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ABSTRACT

The effects of content schemata, embodying the reader's existing knowledge about a topic, on reading comprehension were examined in two experiments in which high school and college students were instructed to take a distinctive point of view while reading and recalling a story. Perspectives assigned before reading, shortly after reading, and long after reading all had substantial effects on recall. The results were interpreted to mean that the schema brought into play by the perspective instructions selectively enhances encoding when operative during reading and selectively enhances retrieval when operative during attempts at recall. The schema operative during reading appears to influence not only the likelihood that certain text elements will be learned but also their longevity in memory. (Author/DF)

CENTER FOR THE STUDY OF READING

Technical Report No. 119

EFFECTS OF THE READER'S SCHEMA AT DIFFERENT POINTS IN TIME

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Abstract

In two experiments, subjects were instructed to take a distinctive point of view while reading and recalling a story. Perspectives assigned before reading, shortly after reading, and long after reading all had substantial effects on recall. The results were interpreted to mean that the schema brought into play by the perspective instructions selectively enhances encoding when operative during reading and selectively enhances retrieval when operative during attempts at recall. The schema operative during reading appears to influence not only the likelihood that certain text elements will be learned but also their longevity in memory.

Effects of the Reader's Schema At Different Points in Time

A major task facing a reader is to find an overall framework or schema within which to understand a text. The schema allows the reader to place the major themes, secondary themes, and supporting details in proper relation to one another, and may be integral to several other comprehension and memory functions, as will be explained later.

The reader uses two general kinds of schemata in interpreting text. The first embodies knowledge of discourse conventions that signal organization. There are probably specialized conventions characteristic of distinct text forms as well as conventions common to most forms; thus, it is possible to speak of a story schema, a personal letter schema, a news article schema, a scientific report schema, and so on. As a class, knowledge of the discourse-level conventions of text may be called textual schemata.

The present research is concerned with a second general type of schemata, namely content schemata, embodying the reader's existing knowledge of real and imaginary worlds. What the reader already believes about a topic helps to structure the interpretation of new messages about this topic. Indeed, as we have argued in detail elsewhere (Pichert & Anderson, 1977; Steffensen, Jogdeo, & Anderson, 1978), there is good reason to believe that content schemata are more important to reading comprehension than textual schemata.

A variety of experimental techniques has been employed to study the effects of content schemata. For instance, titles have been provided that induce different interpretations of ambiguous passages (Bransford & Johnson, 1973; Schallert, 1976). Or, characters in the passage to be read have been assigned the names of well-known figures, thereby insinuating the relevance of the reader's existing knowledge of these individuals (Sulin & Dooling, 1974; Brown, Smiley, Day, Townsend, & Lawton, 1977). Or, alternate introductions to the passage have been written so as to cause readers to identify with different characters (Owens, Dafoe, & Bower, 1979). Or, schemata have been manipulated by selecting subjects with different amounts of knowledge about a topic or different cultural backgrounds (Anderson, Reynolds, Schallert, & Goetz, 1977; Steffensen, Jogdeo, & Anderson, 1978; Spilich, Vesonder, Chiesi, & Voss, 1979).

Two clear findings have emerged from this research. First, readers make inferences consistent with their schemata. Second, they recall more text information important to their schemata. What is not so clear is precisely why these phenomena appear, although there is no shortage of ideas about possible mechanisms. Investigators have been as ingenious at inventing explanations as they have at dreaming up procedures for inducing subjects to bring alternate schemata to bear.

The explanations divide into two classes. Encoding hypotheses suppose processes active during reading. Retrieval hypotheses assume processes active later when information must be remembered. With respect to encoding, one theorist or another has supposed that the reader's schema guides

allocation of attention to the significant aspects of the text, furnishes the ideational scaffolding for assimilating information, and/or enables inferential elaboration where the text is not explicit. Later, when the text is recalled, it has been supposed that the operative schema provides a structure that facilitates an orderly search of memory, provides the criteria for editing unimportant or uncertain information, and/or enables inferential reconstruction where there are gaps in memory. It is apparent that one major issue is when a schema has its influence. The purpose of the research reported in this paper is to investigate the time course of schema effects.

