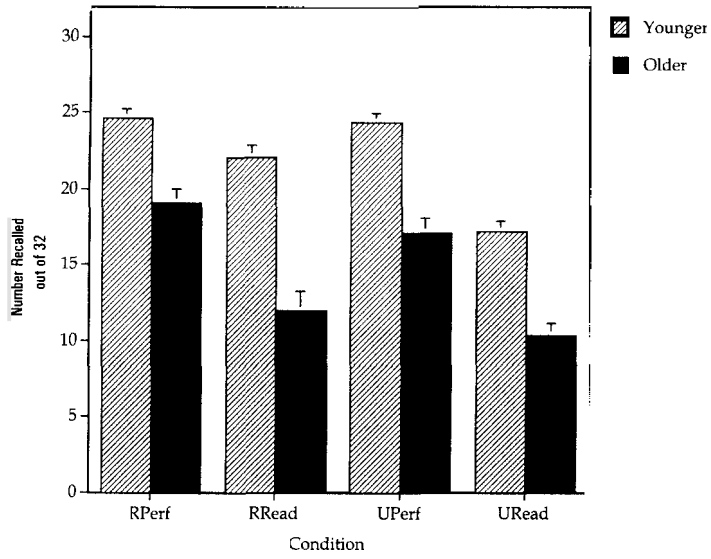

FIGURE 2. Average number of verb–noun pairs from the two lists recalled under gist criteria by younger and older adults. RPerf = related performed items, RRead = related nonperformed items, UPerf = unrelated performed items, URead = unrelated nonperformed items. The bars represent standard errors.

There was also a significant three-way interaction of age, performance, and item relatedness, $F(1, 92) = 8.49$, $MSE = 8.98$, $p = .004$. Thus, the interaction of age and performance varied with item relatedness. For those participants who received related items, there was a significant interaction of age and performance, $F(1, 46) = 15.10$, $MSE = 8.65$, $p < .001$. There was a significant effect of age on memory for both the related performed items, $F(1, 46) = 30.54$, $MSE = 11.71$, $p < .001$, and the related nonperformed items, $F(1, 46) = 49.78$, $MSE = 24.71$, $p < .001$. The effect of age, however, was smaller for the related performed items than for the related nonperformed items. For related performed items, the younger adults recalled an average of 24.58 items ($SD = 2.86$), and the older adults recalled an average of 19.13 items ($SD = 3.90$). For related nonperformed items, the younger adults recalled an average of 22.04 items ($SD = 3.58$), and the older adults recalled an average of 11.92 items ($SD = 6.05$).

For those participants who received unrelated items, there was no significant interaction of age and performance, $F(1, 46) < 1$. For unrelated performed items, the younger adults recalled an average of 24.29 items ($SD = 2.90$), and the older adults recalled an average of 17.08 items ($SD = 4.74$). For unrelated nonper-

formed items, the younger adults recalled an average of 17.17 items ($SD = 3.57$), and the older adults recalled an average of 10.33 items ($SD = 3.75$).

We predicted that the three-way interaction of age, performance, and item relatedness would occur because there would be a significant effect of item relatedness for performed items for the older adults but not for the younger adults. Contrary to this prediction, there was no significant effect of item relatedness on memory for performed actions for either younger adults, $F(1, 46) < 1$, or older adults, $F(1, 46) = 2.66$, $MSE = 18.84$, $p = .11$. Instead, the interaction occurred because the younger adults recalled significantly more related than unrelated nonperformed items, $F(1, 46) = 22.30$, $MSE = 12.79$, $p < .001$, whereas item relatedness did not matter for the older adults, $F(1, 46) = 1.19$, $MSE = 25.33$, $p = .28$. Thus, age differences were smaller for performed than for nonperformed related items because item relatedness facilitated the younger adults' recall of nonperformed items, whereas it did not facilitate the older adults' recall.

Noun and Verb Substitutions

For gist recall, the participants were given credit for an item if the reported verb–noun pair approximated the meaning conveyed by the original verb–noun pair. Sometimes, participants substituted for the original verb a new verb that could be used to describe the same action, and sometimes they substituted a new noun for the original noun. The number of noun substitutions and verb substitutions for each condition are reported in Figure 3.

