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ABSTRACT

When presented with linguistic material, elderly adults are often unable to report as much material as are younger people. To ascertain whether elderly adults are as sensitive as young adults to the underlying structure of the to-be-remembered sentences, a study was conducted using the item recognition priming technique. In this technique, people attempt to remember sentences containing unassociated nouns. The subjects are asked to decide whether or not individual words occurred in the studied sentence. Thirty-six young (18-25 years) and 36 elderly (64-82 years) subjects were tested with a series of 288 item recognition trials consisting of 144 occurring nouns and 144 distractor nouns. When the primed trials were compared with the control trials, a significant and prime effect was found for young and elderly people with no significant differences between the age groups. The differences on paired-recognition of the nouns, a more traditional measure of memory, were significant with young subjects being correct for 83 percent of the trials and elderly subjects being correct for 72 percent of the trials. Elderly persons appeared to be less sensitive to the underlying propositional structure of the sentence than were younger subjects. Younger people showed more within-proposition than between-proposition priming, whereas the elderly subjects did not. Using tests of memory without awareness may give a more complete measure of memory across the lifespan than do traditional measures. (ABL)

AGING AND EPISODIC PRIMING: THE PROPOSITIONAL STRUCTURE OF SENTENCES

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Abstract

Thirty-six young (18-25 years) and 36 elderly (64-82 years) people studied 36 sentences of the form NOUN1 - VERB1 - NOUN2 - conj - NOUN3 - VERB2 - NOUN4. Then they made item recognition judgments regarding whether single nouns had occurred in the sentences. Both young and elderly people showed priming between the nouns within the sentences; a noun was recognized faster when it was tested immediatey after another noun from the same sentence than when it was tested following a noun from a different sentence. However, young people showed more within-proposition than between-proposition priming, whereas the elderly did not, indicating that the elderly are less sensitive than the young to the propositional structure of the sentences.

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When elderly adults are presented with linguistic materials such as sentences and stories, upon later testing they are unable to report as much of the material as young. It is unclear, however, whether this difference is only quantitative, or whether it is also qualitative, in the sense that the elderly people are less sensitive than young to the underlying ideas (propositions) conveyed in the passage. Some studies have found age similarity in sensitivity to propositional structure (e.g., Spilich, 1983; Petros, Tabor, Cooney, & Chabot, 1983), whereas others have found age differences (e.g., Cohen, 1979; Meyer & Rice, 1981). One possible reason for the discrepancy is that memory is typically assessed using the traditional recall and recognition accuracy measures. These may be called tests of "memory with awareness" (Jacoby & Witherspoon, 1982) in that people must make an introspective judgment about whether and what they remember. For example, in recognition tests people are asked, "Do you remember having seen this sentence?" Such measures are likely to be influenced by adult age differences in cautiousness and criterion, and these may vary from study to study.

The present experiment seeks to determine whether elderly adults are as sensitive as young to the underlying propositional structure of to-be-remembered sentences, by using a method introduced by Ratcliff and McKoon (1978) in work with college students. In this so-called item recognition priming technique, people are asked to memorize sentences consisting of previously unassociated nouns, e.g., THE KING CLOSED THE WINDOW AS THE TOWN BECAME CINDERS. Then they are given a series of item recognition trials in which they must decide whether or not individual words occurred in the studied set of sentences. Ratcliff and McKoon demonstrated that among college students, words from the same studied sentence prime each other, that

is the word TOWN is recognized faster following WINDOW than following a word from a different studied sentence. The fact that this priming occurs between previously unassociated words indicates that people have stored and retained new associations among the words within studied sentences. Further, young people have apparently stored the propositional structure of the sentences, since words taken from within the same proposition (e.g., CINDERS-TOWN) prime each other more than words taken from between the two propositions (e.g., WINDOW-TOWN). This item recognition priming method seems particularly useful for lifespan studies, since it is a test of "memory without awareness." That is, memory for an association is inferred from a pattern of response times, and the person need not judge whether he/she remembers the association. In earlier research (Howard, Heisey, & Shaw, In press) we have used this method to assess memory for one propositional sentences (e.g., THE DRAGON SNIFFED THE FUDGE). We found that after only moderate amounts of study of the sentences, elderly individuals showed as much priming as young, despite the fact that there were large age differences in cued recall of the same sentences.