Our previous research has established that a schema has an effect on retrieval in addition to any it may have on encoding (Anderson & Pichert, 1978). Subjects directed to take either a homebuyer or a burglar perspective read a story about two boys playing hooky from school. They go to one of the boys' homes because his mother is never there on Thursdays. The family is well-to-do. They have a fine old home with attractive grounds, but also some defects such as a leaking roof and a musty basement. The family has a number of valuable possessions including ten-speed bikes and original paintings.

Everyone attempted to recall the story twice. Before the second attempt, half of the subjects were directed to take a new perspective (from burglar to homebuyer or vice versa). On the second attempt, subjects recalled additional, previously unrecalled information important to the new perspective but unimportant to the perspective operative when the passage

was read and recalled for the first time. For instance, subjects who shifted to the burglar perspective became more likely to recall information such as that the side door was always unlocked, whereas subjects who shifted to the homebuyer perspective were likely at that point to remember that the roof leaked or that the place had attractive grounds. In several experiments employing this paradigm, from 65% to more than 80% of the subjects have recalled at least one additional piece of information important to their new perspective.

These results strongly implicate a retrieval process. However, the data did not give strong support to the view that the operative schema also influences encoding, perhaps because the paradigm permitted only a weak test of possible encoding benefits (see Anderson & Pichert, 1978, p. 7). The purpose of the first experiment described herein was to determine whether a reader's schema has both encoding and retrieval effects and whether the effects are independent. The design was simple. Subjects were instructed to take one of two perspectives before reading a passage. After reading, half the subjects shifted to the other perspective and then all subjects recalled the passage. A main effect for the first perspective, operative when the passage was read, would suggest an encoding benefit. A main effect for the second perspective, operative during recall, would indicate a retrieval benefit. If there was no interaction between first and second perspective, this would suggest that the encoding and retrieval processes were independent.

Experiment 1

Method

Subjects. Useable data was obtained from a heterogeneous sample of 215 public high school students enrolled in a school in a small midwestern city. Ten other subjects failed to comply with instructions. Eleven subjects were lost when their new ID pictures arrived during the study. One further subject began reading, but decided not to continue.

Materials. The experimental passage was the narrative summarized earlier about what two boys did at one of the boys' homes while they were skipping school. It contained a number of points of interest to homebuyers and burglars. The story was 373 words long and contained 72 idea units which had been rated for their relative importance to a burglar and to a prospective homebuyer (Pichert & Anderson, 1977).

Design and procedure. Subjects were run in groups of 8 to 25. Subjects were told that the study concerned "how people think about and remember stories . . . primarily in memory for the ideas in a story." Envelopes containing inst ctions, the story, and a test booklet were distributed to subjects at random. Subjects read instructions assigning them the burglar or homebuyer perspective after which they were given two minutes to read the passage. Then twelve minutes were allowed to do 79 items from the Wide Range Vocabulary Test (French, Ekstrom, & Price, 1963). Only the first 48 items were scored. The additional 31 items were employed to keep the

retention interval uniform. Since this is a relatively difficult test, intended for advanced high school and college students, not all subjects finished the first 48 items in the twelve minute period.

After the vocabulary test subjects turned to an instruction page which asked half of them to recall the story from their original perspective. The rest were told to think of the story from a new perspective, the perspective not assigned originally. The instructions emphasized "please write down all you are able to recall from the story. Write down as much of the entire story as exactly as you can on the two blank sheets of paper. If you cannot remember the exact words of any sentence, but you do remember the meaning, write down a sentence or phrase as close to the original as possible." Subjects were asked to be sure to keep in mind the perspective from which they were to recall the story and to "be sure to write down every bit of the story you can remember, no matter how inconsequential it may seem."

Following recall subjects completed a debriefing questionnaire. Then they were thanked for their cooperation, exhorted to tell none of their friends what the study was about until the day was over, and dismissed.

Scoring. Idea units were identified in the protocols which, according to gist criteria, matched any of the 28 idea units previously rated as having differential importance from the two perspectives. Fifteen idea units were important to burglars, but much less important to homebuyers. The other thirteen were of higher rated importance to homebuyers than burglars. In an earlier study (Pichert & Anderson, 1977) interrater reliability was .93. Reliability was not assessed this time.

