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ABSTRACT

A study was conducted to determine the effects of age, verbal ability, education, reading habits, and recall strategies on prose recall among adults. Subjects were 422 adults in three age groups--young (18-28 years), middle (40-54), and older (62-80). They were asked to read and recall in writing two 388-word prose passages and to answer questions about their background reading habits and recall strategies. The results indicated that while increasing age was associated with a decrease in recall, both verbal ability and education were better predictors of recall than was age. In addition, a recall strategy factor representing "paragraph by paragraph" retrieval produced the highest simple correlations with total recall and contributed significantly to the explanation of other recall measures. Reading habit factors associated with recall reflected subjects' self-assessment as good and frequent readers as well as their need to know information. The reading and recall strategy factors proved to be better predictors of recall than the reading habit factors. While the findings confirmed the expectation that more practiced readers will recall more, the results also made it possible to refine understanding of the relationship between recall and reading experience. They also suggested that training in the use of reading and recall strategies may be used to improve recall in all age groups. (Extensive tables of data are appended.) (HTH)

Prose Recall: Effects of Aging, Verbal Ability and Reading Behavior

by

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Abstract

This paper describes an exploratory multivariate analysis designed to determine the relative contributions of age, verbal ability, education, reading habits, and recall strategies to the explanation of variation in performance on prose recall tasks among adults. 422 adults in three age groups--young (18-32), middle (40-54) and old (62-80)--read and recalled in writing two 388-word prose passages and answered questions about their background, reading habits and recall strategies. Prose recall measures were based on the Meyer (1975) analysis system and included total recall, recall of logical relationships, recall of details, top-level structure of recall and "levels effect" of recall. Responses to the reading habits and recall strategy questionnaires were submitted to factor analyses and stepwise multiple regression analyses were used to determine the relative contribution of the reader variables to the prose recall measures. Results indicate that while some decrease in recall appears with increasing age, both verbal ability and education are better predictors of recall than is age. In addition, a recall strategy factor representing a "paragraph by paragraph" retrieval strategy produces the highest simple correlations with total recall and contributes significantly to the explanation of the other recall measures. Other important strategy factors include searching for main ideas and concentrating on details. Reading habits factors which correlate with recall include one which reflects subjects' self-assessment as a good and frequent reader and one which represents reading for a need to know the information. The reading and recall strategy factors proved to be better predictors of recall than the reading habits ones. While the findings confirm the expectation that more practiced readers will recall more, they also make it possible to refine our understanding of the relationship. They also suggest that training in the use of reading and recall strategies may be used to improve recall in all age groups.

Prose Recall: Effects of Aging, Verbal Ability and Reading Behavior

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This paper describes an exploratory multivariate analysis of the relationships among recall of prose and characteristics of adult readers, including measures of demographic characteristics and reading behavior. Its goal is to determine the relative contributions of age, verbal ability, education, reading habits, and recall strategies to the explanation of variation in performance on prose recall tasks among adults.

The Problem

The number of studies of adult age differences in learning and memory of prose is growing, but the wide array of results from these studies is contradictory and confusing. While many researchers have reported age deficits on prose learning tasks (e.g. Cohen, 1979; Cohen & Faulkner, 1981; Gordon & Clark, 1974; Taub, 1975, 1976; Taub & Kline, 1978), others have used similar tasks and found no age deficits (Harker, Hartley, & Walsh, 1982; Meyer & Rice, 1981; Taub, 1979). Learning from prose involves the complex interaction of text, task, and learner variables (see Meyer, 1981; Meyer & Rice, 1983) so that a certain amount of variation in results is to be expected in this area.

Much of this variation in findings can be explained by the critical learner variables of verbal ability and education. Meyer & Rice (1983) found clear and large age deficits in prose learning for older adults with average vocabulary test scores and little or no high school education. However, for high verbal ability, college educated older adults, the magnitude of age deficits in learning appears small or nonexistent. This interaction between verbal ability and age has been noted by other investigators for verbal performance (e.g. Riegel & Riegel, 1972) and for recognition memory performance (Bowles & Poon, Note 1).

This paper represents an attempt to look beyond verbal ability alone to determine if there are aspects of reading behavior which may be responsible for some of the variation in performance on prose recall tasks. We suggest a "practice" effect to explain the interaction between age and verbal ability in the recall of the logic of discourse. Adults of all ages whose everyday lives provide opportunities and occasions for practice at reading and remembering are expected to perform better on prose recall tasks. For example, school keeps young adults reading, but without the influence of school, the reading habits of average and high verbal ability older adults may vary considerably. To test this expectation, we have collected data on the everyday reading habits and specific recall strategies of 422 adults participating in our prose recall studies.

The prose recall measures to be used in this study are based on the Meyer (1975) analysis system. In their recent

review of issues in adult development of learning and memory, Hartley, Harker and Walsh (1982) note that the Meyer system of prose analysis is the most used in aging research. Through this analysis system (Meyer, 1975) all of the information from a text is represented in a detailed outline or tree structure called the content structure. The content structure shows the text's overall organization and the interrelationships among its ideas and their relative importance. From this structure are developed measures of total recall, recall of relationships, recall of details, and the "levels effects."

Research has shown that information located at the top levels of the content structure of a passage is recalled and retained better than the information at lower levels of the structure (Meyer, 1975). This "levels effect" has been confirmed with various types of materials, recall tasks, and subjects ranging from elementary school children to graduate students (Kintsch & Keenan, 1973; Mandler and Johnson, 1977; Meyer, 1977; Thorndyke, 1977). However, our previous research (Meyer & Rice, 1981) suggested an age-related difference in the levels effect. We found that middle-aged and older subjects did not recall information from the high levels of the hierarchical content structure significantly better than lower level information, as do the young subjects.

