Age Differences in the Ability to Recall and Summarize Textual Information

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In order to examine age differences in the ability to manipulate textual information, young and old adults were asked to recall and summarize prose passages. It was found that while older adults showed a moderate age-related decline in the amount of information recalled, they had considerable difficulties in summarizing the same material. It was thought that this deficiency was due to the inability of the older adults to simultaneously comprehend textual information and organize an effective summary of the information. These results, which suggest that older adults manifest an age-related decrement in effortful linguistic processes, were discussed in terms of Kintsch and van Dijk's [1978] model of discourse processing.

Previous research on adult age differences in memory for textual material has, for the most part, concentrated on investigations of factors that influence the amount of information retained. As useful as these lines of investigation have been, the efficient processing of text requires more than the retention of information. Recent trends in linguistic research have concentrated on a more global approach to discourse processing known as communicative competency [5; 8]. In addition to process for storing and reproducing text, communicative competency is thought to include procedures for establishing a textual format in linguistic material, dealing with textural discrepancies or ambiguities, and for summarizing discourse [5; 8; 17]. Of the procedures mentioned above, summarization provides a unique opportunity for investigating text processing competency. A successful summary of a textual passage will alter and delete elements of the surface structure of the material, but will retain the essential meaning of the text. Moreover, summarization procedures are unique to textual material in that they cannot be meaningfully applied to other verbal material, such as lists of random words.

A summarization of a prose passage will differ from a verbatim recall of the same material in many ways other than in the amount of information reproduced. Certainly a successful summarization will eliminate extraneous details, thereby resulting in a reproduction with less information than the original, but the distinction between verbatim recall and summarization is not essentially one of quantity, but one of the quality of the information reproduced. The comparison of the results from recall and summarization is thus not a comparison of the information produced, but rather a comparison of the processes involved in manipulating the essential meaning of the text. To this extent Kintsch and Kozminsky [10] argue that the psychological processes involved in recall are reproduction and reconstruction, whereas summarization involves primarily comprehension and organizational processes.

Research conducted by Kintsch and his colleagues [10; 11; 19] on comparisons between the recall and summarization of textual material has given some indication as to how these processes are thought to operate. Kintsch, Mandel, and Kozminsky [11] presented their subjects with prose passages and asked them to summarize the textual material. No differences could be found between summarizations produced from well-structured stories that were presented in either a normal or a scrambled presentation order. However, for less well-structured stories, judges were capable of distinguishing between summarizations produced under the two presentation conditions. Additionally, Kintsch and Kozminsky [10] had subjects summarize short stories after either reading them or listening to them and found no differences in summarizations as a function of either presentation condition. To explain these results, van Dijk and Kintsch [19] suggested that the summarization of a story involves the comprehension and organization of the textual information while at the same time relating the newly acquired information to previously stored information. Van Dijk and Kintsch suggest that this is accomplished first by converting the incoming information into a propositional text base according to the system proposed by Kintsch [9]. Once this text base has been established, previously acquired knowledge serves to aid in the identification of the most salient information in order to form a framework of macro-structure units [18]. When a summarization is required, these macro-structural units are retrieved and edited to fit any constraints that may be present. Summarization is thus seen as an extension of the processes used to comprehend initially the prose passage and organize the pulsing of its constituent elements. Factors that serve to impede the initial processing of the material, such as a poorly structured story and a scrambled presentation format, will therefore disrupt the formation of an appropriate text base, thereby disrupting any subsequent summarization efforts. However, if the textual material can be encoded properly, regardless of presentation conditions, then summarization efforts will not be impaired.

It can be seen that the process of comprehension and organization are critical for efficient communicative competency and that these processes may be examined experimentally through the comparison of efforts to summarize and verbatim recall.
recall textual material. In order to assess the abilities of young and old individuals to summarize text, participants in this study were presented with prose material from three different levels of difficulty. In this way it could be determined whether the summarization abilities of young and old individuals are affected by the complexity of the material. It was thought that there would be little difference between the abilities of young and old individuals to both recall and summarize the easier material. However, as the complexity of the material increased, it was expected that older individuals would show a decrement in recall, but would be particularly penalized when required to summarize the more difficult texts. This prediction follows from results reported by Cohen [2; 3] who found that older individuals were capable of making simple decisions concerning information contained in prose material, but were less capable of drawing correct inferences from the same material.