Results

Table 1 presents mean proportions recalled as a function of the importance of the information to the two perspectives. Significant effects were obtained for both importance to the first perspective, $F(1,207) = 38.3$, $p < .01$, and importance to the second perspective, $F(1,207) = 26.4$, $p < .01$, but, as can be seen from the table, there was no interaction. Burglar information was better recalled than home buyer information and subjects with high scores on the vocabulary test recalled more than subjects with low scores. There were no other significant effects.

Insert Table 1 about here

Experiment 2

The results of Experiment 1 indicate that perspectives assigned before and shortly after reading a passage both have substantial effects on recall and that the effects are independent. The question addressed in the second experiment is what would happen if a new perspective were introduced a considerable period of time after a passage had been read.

There are two aspects to the perspective shift effect. One is the negative influence on subsequent recall of information important to the original perspective which is unimportant in the light of the new perspective. There is no reason to suppose that a substantial delay would reduce the negative effect, unless the delay were so long that subjects were not recalling much of anything and there was, therefore, no room for a negative influence to show itself relative to a control group.

With respect to the positive effect of a shift on recall of information that becomes important in the light of the changed perspective, one's immediate intuition is that a long delay would reduce or eliminate the effect. The reasoning is that information that is unimportant during encoding and is not produced during a first attempt at recall seems destined for a short memorial half-life, if it were stored at all. Unless the new perspective were introduced shortly after reading, it seems as though there would be no previously unrecalled information in memory that could be recovered when the perspective shifted.

Method

Subjects. Seventy-one introductory educational psychology students participated in this experiment in order to fulfill a course requirement. Five other subjects failed to reappear for the delayed retention test.

Materials, design, and procedure. Subjects read the skipping school passage from the perspective of either a burglar or homebuyer, worked on the Wide Range Vocabulary Test for twelve minutes, and then attempted to recall the passage. When everyone had completed the first recall, five minutes were allowed to do six items from the Surface Development Test (French, Elkstrom, & Price, 1963). This test requires subjects to mentally "fold" a two dimensional figure to match a three dimensional representation. The task is to match numbered edges on the two dimensional figure with the lettered edges on its three dimensional counterpart.

Next, one randomly selected group of subjects turned to an instruction page which asked them to recall the story a second time. A random half of this smaller group did so from the same perspective and the other half from the alternate perspective. Subjects in the no-change condition were told the study was being done to determine whether or not people can remember things about a story they thought they had forgotten if they are given a second chance. Their original perspective instructions were then repeated. Subjects in the change of perspective condition were told, "This study is being done to determine whether or not people can remember things about a story they thought they had forgotten if they are given a new perspective on that story . . . Please try to think of the story you read from the following new perspective." The new perspective was then described exactly as it had been for those subjects given it originally. Recall instructions were repeated for both groups and the experimenter stressed ". . . this study is attempting to determine differences in persons' recall from one time to the next so please write down <u>every</u> bit of the story which you can remember."

A second group of subjects turned to a filler task, the "Memory Precision Test," which asked them to write from memory any two familiar pieces of literature. Suggested as examples were Lincoln's Gettysburg Address, the Star Spangled Banner, the Twenty-third Psalm, and the Scout Oath. Subjects were told to write as much and as accurately as they could.

Approximately two weeks (range = 14 to 16 days) after the initial session, the experimenter returned to the subjects' classrooms and again asked for recall. The instructions began, "Two weeks ago you read a story about two boys playing hooky from school." The rest of the instructions were the same as those used two weeks earlier to obtain the second story recall. A random half of the subjects were asked to recall the story from the perspective originally assigned, the remaining half from the other perspective. The delayed protocols of subjects who had recalled the story a second time two weeks earlier were not included in the data analysis; thus, retention interval was a between-subjects factor.

When subjects had written everything they could recall, they completed a short debriefing questionnaire. Subjects were then assured they would not ever have to write the story again, thanked for their cooperation, and dismissed.

Results

As in most of our previous studies burglar information was better recalled than homebuyer information. However, this factor did not interact with other variables. For clarity and economy of presentation, the burglar and homebuyer data were pooled in all of the analyses reported below. Table 2 contains mean proportions of idea units recalled on the first and second attempts.