Another recall measure used in this study describes how similar the top-level structure of a recall protocol is to that of the original passage. Passages can be written with different types of superordinate organization or top-level structures

(Meyer, 1979). Meyer and Freedle (in press) have found that discourse organized by different types of top-level structures was differentially recalled. Further studies have shown that subjects who are able to identify and use the top-level organizational structure of a passage will recall more of it that those who do not (Meyer, 1979; Meyer, Brandt & Bluth, 1980; Meyer & Freedle, in press.)

Methods

Subjects

Data have been collected from 146 young, 117 middle-aged, and 159 older subjects. The young adults fell within the age range of 18 to 32, the middle between 40 and 54, and the old adults were 62 to 80. Most of the subjects responded to a call for subjects given in a feature article about aging and prose learning which appeared in the Sunday paper. The volunteers were paid $4 per hour for their participation.

Materials

Prose passages. The passages used for the prose recall measures were two 388-word expository prose passages: one on the topic of supertankers and the other on the topic of railroads. The passages are indistinguishable from naturally occurring prose and were adapted from publications for ninth grade readers. Each passage contained 244 scorable idea units, 14 major logical relationships, and 14 details (names, numbers, dates) as determined by the Meyer prose analysis system (Meyer, 1975).

Aspects of textual organization were also manipulated in

this study. Versions of the passages were written with and without signaling of the major logical relationships (see Meyer, 1975) and with and without specific details. In addition, a version with no signals and emphasized details was also used. While these textual manipulations are not the main focus of this paper, variables representing these conditions were included in the multiple regressions analyses to control for the effects of textual variables on recall.

Questionnaires. Subjects were asked to provide information on their education, occupation, and whether or not they were currently in school. They also answered a 19 item questionnaire about their everyday reading habits and preferences (e.g. How many hours a week do you spend reading newspapers?) and a 16 item questionnaire on the specific memory strategies used in the prose recall tasks (e.g. Did you repeat the numbers and facts to yourself as you read?). Subjects also answered questions about their health. Vocabulary was assessed through the Quick Word Test (Borgatta & Corsini, 1964).

Procedures

The order of presentation of the two passages was counterbalanced. Subjects were instructed to read the passages at their normal reading speed for a magazine article of interest to them. They used digital timers to record their reading and writing times. Subjects read the first passage, recalled it in writing, then read and recalled the second passage. Subjects were told that we wanted to see how many ideas they could remember and if they could remember how the ideas were inter-

related. The questionnaires followed the recall tasks.

Analysis

The recall protocols were scored for presence or absence of the 244 idea units in the content structure of each passage (Meyer, 1975); inter-scorer reliability was greater than .95. In addition, the number of idea units from levels 1-5 (high in the content structure) and levels 6-9 (low in the content structure) were tallied. Also tallied were the number of major logical relationships and details recalled. The protocols were also scored for top-level structure. Thus, five measures of prose recall were developed for this study: total recall, levels effect (high level tally minus low level tally), recall of logical relationships, recall of details, and top-level structure of recall. These are the dependent measures in the multivariate analysis.

In addition to the textual variables of signals and details described above, other independent measures in the analysis include age in years, vocabulary scores, years of education and reading habits and recall strategy factors. The responses to the reading habits questionnaire and the recall strategy questionnaire were submitted to factor analyses for data reduction purposes. Stepwise multiple regression analysis was used to determine the relative contribution of the various learner variables to the prose recall measures. Regression was performed separately for each recall measure. In addition, separate analyses were performed for each age group (young, middle, old) to determine if explanatory factors differed among age groups.

Results

Factor Analyses

Responses of all subjects to the 19-item reading habits questionnaire were submitted to a principal components factor analysis procedure (BMDP4M) with orthogonal rotation. Five major factors were identified by the analysis. Rotated and sorted factor loadings for the reading habits variables on the five factors appear in Table 1. The variables sorted relatively neatly into readily interpretable factors. Variables which have high loadings on factor 1 include the hours per week spent reading text and reading because of need for information. This factor has been labelled "Read for Need." It also has relatively high loadings for outlining what is read and "arguing back" to what is read. These indicate an analytical, rather than a passive, approach to reading. The second factor has high loadings for variables which indicate time spent reading newspapers and magazines and reading for "interest". Factor 2 has been labelled "Read News and Magazines." Factor 3, "Read Stories for Relaxation," has high loadings for those variables, and negative loadings for ranking of news and magazines. The fourth factor, "Read Lots and Like it," has high loadings for three scales in which subjects rated the frequency with which they read, how much they liked to read, and whether they considered themselves to be good readers. The fifth factor, "Read for Other Reasons," is the most difficult to interpret. It includes high loadings for reading of "other" material, and negative ratings for news, magazines, and

stories. Inspection of subjects' specifications for "other" suggests a group of Bible readers who give "frivolous" reading a low ranking. These five factors explain about 57% of the variance in the responses to the reading habits questionnaire.

Insert Table 1 about here

Responses to the reading and recall strategy questionnaire were submitted to a similar factor analysis procedure. Again, five factors were identified. The rotated and sorted factor loadings for the strategy variables are given in Table 2. The first factor seems clearly to represent an "Outline strategy." Variables which indicate an active search for the organization of the passage and an attempt to outline it are loaded highly on this factor. The second factor is even more clearly related to a "Detail strategy." All variables relating to details such as numbers and facts load highly on it. The third factor is a little more difficult, and has been labelled a "Relating strategy," since relating reading to what was already known and thinking of examples were highest on this factor. Making images or pictures in the mind while reading also loaded on this factor, and can also be seen as an attempt to relate the passage to one's own experience. The fourth factor appears to represent a "Main Idea strategy," with variables relating to identifying important points loading highly. There is also a negative loading on this factor for writing "hard things first." The fifth factor also has a negative loading for this

variable, and high, positive loadings for writing paragraph by paragraph, and having each thing written remind of the next to be written. This final factor has been labelled a "Paragraph strategy."