To determine whether the difference between verbatim and gist recall was primarily attributable to the substitution of the noun or the verb, we conducted a 2 (age: younger vs. older) × 2 (performance: perform vs. read) × 2 (item relatedness: related vs. unrelated) × 2 (word type: substitution of noun vs. substitution of verb) ANOVA. The younger adults made significantly fewer substitutions than the older adults did, $F(1, 92) = 41.80$, $MSE = 1.33$, $p < .001$, and significantly more substitutions were made for performed pairs than for nonperformed pairs, $F(1, 92) = 57.38$, $MSE = 1.10$, $p < .001$. There were significantly more verb substitutions than noun substitutions, $F(1, 92) = 60.91$, $MSE = 1.21$, $p < .001$. There was no significant effect of relatedness, $F(1, 92) = 2.54$, $MSE = 1.33$, $p = .114$.

There was a significant interaction of age and performance, $F(1, 92) = 32.83$, $MSE = 1.10$, $p < .001$. There was also a significant interaction of age, performance, and relatedness, $F(1, 92) = 4.16$, $MSE = 1.10$, $p = .044$. The older adults made significantly more substitutions for performed than for nonperformed items both when items were related, $F(1, 23) = 32.81$, $MSE = 4.17$, $p < .001$, and when they were unrelated, $F(1, 23) = 31.52$, $MSE = 2.07$, $p < .001$. For the younger adults, there was no significant effect of performance on substitutions for either related, $F(1, 23) < 1$, or unrelated pairs, $F(1, 23) = 3.86$, $MSE = 1.75$, $p = .062$, although the effect of performance approached significance for unrelated pairs.

The only other significant effect was the three-way interaction of age, per-

formance, and word type, $F(1, 92) = 4.15$, $MSE = 1.11$, $p = .045$. For the younger adults, there was no significant effect of performance, $F(1, 47) = 2.82$, $MSE = 1.33$, $p = .10$. The older adults, on the other hand, made significantly more substitutions for performed than for nonperformed items for both nouns, $F(1, 47) = 22.98$, $MSE = 1.18$, $p < .001$, and verbs, $F(1, 47) = 36.22$, $MSE =$

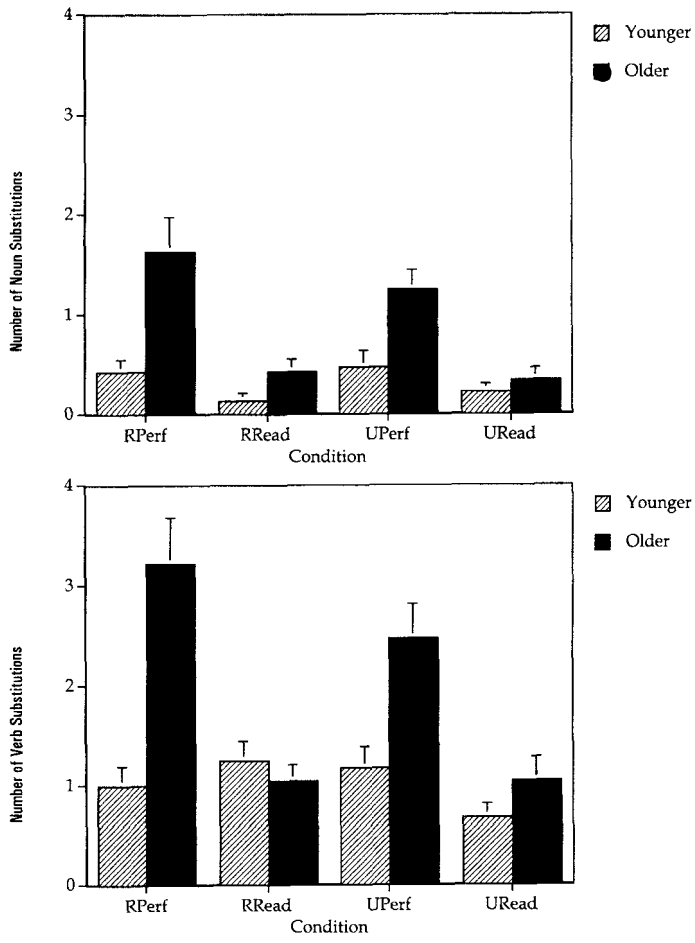

FIGURE 3. Number of noun substitutions and number of verb substitutions for each condition. RPerf = related performed items, RRead = related nonperformed items, UPerf = unrelated performed items, URead = unrelated nonperformed items. The bars represent standard errors.

2.13, $p < .001$. The effect of performance, however, was larger for verbs than for nouns.

Discussion

As has been found in other studies (e.g., Earles, 1996; Kausler & Hakami, 1983), memory for performed activities was found to be better for younger than for older adults. This is important because memory for activities that have been performed, such as sending a letter or locking a door, is essential for successful everyday functioning.