Insert Table 2 about here

The first analysis involved the difference between the first and second attempts in proportion of elements recalled that were unimportant to the original perspective. These elements become important in the light of the second recall schema for subjects who shifted perspectives but remained unimportant for no-shift control subjects. Computed was a 2 x 2 x 2 analysis of variance in which the factors were retention interval (Immediate versus Delay), importance of information to the perspective active during the second recall attempt (High versus Low), and vocabulary knowledge (High versus Low). Significant effects for retention interval, $F(1,63) = 60.4$, $p < .001$, and second recall perspective, $F(1,63) = 15.0$, $p < .001$, appeared. These results replicate earlier studies showing a positive effect of a perspective shift. That is, the results confirm that subjects who shift perspectives recall additional information which becomes important in the light of the changed perspective. The noteworthy new finding is that the positive effect is about as large when the perspective shift occurs two weeks later as when the shift occurs shortly after the passage is recalled for the first time.

A parallel analysis involved the difference between the first and second attempt in proportions of text elements recalled that were important to the initial perspective. Again, the main effects for retention interval $F(1,63) = 24.7$, $p < .001$, and importance to second recall perspective, $F(1,63) = 6.3$, $p < .02$, were significant. These results confirm our previous finding that a perspective shift has a negative effect on recall of information important to the initial perspective which becomes unimportant

as a result of the shift. Though the negative effect was somewhat larger after two weeks, the interaction of retention interval and second recall perspective was not significant.

A further set of analyses was done to provide a more detailed picture of the results. Table 3 summarizes mean proportions of text elements recalled on the second attempt given that the information was or was not recalled on the first attempt. Beginning with already-recalled information of low importance to the initial perspective, only retention interval had a significant effect, $F(1,57) = 50.1$, $p < .001$. Already-recalled information of high importance to the initial perspective was influenced by both retention interval, $F(1,57) = 24.1$, $p < .001$, and importance to second recall perspective, $F(1,57) = 9.6$, $p < .001$. With respect to previously unrecalled information of low importance to a subject's initial perspective, significant effects were observed for retention interval, $F(1,57) = 7.0$, $p < .02$, importance to second recall perspective, $F(1,57) = 13.1$, $p < .001$, and the interaction of these two factors, $F(1,57) = 5.7$, $p < .03$. No significant effects appeared in an analysis of previously-unrecalled information of high importance to the initial perspective.

Insert Table 3 about here

General Discussion

The present research shows that a perspective assigned before reading, shortly after reading, or long after reading has a pronounced influence on text recall. The straightforward interpretation is that a perspective

taken beforehand activates a schema which selectively enhances encoding whereas a schema activated afterwards selectively enhances retrieval. As a matter of logic, there is no escape from the latter conclusion since a perspective considered for the first time after reading could not influence encoding.

The explanation for the effect of a perspective assigned prior to reading may appear to be less certain. One would suppose that ordinarily people maintain the same schema when recalling a passage as when reading it. Thus, the influence of a schema induced beforehand might also be attributable to a retrieval process instead of an encoding process. A close look at the data, however, suggests that the reading perspective does affect encoding. Presumably a perspective shift disables the schema operative during reading, thereby preventing this schema from influencing retrieval. Consistent with this assumption is the fact that there was a sharp drop in recall of information that had been important to the reading schema but became unimportant when the perspective shifted. On the other hand, recall of this information was still superior to the recall of information unimportant to both the reading and the recall perspectives, a superiority which can be accounted for plausibly only in terms of an encoding process.

We conclude that all of the data conforms to a theory that says that the schema brought into play by perspective instructions will facilitate encoding if it is operative while a passage is being read and will facilitate retrieval if it is operative when the passage is being recalled. Information important only to the reading perspective benefits from just the encoding process.

Information important only to the recall perspective benefits from just the retrieval process. When the reading and recall perspectives are the same, information important to the perspective is enhanced by both processes.

The experiments reported in this paper do not illuminate the specific mechanisms by which schemata influence encoding and retrieval. Other research suggests that during encoding the operative schema may guide allocation of attention to important text elements. Subjects report paying closer attention to important elements (Anderson & Pichert, 1978) and they do spend more time on these elements (Carpenter & Just, Note 1; Cirilo & Foss, Note 2).