In the present experiment, seventy-two people were tested, 36 young (mean age = 20.5 years, SD = 1.5, range = 18-25) and 36 elderly adults (mean age = 69.9 years, SD=4.5, range = 64-82). None of the participants was institutionalized and the age groups were similar in WAIS vocabulary score and educational level. Each participant studied a list of 36 two-propositional sentences of the form NOUN1 - VERB1 - NOUN2 - conj - NOUN3 - VERB2 - NOUN4. The nouns within sentences were chosen to be unassocated with each other. After two study periods totalling 30 seconds of study per sentence, people completed a series of 288 item recognition trials consisting of the 144 nouns that had appeared in the sentences as well as 144 distractor nouns matched to the sentence nouns in length and frequency. Prime type was the major within-subjects variable. Counterbalancing insured that across subjects each

of the sentence nouns was tested equally often in each of three prime type conditions: control in which a noun was tested following a noun from a different studied sentence, between-proposition prime in which a noun was tested following a noun from the other proposition of the same studied sentence, and within-proposition prime in which a noun was tested following a noun from the same studied proposition.

Each participant then completed a paired-recognition and a cued-recall test of the sentences, with the order of these being counterbalanced across subjects. The paired-recognition test consisted of 36 trials (18 "yes" and 18 "no") in which two words from the sentences were presented together, and people were asked to report "yes" if the two words had come from the same sentence and "no" otherwise. For the cued recall test there were 36 trials, in each of which the person was given a noun from one of the studied sentences and asked to recall the rest of the sentence. Across subjects, each of the four nouns in each sentence was used as the sentence cue the same number of times.

There were three major findings. First, when primed trials (within- and between-proposition primes combined) are compared with control trials, young and elderly people both show a significant prime effect, $F(2, 140) = 13.90$, $p<.001$, with no significant difference in magnitude of the prime effect between the age groups. The prime effect (defined as response time on control trials minus response time on primed trials) was 96 msec for the young participants and 73 msec for the elderly. This indicates that both groups of participants had stored the associations among the words in the sentences. Second, despite the age equivalence in overall priming described above, the traditional measures of memory accuracy yield significant age differences in memory for the sentences. The difference between the cued recall of young and elderly is significant, $F(1,68)=21.37$, $p<.0001$. Of a possible 3 nouns that

could be recalled per sentence, the young recalled a mean of 1.55 and the elderly only .83. On paired-recognition of the nouns, there was also a significant age difference, $F(1,68)=88.96$, $p<.01$. The young were correct on an average of 83% of the trials and the elderly on only 72%. When the above findings are considered together, they indicate that age differences in memory are reduced when priming, instead of recognition or recall accuracy, is used as a measure. This suggests that at least some age differences on recall and recognition tasks are due to retrieval, rather than storage, difficulties.

Third, there is, nonetheless, an age difference in the pattern of within- and between-proposition priming. In keeping with McKoon and Ratcliff's results with college students, the young people show a larger within-proposition than between-proposition prime effect (i.e., the response time difference between control trials and primed trials was 114 msec for within-proposition primes, but only 78 msec for between-proposition primes.) In contrast, the elderly participants revealed slightly (though not significantly) less priming for within- than between-propositon primes, showing prime effects of 60 msec and 85 msec for within- and between-proposition priming, respectively. This observation is also supported by correlations. The correlation between an individual's age and the magnitude of his/her between-proposition prime effect was not significant ($r=-.10$, $p>.10$), but the correlation between age and the within-proposition prime effect was significant ($r=-.28$, $p<.02$). This finding indicates that when memory structure is assessed via priming, the elderly persor is less sensitive to the underlying propositional structure of the sentences than are young people. Thus, this method reveals qualitative differences between young and elderly in memory structure for sentences.

In general, the present findings indicate that item recognition priming is a sensitive means of assessing the structure of stored information across

the adult lifespan. Using such measures of "memory without awareness" may give a fuller picture of age differences and similarities in memory than using only traditional measures that call upon "memory with awareness."

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