Although younger adults remember performed activities better than older adults, some studies have revealed that age differences are sometimes smaller for performed than for nonperformed items (e.g., Nyberg et al., 1992). Earles (1996), however, found equally large age differences for the two types of items. It is thus important to determine the conditions under which performance reduces age differences in recall.

Verbatim and Gist Recall

The results of the present study revealed that the extent to which performance reduces age differences in recall depends on the way memory is measured. When verbatim recall of the verb–noun phrases that described the actions was used as a dependent measure, age differences in recall of performed verb–noun phrases were not significantly larger than age differences in recall of nonperformed verb–noun phrases. When recall of the gist of a verb–noun phrase was instead used as a dependent measure, however, age differences for related verb–noun pairs were smaller when those pairs were performed than when those pairs were not performed.

When older adults were able to recall the gist of an action, they often had difficulty remembering the particular verb–noun pair that was used to describe that action. Younger adults were better at remembering the specific verb and noun that were used to describe each action. Thus, the difference between verbatim recall and gist recall of performed actions was much larger for the older than for the younger adults. When verbatim recall was used, performance did not reduce age differences in recall because performance did not enhance memory for the exact verb and noun any more for older than for younger adults. When gist recall was used, however, performance reduced age differences in recall because even when older adults did not recall the exact verb–noun pair, they often remembered something about the action.

Even when older adults had some memory for an action, they had difficulty remembering the particular verb used to describe that action. The older adults were more likely to substitute a new verb for the original verb than were the younger adults. This difficulty in remembering verbs may occur because many different verbs can be used to describe the same action (Huttenlocher & Lui,

1979). Thus, even when older adults remembered performing an action, they may have had to choose from a number of different verbs when trying to reconstruct the verb–noun phrase that was used to describe that action. In contrast to verbs, a particular noun tends to be preferred as the label for a particular object (Rosch et al., 1976), and thus participants may have been better at reconstructing the noun used in the description of an action.

Item Relatedness

Most activities are not performed in isolation; rather, they are performed as a series of related acts. As has been found in previous studies (e.g., Engelkamp et al., 1990; Helstrup, 1989), item relatedness did not improve memory for performed items in the present study. This was true for both younger and older adults.

When items were related, however, performance reduced age differences in gist recall. This occurred because item relatedness improved memory for nonperformed items for the younger adults, but not for the older adults. In fact, the younger adults remembered related verb–noun pairs almost as well when they were not performed as when they were performed, suggesting that the younger adults may have used alternative memory strategies to remember the related nonperformed items. The performance of an action may have reduced the ability of the younger adults to use these strategies. Thus, the effects of performance and relatedness were not additive.

In contrast to the younger adults, the older adults remembered performed items much better than nonperformed items, when they were both related and unrelated. This finding suggests that performance of an action by older adults results in an enduring memory trace of that action that does not occur when items are not performed. In contrast, item relatedness did not improve the recall performance of the older adults. In the current study, 10 s were given to encode each item. When the items were not performed, the older adults may have been less able than the younger adults to use this encoding time effectively.

Thus, when younger adults are better able than older adults to generate successful encoding strategies for nonperformed items, performance may reduce age differences in recall because performance is a successful strategy for both younger and older adults. In other words, performance of an action reduces the need for self-generated memory strategies and thus may benefit the gist recall of older more than younger adults.

Conclusions

In summary, as hypothesized, performance reduced age differences in recall of the gist of an action but did not reduce age differences in recall of the exact verb and noun used to describe the action. Older adults found it especially difficult to remember the exact verbs from the performed pairs.

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APPENDIX

List Used in Study

Kitchen	Dressing Room	Office	Tool Shop
tear paper towel	take tissue	flip calendar	hold gloves
polish fork	fold towel	write name	trace circle
stack plates	recap toothpaste	cut card	add measurements
clasp hands	cross legs	pound fist	wipe brow
shake salt	wear ring	sharpen pencil	tie knot
break toothpick	lift mirror	staple paper	turn on flashlight
close bottle	unroll sock	punch hole	examine mask
lick lips	smooth hair	scratch head	create cough
flatten sponge	look at watch	rip envelope	measure line
smell candy	zip case	remove cap	remove tape
cover bowl	squeeze cotton	clutch calculator	pinch clothespin
pat stomach	rub eye	massage neck	flex muscle
crush foil	sniff flower	date check	separate bolts
open bag	wear scarf	wind clock	bend wire
tighten lid	unfasten pin	erase mark	grip pliers
hum tune	form smile	make yawn	stand up

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