Insert Table 2 about here

Of the five strategy factors, the Detail and Relating strategies appear to be primarily encoding or input strategies, while the Paragraph strategy is a retrieval or output strategy. The Outline and Main Idea strategies have both encoding and retrieval elements. The total variance explained by the five strategy factors is 58% of the variance. This number is very close to the amount explained by the reading habits factors, above. Neither amount is as high as might be desired for the regression analyses to be performed, the concern being that in reducing the data through factor analysis, some of the explanatory ability of the reading behavior variables will have been lost. However, to respond to this concern, a multiple regression analogous to that which will be reported below was performed using all of the variables submitted to the factor analyses described here. The amount of variance in recall scores explained with all the variables was less than 1% more than with the factors reported here, so that no loss in explanatory ability seems to have occurred as a result of data reduction.

Reader (Independent) Variables

Table 3 gives the means and standard deviations for each of the reader variables and factors to be used in the regression analysis, as well as their intercorrelations. Statistics are reported for analyses done with all 422 subjects and also for each of the three age groups. ANOVA procedures were performed on each of the reader variables (except age) to determine if there were differences among age groups, and t-tests were used to determine which pairs of means differed significantly. Significant differences were found in nine of the twelve variables, including vocabulary (young lower than middle and old), education (old lower than middle and young), Read for Need (significant differences among all groups with young highest and old lowest), Read News and Magazines (all groups, with young lowest and old highest), Read Lots and Like it (young lower than middle), Read for Other Reasons (old higher than young), Outline strategy (young higher than middle or old), Main Idea strategy (young higher than middle), and Paragraph strategy (old lower than young or middle).

Insert Table 3 about here

As would be expected given the above results, there were strong correlations between age and vocabulary (.336), Read for Need (-.366), Read News & Magazines (.307), and Paragraph strategy (-.201). Age correlates positively with education only for the young group (.491), which is clearly the result of the fact that young people are in the process of pursuing their

education. Vocabulary correlates highly with education (.460), Read Lots (.404), and the Paragraph strategy (.269). Education shows a similar pattern, with higher correlations with Read for Need (.256). There are also intercorrelations between Paragraph strategy and Read Lots (.212). The most striking age differences in correlation patterns appear with Read News & Magazines, where the old group has correlations between this factor and vocabulary (.298) and education (.241), while the middle and young groups have no correlation. In general, correlations run fairly low except for such unsurprising findings as high correlations between vocabulary and education.

Prose Recall (Dependent) Variables

Table 4 gives the means and standard deviations for the five prose recall measures as well as simple regression coefficients (r) between these recall measures and the reader variables. Statistics are given for all 422 subjects and separately for each age group. ANOVA procedures were used to test for differences among age groups on the prose measures and t-tests were used to determine which are groups were significantly different. Age group differences were significant for four of the five recall measures: total recall (percentage of idea units correctly recalled from the passages), recall of logical relaltions (the number of relations correctly recalled), recall of details (the number of names, dates and numbers correctly recalled), and the top-level structure of the recall (scaled from 1-same as author to 9-random list). The pattern of age differences was the same for each of these four mea-

sures; in each case the old group was significantly lower than the middle and young groups, which did not differ. For the top-level structure measure a higher score indicated a lower level of performance. The means reflect this directionality of the variable, but the signs on the correlation coefficients have been changed to make comparisons with other variables easier. No age differences were found for the levels effect measure (percent recalled from top half of structure minus percent recalled from bottom half).

Insert Table 4 about here

When all subjects are taken together, the best single predictor of total recall among the reader variables is Paragraph strategy (r=.415), followed by vocabulary (.372), education (.332), and age (-.244). Within the three age groups there are no correlations with age for total recall. Best predictors for the young group are Paragraph strategy (.428) and vocabulary (.421), in that order. For the middle group vocabulary is highest (.472), followed by Paragraph strategy (.372) and Read Lots and Like it (.294). For the old group vocabulary is highest (.544), followed by education (.423) and Paragraph strategy (.329). There are also smaller but significant overall correlations with total recall for Read for Need (.195), Read Lots and Like it (.224), and Detail (.140) and Main Idea strategies (.166).

Similar patterns hold for the measures of recall of rela-

tions, recall of details, and the top-level structure of recall. However, for recall of details, the correlations with education are lower and those with the Detail strategy are much higher for each age group. Correlations for top-level structure of recall are generally lower, probably reflecting the skewed distribution of this variable in which most subjects score at the highest end (i.e. most use the same structure as the author). Reader variables are poor predictors of the levels effect: only the use of the Detail strategy and education are significantly correlated (r=-.281 and .181, respectively).

Correlational patterns are relatively consistent across age groups. The oldest age groups has consistently higher correlations with education (except for the levels effect) and with vocabulary than do the other groups. In general, the effects of vocabulary and education appear to increase with age. There are also occasional significant correlations within single age groups. For instance the oldest age group shows significant correlations between the reader variables of Read for Need and Main Idea Strategy and measures of total recall and recall of details as well as significant negative correlations between Outline strategy and these same measures. The middle age group shows significant negative correlations between Read News & Magazines and measures of total recall and recall of details and between Read Stories and recall of relations.