METHOD

Participants

Fifty individuals took part in this experiment, twenty-five of whom ranged in age from 18 to 26 years (mean age = 21.4 years). These individuals were freshmen and sophomores attending Erindale College and participated in order to fulfill a class requirement. The remaining twenty-five participants ranged in age from 64 to 70 years of age (mean age = 66.9 years). The older group of participants were recruited from a volunteer pool of former University of Toronto graduates living in the vicinity of Erindale College. The two groups of participants were tested with the Mill Hill vocabulary test and no significant difference was found. Both groups of participants were comprised of men and women in approximately equal numbers.

Materials and Procedures

The stories used in this experiment were selected from junior high, high school, and college level general science textbooks. Four passages of approximately 350 words were chosen from each of the texts. The topics of each passage were chosen to be of general interest and did not require any specialized knowledge to comprehend. Particular care was taken to insure that the topics of the passages were of equal interest and familiarity to both age groups. The stories, which covered such topics as "The invention of the phonograph" and "How spiders weave their webs", were pilot tested on members from each age group. No difference was found in comprehensibility ratings by either group of participants, however the stories from each of the three levels of difficulty were significantly different in comprehensibility ratings.

The participants were told that they would be presented with a series of stories and would be required to either summarize or verbatim recall the material. Each individual was required to summarize one story from each of the three levels of textual difficulty and to recall verbatim one story from each of the same sources. The stimulus materials for each participant were randomly drawn from the pool of available stories. Although twelve stories were selected to form the pool, only six stories were utilized with each participant. This random selection process was employed to insure that the results of the experiment could not be attributed to the choice of stimulus materials. The assignment of the selected passages to the summary and recall conditions as well as the presentation order of the passages was also accomplished by random selection methods. Prior to the presentation of each story, the participants were told whether they would be required to summarize or verbatim recall the story to be presented. In the case of verbatim recall, the participants were told to attempt a word-for-word reproduction of the textual material, while in the summarization condition the participants were told to eliminate all extraneous material and present just the essential details of the story. The participants were cautioned not to eliminate so much material that the meaning of the story would be lost. No other instructions were given to the participants. The passages were presented to the participants by means of an audio tape recorder. Each story was presented only once to the participants. In order to eliminate the effects of primary memory, the participants were required to perform a number counting task immediately after the finish of each story. After the distractor task had been completed, the participants were then asked to either summarize or recall the textual material. The participants' responses were recorded with an audio tape recorder. The stories were presented in two sets of three stories each to avoid any fatigue factor. Between the first and second sets of stories there was a thirty minute delay interval during which the participants performed a word identification task.

RESULTS

The stories used in this experiment were parsed according to the system of analysis proposed by Kintsch [10]. Each participant's responses were scored by tabulating the number of propositional units recalled at each level of textual difficulty as a function of hierarchical saliency level. Due to the theoretical considerations discussed above, the results of the recall and summarization conditions were analyzed separately. The data for the verbatim recall condition are presented in Figure 1. These data represent the proportion of propositional units recalled at each hierarchical level of saliency. The analysis of variance, which treated both participants and story type as random factors, showed significant main effects of age, $F(1,18) = 10.74$, $p<.01$, with younger individuals displaying higher levels of recall than the older group of participants; story difficulty level, $F(2,96) = 10.55$, $p<.01$, with more propositional units being recalled in the easy (junior high text) material condition; and hierarchical level, $F(3,8) = 27.14$, $p<.01$, with propositional units from the most salient levels being recalled most often. Additionally, there was a significant interaction between story type and hierarchical level, $F(6,22) = 5.92$, $p<.01$, with more propositional units being recalled in the easy story condition at the most salient hierarchical levels, and a significant interaction between age and hierarchical level, $F(3,38) = 4.70$, $p<.01$, with older individuals recalling relatively fewer propositional units at the lowest hierarchical levels. All other interactions were nonsignificant.

The results of the summarization test condition are presented in Figure 2. These data represent the number of propositional units used at each hierarchical level in each summary. The data were scored in the same manner as the recall condition. The analysis, which again treated both participants and story type as random factors, revealed significant main effects of age, $F(1,7) = 24.06$, $p<.01$, with younger individuals using more propositional units in their summarizations; story type, $F(2,96) = 10.54$, $p<.01$, with younger individuals using more propositional units being used in the summarizations of the easy material; and hierarchical level, $F(3,8) = 56.14$, $p<.01$, with propositional units from the more salient levels of the text base hierarchy used most often. Additionally, significant interactions were found between age and hierarchical level, $F(3,8) = 14.07$, $p<.01$, with younger individuals using more propositional units from the most salient hierarchical levels; and story type and hierarchical level, $F(6,228) = 4.24$, $p<.01$, showing that young and old individuals
Figure 1. Proportions of propositional units recalled as a function of age, difficulty, and hierarchical level.