Multiple Regression Analyses

Multiple regression analyses were performed to clarify the relative contributions of the different reader variables to the explanation of the prose recall measure. The text variables of signals, specific details, and emphasized specific details were included to control for their effects on recall, since not all subjects read the same version of each passage. Stepwise multiple regression procedures were used (BMDP2R), with the text variables forced into each equation. Reader variables were entered into the equation based on their potential contribution to its explanatory power. Separate analyses were performed for each of the five recall measures and for each of the three age groups. Standardized regression coefficients (beta weights) and r-squares for each equation are given in Table 5.

Insert Table 5 about here

About 40% of the variance in the total recall measure is explained by the text and reader variables. Vocabulary has the largest standardized regression coefficient (.437), followed by age (-.345; negative relationship), Paragraph strategy (.234), Detail strategy (.198) and Main Idea strategy (.116). A small but significant contribution is also made by the presence of signals (.121). Similar patterns hold across age groups, except that years of age does not appear in any of the equations for the separate age groups. In addition, the performance of the young group is unaffected by signals, but negatively correlated with Read Other (-.151). The middle group

shows a negative relationship with Read News and Magazines (-.239). The performance of the oldest group is diminished when specific details appear in the text (-.138), and is positively influenced by education (.169) and the Main Idea (as opposed to the Paragraph) strategy (.166).

The other recall measures are much more susceptible to the effects of the textual manipulations. Vocabulary remains as the strongest contributor to recall of relations (.419), but it is followed by presence of signals (.306), then age (-.257) and Paragraph strategy (.208). The presence of specific details is negatively related to the recall of logical relations (-.137). Within age groups, the one group showing a decline in recall of relations with age is the youngest group, though the effect is small (-.157).

For recall of details, the reader variables are even less important with the largest contribution being made by the presence of specific details (.356), followed by the Detail strategy (.273), vocabulary (.262) and age (-.213). For this measure the oldest age group showed the largest contribution of vocabulary (.374). The top-level structure of recall is most affected by education (.210), followed by the presence of signals (.206), vocabulary (.165), and age (-.157). The levels effect is almost entirely explained by text manipulations, with strong contributions by specific details (-.335; negative effect - i.e. lower levels recalled better than higher), signals (.273), and the Detail strategy (-.169). The reader variable of education has a small but significant contribution

overall to the levels effect.

Discussion

First, a generalization: if all 422 subjects are considered together, that is if a life-span perspective is taken of a large group of heterogeneous individuals, significant effects of age on prose recall measures are found. Older subjects perform at lower levels on total recall, recall of logical relations, recall of details and top-level structure of recall. Now for the caveats: first, age effects are not s when a narrower age focus is taken, say a span of about 15 years. Second, other factors, notably verbal ability and recall strategies, both overshadow and mediate the effects of age on prose recall.

With respect to the first caveat: no correlations with age were found within the middle age group for any of the recall measures. One such correlation was found for the youngest age group: when other variables were controlled, a decline in recall of relations between ages 18 and 32. This unexpected finding suggests that Cohen (1979, 1981), who finds age differences in recall for relationships when comparing college-age and older adults, may be catching young adults at the peak of their ability in this skill. For the oldest age group, the only correlation with age was for top-level structure, and in this case the oldest individuals in the group performed better than the younger ones. No evidence of decline in prose recall skills between the ages of 62 and 80 is indicated by these data.

As indicated above, other variables are more important than age in predicting prose recall. The most influential of these is vocabulary, particularly for measures of total recall and recall of logical relations. Vocabulary effects are stronger than age ones for all recall measures studied. In addition, effects of vocabulary become progressively stronger from the youngest to the oldest age groups. The relationship between vocabulary and recall for the oldest age group is stronger than the overall vocabulary effect. This is not to say that vocabulary explains age differences. In fact it runs counter to age effects with a positive rather than negative correlation. Vocabulary would appear to mediate age effects: the beta weight for age when vocabulary is controlled is considerably large than the simple r between age and recall. This mediating effect of vocabulary is in line with the results of Meyer & Rice (1983) where it was found that older subjects with higher verbal ability compare favorably to similar young subjects while older subjects of lower ability show significant deficits when compared with young subjects.

Education is another variable which is a better predictor of recall than is age (see Table 4). However, education appears seldom in the multiple regression equations because it is largely redundant with vocabulary. Education does appear as significant in the multiple regression analyses for those prose recall measures which are enhanced by some technical knowledge of textual organization, i.e. top-level structure of recall and the levels effect. Education has its strongest effects for the

oldest age group, which is consistent with the idea that attaining high levels of education was a more difficult achievement two generations ago (Meyer & Rice, 1983; Krauss, 1980).

In general, the reading and recall strategy factors proved to be better predictors of prose recall than the reading habit ones. Chief among the strategies is the Paragraph strategy, which is the single best predictor of total recall. It also figures signficantly in the majority of multiple regression equations, though its contribution is lessened by its inter-correlations with vocabulary (positive) and age (negative). The differences in use of this strategy among age groups were found to be significant by ANOVA techniques, with the oldest group being lower than the young and middle. Given the power of this strategy, it would be extremely useful to define its exact nature. As was discussed under the factor analysis section above, this factor has high loadings for the variables "wrote paragraph by paragraph" and "each thing written reminded of next," and a negative loading for "wrote hard things first." Thus, this appears to be a retrieval strategy (as opposed to an encoding strategy) which involves an understanding of the paragraph structure of the text. It represents a systematic and apparently serial (next, next, next) approach to retrieval. Note that the memory representation would have to be quite complete for such a strategy to be effective. It is not clear whether the Paragraph strategy is one which contributes to good recall, or one which is only available to those with good com-

prehension and recall skills.

The Detail strategy also contributes to total recall and more significantly (and unsurprisingly) to recall of details. Its role with respect to the levels effect is negative, causing more recall from the lower levels of the structure. No age differences in the use of this strategy were found.

The Main Idea strategy showed small but significant contributions to recall. In the equation for the oldest age group, the Main Idea strategy occupied the place which the Paragraph strategy held for the other age groups. This strategy appears to be a mix of encoding and decoding functions and may be simpler than the Paragraph strategy.

The Relating strategy showed no age differences an no contribution to recall. The only contribution by the Outline strategy was a negative one to top-level structure of recall for the oldest group. This lack of performance for this factor is puzzling. Since this factor appears to represent an active search for the organization of the passage, most theories of prose recall would have predicted a some effect, and certainly not a negative one. The strategy is age-related, with young subjects reporting more use than middle and older ones, as might be expected with young subjects using this strategy for school materials. However, it has no positive impact, and a negative one for the oldest group. Perhaps the extra processing required for organizing and outlining reduces the efficiency of comprehension for older subjects. Still, this is a surprising finding.

Reading habit factors appeared very seldom in the multiple regression analyses, and produced only a few positive correlations in the simple regressions (Table 4). The highest of these came from the Read Lots and Like it factor, in which subjects provided a sort of self-evaluation of themselves as readers. Not surprisingly, people who read a lot, like it, and consider themselves to be good at it do better on prose recall tasks. Of those factors which described specific behaviors, only Read for Need displayed a consistent pattern of small but significantly positive correlations with recall. Read for Need included high loadings for variables related to reading of textual materials and also outlining what is read. The factor is very strongly related to age, and tended to drop out of the multiple regressions when age was included.

The other reading habit factors contribute very little to the explanation of prose recall performance. However, one interesting finding is related to the Read News and Magazines factor. This factor is strongly age related (see Table 3), with older subjects reading more news and younger subjects less. Read News is also positively correlated with vocabulary and education for the oldest group, but not the younger ones. This may reflect a change in our culture in the picture of an educated person, or it may simply reflect the amount of time older subjects have for this activity.

As mentioned above, age effects were found for all prose recall measures except the levels effect. The lack of an age effect for this measure is contrary to the findings of Meyer &

Rice (1981) who found young subjects to be more sensitive to the hierarchical organization of a passage. It is unlikely that the earlier finding is simply incorrect, since it has been replicated (Theobald, Note 2). It is possible that the different techniques for measuring the effect are responsible for the discrepancy. The earlier paper used ANOVA techniques on three levels in the content structure, while this one makes a single measure by subtracting the bottom half from the top. Some of the finer distinctions may be lost by this latter technique. Also, the extreme importance of textual manipulations (see Table 5) suggests that relatively subtle differences in passage organization may produce very different recall results.

Conclusions

While age does contribute significantly to the explanation of variation in prose recall (the relationship is negative: increasing age, decreasing recall), its contribution is secondary to that of verbal ability. Vocabulary scores alone account for about one-fifth of the variation in prose recall measures and are better predictors of recall than education. Similar patterns hold for the different age groups, though education is a stronger predictor for the older groups than for the young adults.

Significant contributions are also made by factors from the recall strategies and reading habits measures. A factor representing a "paragraph by paragraph" retrieval strategy produces the highest simple correlations with total recall and

contributes significantly to the explanation of all the recall measures. Other important strategy factors include searching for main ideas and concentrating on details. Both the paragraph and main idea strategies represent an analytical and knowledgeable approach to understanding a prose passage. A reading habits factor which reflects subjects' self-assessment as a good and frequent reader show a consistently strong relationship with recall measures. In addition, a factor representing reading for a need to know the information shows small but consistent correlations with recall measures. This factor is also highly correlated with age: older subjects had lower scores on this factor.

This exploratory study helps to put the role of aging in performance on prose recall tasks in some perspective. Age is just one, and not the most important, of the characteristics of learners which affect their recall. While some decrease in recall appears with age, verbal ability is a better predictor of recall than is age. Certain aspects of reading behavior, notably time spent reading for later use of the information and an analytical approach to reading also affect recall. While the findings confirm the expectation that more practiced readers will recall more, they also allow us to refine the definition of the relationship. Only specific kinds of practice appear to be useful for the sort of prose recall task which we presented to subjects. Furthermore, reading and recall strategies are better predictors of recall than are reading habits.

The results of the study have two important implications for future research in this area. First, they underline the importance of careful control of learner variables in all aging research. Second, they suggest that the everyday experiences and habits of subjects will need to be included in any complete model of aging and prose recall. Furthermore, the findings suggest that training in the use of reading and recall strategies may be used to improve recall in all age groups.