Figure 2. Proportions of propositional units used in summarization as a function of age, difficulty, and hierarchical level.
used relatively more propositional units in their summaries from the most salient levels of the textual materials.

**DISCUSSION**

Although the results of the verbatim recall and summarization conditions show a great deal of similarity, there were significant differences between the performance of the two age groups in these conditions. In both recall and summarization conditions, older individuals displayed a poorer memory for the details of the story. Additionally, there was an age by hierarchical level interaction in both summary and recall conditions; however, the nature of this interaction displayed opposite trends in the two conditions. In the verbatim recall condition, young individuals recalled more propositional units at the less salient levels of the text hierarchy than their older counterparts, while the number of salient propositional units used was approximately equal for both age groups. This trend was reversed in the summarization condition where the two age groups were equal in their performance levels at the least salient hierarchical levels of the text, but younger individuals used a greater number of the most salient propositional units in their summaries. When older individuals are asked to recall a prose passage, it appears they can achieve some measure of success by reproducing the story immediately after it has been encoded, showing a decrement in memory only at the lowest levels of saliency in the text base hierarchy. However, when asked to summarize the same material, younger individuals successfully concentrated their reproductive efforts on the most salient material and excluded extraneous material. In contrast, the summarization efforts of the older individuals showed approximately the same probability of using propositional units from any of the hierarchical levels in the summaries.

The results of the younger group of individuals, which are consistent with the theoretical position of van Dijk and Kintsch [19], show that the younger participants were capable of both comprehending the text and organizing the information to form a summary that concentrates on the most salient information. However, the results of the summarization performance of the older individuals, which showed equally low levels of utilization of propositional units at all levels of the text hierarchy, present some problems for van Dijk and Kintsch's position. If summarization is thought to be associated primarily with comprehension and organizational processes, does this mean that older individuals are incapable of using these processes to deal with textual information? It would seem unlikely that older individuals are incapable of comprehending textual material given their results in the verbatim recall condition that used the same material. It seems more likely that the older individuals in the present study were deficient in the ability to organize and manipulate successfully the text base formed by the comprehension processes. Kintsch Mandel, and Kozminsky [11] suggested that the quality of summarization efforts would be negatively affected by either the complexity of the material or by a limitation of the amount of cognitive capacity that could be devoted to the task. This is shown in the present experiment by a decline in memory only at the lowest levels of saliency in the text base hierarchy. However, when asked to summarize the same material, younger individuals successfully concentrated their reproductive efforts on the most salient material and excluded extraneous material. In contrast, the summarization efforts of the older individuals showed approximately the same probability of using propositional units from any of the hierarchical levels in the summaries.

The difference between the processes of comprehension and organization can also be thought of in terms of the difference between automatic and effortful processing strategies. Kintsch and van Dijk [12] have suggested that comprehension is an automatic, well-learned process that makes little or no demands on other cognitive resources, while organization and summarization may be considered to be effortful processes in that they require a great deal of cognitive effort to perform. The results of the present study would seem to confirm that the organizational processes necessary for summarization may be considered effortful in that they were negatively affected by the cognitive demands of the presentation condition. This pattern of results also agrees with the findings of Hasher and Zacks [6] who showed that older individuals display little decrement in automatic processes, but manifest a decrement in the ability to perform effortful processing strategies. It was thought that the restrictive demands of the summarization task served to disrupt those effortful processes of textual organization, while only minimally affecting the automatic processes of text comprehension.

Kintsch and van Dijk [12] have formulated a three-stage model of discourse processing that is composed of: 1. The encoding and parsing of discourse into its constituent elements; 2. Condensation of the textual elements into its gist and the storage of this representation; and 3. The generation of new textual elements from the memorial consequences of stages 1
and 2. The results of the present study suggest that the encoding and comprehension processes of the first stage of Kintsch and van Dijk's model are vulnerable to the effects of age, particularly those operations that require more than just a simple reproduction of stored textual material and that must be performed under conditions that limit the amount of cognitive capacity that can be devoted to the processing requirements [12].

REFERENCES