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Table 1

Factor Loadings for Reading Habits Variables (Rotated and Sorted)

Variables	1 Read for Need	2 Read News and Magazines	3 Read Stories for Relaxation	4 Read Lots and Like It	5 Read for Other Reasons
Hours/week read TEXT	.887	--[a]	--	--	--
Hours/week read because NEED information	.818	--	--	--	--
How often OUTLINE what is read	.634	--	--	--	--
Rank of TEXT on 'I like to read' scale	.583	--	--	--	--
Hours/week read NEWSPAPERS	--	.788	--	--	--
Hours/week read MAGAZINES	--	.765	--	--	--
Hours/week read for INTEREST	--	.679	--	--	--
Hours/week read STORIES	--	--	.839	--	--
Hours/week read for RELAXATION	--	--	.789	--	--
LIKE to Read scale	--	--	--	.783	--
Read OFTEN scale	--	--	--	.700	--
GOOD reader scale	--	--	--	.679	--
Hours/week read OTHER materials	--	--	--	--	.757
Rank of OTHER on 'I like to read' scale	--	--	--	--	.714
Rank of NEWS on 'I like to read' scale	-.262	.391	-.419	--	-.379
Rank of MAGAZINES on 'I like to read' scale	--	.288	-.388	--	-.437
Hours/week read for OTHER purposes	--	--	--	--	.456
ARGUE back to reading	.409	--	--	--	--
Rank of STORIES on 'I like to read' scale	--	--	.472	.360	-.444
Eigen values	2.55	2.20	2.09	2.04	1.99
Total Variance Explained 57%					

[a]Denotes a loading of less than .250.

Table 2

Factor Loadings for Reading and Recall Strategy Variables (Rotated and Sorted)

Variables	1 Outline Strategy	2 Detail Strategy	3 Relating Strategy	4 Main Idea Strategy	5 Paragraph Strategy
ORGANIZED writing in mind before starting	.787	--[a]	--	--	--
OUTLINED writing in mind	.738	--	--	--	--
OUTLINED passage or figured out organization	.675	--	--	--	--
SUMMARIZED reading as went along	.622	--	--	--	--
Memorized NUMBERS and FACTS	--	.828	--	--	--
Concentrated on DETAILS	--	.820	--	--	--
Repeated DETAILS to self	--	.780	--	--	--
Thought of EXAMPLES relevant to reading	--	--	.819	--	--
RELATED reading to what was known	--	--	.810	--	--
Identified IMPORTANT POINTS	--	--	--	.767	--
Identified IMPORTANT POINTS during reading	--	--	--	.761	--
Wrote PARAGRAPH by paragraph	--	--	--	--	.745
Each thing written reminded of NEXT	--	--	--	--	.720
Identified IMPORTANT POINTS after reading	.339	--	--	.338	--
Wrote HARD things FIRST	.257	--	--	-.399	-.321
Made IMAGES or pictures in mind as read	--	--	.487	.293	--
Eigenvalues	2.40	2.16	1.72	1.66	1.33
Total Variance Explained 58%					

[a]Denotes a loading of less than .250.

Table 3

Correlation Matrix for Reader Variables with Means, Standard Deviations, and Simple 'r's

		$\bar{X}$	SD	Age	Vocabulary	Education	Read for Need	Read News	Read Stories	Read Lots	Read Other	Outline Strategy	Detail Strategy	Relating Strategy	Main Idea Strategy	Paragraph Strategy
Age (Years)	All	47.60	19.47	1.000												
N = 146	Young	24.31	4.42	1.000												
N = 117	Middle	47.77	4.41	1.000												
N = 159	Old	68.88	4.58	1.000												
Vocabulary	All	59.10	18.46	.336	1.000											
$F(2, 419) = 38.3$	Young	49.16	17.12	.192	1.000											
$p < .001$	Middle	65.30	15.16	.109	1.000											
	Old	63.61	18.15	-.098	1.000											
Education	All	14.70	2.82	-.090	.460	1.000										
$F(2, 419) = 7.2$	Young	14.99	2.39	.491	.552	1.000										
$p < .001$	Middle	15.27	2.75	-.047	.481	1.000										
	Old	14.08	3.10	.134	.552	1.000										
Read for Need	All	0.00	1.00	.366	.011	.256	1.000									
$F(2, 419) = 35.1$	Young	.50	1.13	-.081	.227	.288	1.000									
$p < .001$	Middle	-.05	.92	-.007	.125	.227	1.000									
	Old	-.39	.71	.135	.142	.201	1.000									
Read News	All	0.00	1.00	.307	.204	.084	-.005	1.000								
and Magazines	Young	-.33	.76	.019	-.082	-.054	.079	1.000								
$F(2, 419) = 21.9$	Middle	-.08	.77	.180	.020	.118	.189	1.000								
$p < .001$	Old	.38	1.20	.028	.298	.241	.145	1.000								
	All	0.00	1.00	-.024	.120	.022	-.002	.001	1.000							
Read Stories	Young	.07	.90	.077	.268	.140	.103	-.066	1.000							
for Relaxation	Middle	-.13	.92	-.105	-.002	-.235	.066	.109	1.000							
n.s.	Old	.03	1.14	-.061	.155	.106	-.203	-.007	1.000							

Table 3 (continued)

		$\bar{X}$	SD	Age	Vocabulary	Education	Read for Need	Read News	Read Stories	Read Lots	Read Other	Outline Strategy	Detail Strategy	Relating Strategy	Main Idea Strategy	Paragraph Strategy
Read Lots and Like It	All	0.00	1.00	.092	.404	.268	-.003	-.007	.006	1.000						
	Young	- .16	1.03	.253	.456	.349	-.004	-.102	.086	1.000						
$F(2, 419) = 3.92$	Middle	.18	.91	-.080	.530	.233	.039	-.041	-.027	1.000						
$p < .05$	Old	.02	1.00	.001	.252	.245	.086	.025	-.013	1.000						
Read for Other Reasons	All	0.00	1.00	.140	.100	-.006	-.003	.010	-.001	-.004	1.000					
	Young	- .13	.99	.262	.097	.100	-.040	.046	.085	-.001	1.000					
$F(2, 419) = 3.0$	Middle	- .03	.90	.081	.112	.085	-.120	-.132	-.221	.187	1.000					
$p < .05$	Old	.14	1.07	.017	.029	-.083	.293	-.028	.052	-.129	1.000					
Outline Strategy	All	0.00	1.00	-.122	-.151	-.059	.106	-.099	.051	.060	.017	1.000				
	Young	.20	1.00	-.011	.013	.129	.091	-.070	-.053	.082	-.028	1.000				
$F(2, 419) = 4.9$	Middle	- .12	.99	.068	-.070	-.283	.054	.058	.123	.179	-.044	1.000				
$p < .01$	Old	- .11	.97	.056	-.224	-.076	.014	-.128	.070	.011	.133	1.000				
Detail Strategy n.s.	All	0.00	1.00	.058	-.032	-.105	-.036	-.056	-.023	.040	.099	-.022	1.000			
	Young	- .11	.99	-.181	-.217	-.254	-.060	.046	-.074	-.075	.066	-.105	1.000			
	Middle	.05	1.08	.121	.006	-.094	-.112	-.265	-.013	.052	.052	.087	1.000			
	Old	.03	.93	.070	.022	.000	.171	-.054	.019	.123	.151	-.003	1.000			
Relating Strategy n.s.	All	0.00	1.00	.052	.012	.062	.077	.088	-.005	.047	.025	.002	.006	1.000		
	Young	- .03	1.01	-.019	-.136	-.003	.070	.127	-.083	-.096	-.108	-.154	-.125	1.000		
	Middle	.04	1.03	.150	.119	-.054	.058	.020	.001	.108	.103	.049	.043	1.000		
	Old	.03	.98	.207	.043	.194	.176	.097	.054	.133	.082	.130	.098	1.000		
Main Idea Strategy	All	0.00	1.00	-.094	.017	.039	.151	-.008	-.062	.076	.080	-.003	.003	-.005	1.000	
	Young	:17	.89	.045	.071	.056	.105	-.008	-.092	.064	.031	.083	-.124	-.002	1.000	
$F(2, 419) = 3.6$	Middle	- .16	1.10	-.171	-.058	-.005	.107	.036	-.049	.016	.154	-.057	-.029	-.017	1.000	
$p < .05$	Old	- .03	1.00	-.023	.162	.063	.184	.013	-.075	.182	.092	-.081	.161	.014	1.000	
Paragraph Strategy	All	0.00	1.00	-.201	.269	.306	.016	-.029	-.066	.212	-.005	.002	.000	.009	.003	1.000
	Young	.15	.95	-.080	.290	.217	.178	-.014	-.146	.123	-.031	.030	.027	.001	-.029	1.000
$F(2, 419) = 16.4$	Middle	.27	.99	.116	.356	.199	.131	-.028	-.128	.299	.044	-.116	.011	.023	-.170	1.000
$p < .001$	Old	- .34	.97	.013	.381	.361	.107	.123	.045	.256	.056	.024	-.019	.011	.170	1.000

Note. (indicates means are significantly different.

Table 4

Simple Correlation Coefficients (r) Between Reader Variables and Recall Measures

			N	Total Recall		Recall of Relations		Recall of Details		Structure of Recall (TLS)		Levels Effect	
				$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
		All	422	.341	.122	11.93	4.46	8.18	4.88	3.09	2.07	.097	.097
		Young	146	.369	.124	12.49	4.11	8.78	4.96	2.70	1.87	.096	.104
		Middle	117	.361	.109	12.59	4.13	8.78	5.00	2.88	1.96	.098	.099
		Old	159	.302	.119	10.94	4.83	7.19	4.58	3.61	2.22	.097	.090
				$F(2, 419) = 14.5$ $p < .001$		$F(2, 419) = 6.5$ $p < .01$		$F(2, 419) = 5.3$ $p < .01$		$F(2, 419) = 8.4$ $p < .001$		n.s.	
	Reader Variables			r		r		r		r		r	
Demographic Variables	Age (Years)	All		-.244***		-.153**		-.146**		-.160***		.022	
		Young		-.119		-.088		-.131		.068		.105	
		Middle		-.134		-.117		.053		-.013		-.017	
		Old		.000		.029		-.061		.178*		.083	
	Vocabulary	All		.372***		.369***		.237***		.240***		.096	
		Young		.421***		.438***		.192*		.302***		.175*	
		Middle		.472***		.439***		.247**		.311***		.118	
		Old		.544***		.446***		.425***		.341***		.015	
	Education	All		.332***		.328***		.169***		.355***		.181***	
		Young		.176*		.197*		-.004		.332***		.242**	
		Middle		.269**		.314***		.145		.203*		.219*	
		Old		.423***		.370***		.265***		.411***		.119	

Table 4 (continued)

	Reader Variables		Total Recall r	Recall of Relations r	Recall of Details r	Structure of Recall (TLS) r	Levels Effect r
Reading Habits Factors	Read for Need	All	.195***	.166***	.132**	.144**	-.011
		Young	.119	.144	.068	.142	.057
		Middle	.066	.076	-.015	.007	.035
		Old	.190*	.156	.241**	.086	-.165*
	Read News and Magazines	All	-.069	.015	-.065	-.035	.068
		Young	.003	.007	.070	-.120	-.055
		Middle	-.282**	-.077	-.268**	-.058	.163
		Old	.135	.162*	.049	.134	.110
	Read Stories for Relaxation	All	-.005	-.003	.043	.026	-.014
		Young	.033	.101	-.039	.104	.022
		Middle	-.161	-.208*	-.044	-.122	-.121
		Old	.059	.045	.176*	.060	.027
	Read Lots and Like It	All	.224***	.217***	.140**	.203***	.094
		Young	.201*	.188*	.045	.273***	.166*
		Middle	.294***	.215*	.272**	.119	.041
		Old	.249***	.260**	.157	.233**	.056
	Read for Other Reasons	All	-.037	-.011	.040	-.021	-.043
		Young	-.111	.013	-.052	-.061	.019
		Middle	.178	.157	.187*	.133	.043
		Old	-.021	-.075	.075	-.024	-.163*

Table 4 (continued)

	Reader Variables		Total Recall r	Recall of Relations r	Recall of Details r	Structure of Recall (TLS) r	Levels Effect r
Strategy Factors	Outline Strategy	All	-.011	-.024	-.028	-.035	.096
		Young	.136	.095	.051	.039	.120
		Middle	-.082	-.072	.040	-.044	.053
		Old	-.175*	-.125	-.207**	-.144	.115
	Detail Strategy	All	.140**	-.010	.332***	-.011	-.281***
		Young	.096	.025	.230**	-.065	-.305***
		Middle	.207*	-.058	.506***	.069	-.367***
		Old	.177*	.061	.310***	-.004	-.180*
	Relating Strategy	All	.024	.080	-.035	.049	.083
		Young	.069	.039	-.147	-.015	.128
		Middle	.056	.039	-.024	.088	.072
		Old	.107	.148	.076	.086	.041
	Main Idea Strategy	All	.166***	.139**	.093	.147**	.040
		Young	.123	.130	.072	.144	.106
		Middle	.068	.042	.039	.096	.065
		Old	.268***	.212**	.222**	.174*	-.040
	Paragraph Strategy	All	.415***	.359***	.319***	.287***	-.003
		Young	.428***	.368***	.281***	.222**	-.003
		Middle	.372***	.313***	.400***	.202*	-.128
		Old	.329***	.314***	.212**	.307***	.103

*p < .05
**p < .01
***p < .001

Table 5

Standardized Regression Coefficients (β) from the Multiple Regression Analyses for Each Recall Measure

	Variables in Equation		N	Total Recall r^2	Recall of Relations r^2	Recall of Details r^2	Structure of Recall (TLS) r^2	Levels Effect r^2
		All	422	.402***	.393***	.428***	.286***	.325***
		Young	146	.341***	.370***	.379***	.189*	.312***
		Middle	117	.425***	.406***	.552***	.223**	.339***
		Old	159	.408***	.373***	.401***	.371***	.333***
				β	β	β	β	β
	Signals	All		.121**	.306***	-.020	.206***	.273***
		Young		.060	.267***	-.020	.185*	.209**
		Middle		.200*	.322***	.034	.265**	.271**
		Old		.155*	.368***	-.035	.224**	.337***
Text Variables	Specific Details	All		-.051	-.137**	.356***	-.054	-.335***
		Young		.065	-.076	.448***	.006	-.341***
		Middle		-.111	-.164*	.376***	-.010	-.334***
		Old		-.138*	-.156*	.246***	-.168*	-.379***
	Emphasized Details	All		-.010	.000	.067	-.120*	-.028
		Young		-.085	-.035	.048	-.106	-.077
		Middle		-.001	-.082	-.054	-.148	.082
		Old		.079	.062	.179*	-.113	-.053

Table 5 (continued)

	Variables in Equation		Total Recall β	Recall of Relations β	Recall of Details β	Structure of Recall (TLS) β	Levels Effect β
Demographic Variables	Age (years)	All	-.345***	-.251***	-.213***	-.157**	--
		Young	--	-.157*	--	--	--
		Middle	--	--	--	--	--
		Old	--	--	--	.170*	--
	Vocabulary	All	.437***	.419***	.262***	.165**	--
		Young	.392***	.451***	.193**	.193*	--
		Middle	.367***	.321***	--	.293***	--
		Old	.443***	.445***	.374***	.188*	--
	Education	All	--	--	--	.210***	.147***
		Young	--	--	--	.204*	--
		Middle	--	--	--	--	.190*
		Old	.169*	--	--	.220**	--
Strategy Factors	Paragraph Strategy	All	.234***	.208***	.187***	.166***	--
		Young	.309***	.203**	.261***	--	--
		Middle	.263**	.259**	.296***	--	--
		Old	--	.162*	--	.192**	.145*
	Detail Strategy	All	.198***	.097*	.273***	--	-.169***
		Young	.206**	.154*	.220**	--	-.225**
		Middle	.199*	--	.369***	--	-.219*
		Old	.164*	--	.247***	--	--
	Main Idea Strategy	All	.116*	.086*	.081*	.101*	--
		Young	--	--	--	--	--
		Middle	--	--	--	--	--
		Old	.166*	--	--	--	--
	Outline Strategy	All	--	--	--	--	--
		Young	--	--	--	--	--
		Middle	--	--	--	--	--
		Old	--	--	--	-.165*	--

Table 5 (continued)

	Variables in Equation		Total Recall β	Recall of Relations β	Recall of Details β	Structure of Recall (TLS) β	Levels Effect β
Reading Habits Factors	Read Lots	All	--	--	--	--	--
		Young	--	--	--	--	--
		Middle	--	--	.147*	--	--
		Old	--	--	--	--	--
	Read "Other"	All	--	--	--	--	--
		Young	-.151*	--	--	--	--
		Middle	--	--	.154*	--	--
		Old	--	--	--	--	--
	Read News	All	--	--	--	--	--
		Young	--	--	--	--	--
		Middle	-.239**	--	--	--	--
		Old	--	--	--	--	--
	Read Stories	All	--	--	--	--	--
		Young	--	--	--	--	--
		Middle	--	--	--	--	--
		Old	--	--	--	--	--

*p < .05
**p < .01
***p < .001

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