A promising explanation for the retrieval effect is that the schema provides a "retrieval plan." The idea is that the rememberer organizes memory search in terms of categories of information marked as important in the schema. To illustrate, everyone's burglary schema may be supposed to include the knowledge that burglars are interested in entering the premises to be robbed, finding loot, and avoiding detection. A person attempting to recall the skipping school passage who is told to play the role of a burglar is hypothesized to procede from these general concerns to related text information such as, respectively, that the side door is unlocked, that there are three ten-speed bikes in the garage, and that the view from the road is blocked by a tall hedge. The schema can be thought of as providing implicit cues or mental pathways to relevant text information. In this view text information that does not connect with the schema guiding memory search is unlikely to be recalled. A top-down search emanating from a burglary schema could not turn up the information in the skipping school passage

that the house has new stone siding, for instance. Retrospective self-reports of subjects about why they remembered information have provided some preliminary support for the retrieval plan hypothesis (Anderson & Pichert, 1978).

The retrieval plan hypothesis gives a very reasonable account of the fact that subjects who shift perspectives recall previously unrecalled information. There are other possible explanations for the phenomenon, however. One is that subjects may be editing their output when they write down what they can remember on the first attempt. The increment on the second attempt might represent a change in editing standards rather than a genuine change in what information is recallable. The output editing hypothesis has several forms. Because of fatigue or boredom, subjects might not bother to write down unimportant elements. Or, they might adopt a more stringent criterion of confidence for unimportant elements. Or, important elements might be given recall priority thereby subjecting unimportant elements to output interference (Roediger, 1974). This class of hypotheses has not fared well to date (cf. Anderson, 1978). Subjects report writing down every detail they can remember, no matter how insignificant. The perspective shift effect is found even when money is paid for complete and accurate recall (Surber, 1977). When a signal detection analysis is done of performance on a recognition task, it does not appear that a perspective shift affects the bias parameter (Surber, 1977). Finally, unpublished research done in our laboratory shows that instructing subjects to recall information <u>not</u> relevant to their perspective before they recall

the information that is relevant does not diminish the perspective shift effect. Our tentative conclusion is that, while surely there are circumstances under which what gets reported from memory will be edited, this does not seem to be the explanation for the perspective shift phenomenon under the conditions that have prevailed in our experiments.

Another possible explanation for the phenomenon of recall of previously unrecalled information is that the new schema allows inferential reconstruction of the text elements not reported the first time. Spiro (1977) and Snyder and Uranowitz (1978) have done some ingenious experiments which show that this hypothesis is creditable. It gives a poor account of our data, however, because there are insufficient grounds for inferring many of the elements subjects produce after a perspective shift. Consider the information in the text that Mother is never home on Thursdays. From the burglary schema, a rememberer may be presumed to know that a burglar would be interested in avoiding detection, but it would be a coincidence, indeed, if by reconstruction or, less politely, fabrication, he or she were able to hit on just this state of affairs that enable avoiding detection.

There have been previous failures to show any effect on recall from a manipulation that causes subjects to bring to bear a schema after reading a passage. Notably, the present research may seem to conflict with the well-known experiments of Bransford and Johnson (1973). They found that a picture that indicated the proper relationships among the objects mentioned in an otherwise ambiguous passage strongly enhanced recall when presented

before the passage but had no effect when presented after it had been read. Similarly, a title given before, but not after, an ambiguous passage facilitated recall. The critical feature of the passages used in the Bransford and Johnson experiments was that without assistance subjects were unable to discover schemata within which the passages made sense. Because there was no framework for encoding the information, little could be learned or remembered. In the skipping school passage, on the other hand, all of the elements were understandable in terms of some schema or other that was transparent to the reader. The segments not directly relatable to the schema activated by the perspective instructions could be comprehended in terms of schemata embodying knowledge about the motivations of young boys, the physical layout of houses, or some other matter of common knowledge.

It is most interesting that a perspective shift continues to influence recall even when it occurs after a two week interval. The data are clear that there is still an aggregate effect, less clear about the locus of the effect. The most striking finding of our studies is the phenomenon of recall of previously unrecalled information following a perspective shift. In the second experiment reported here, previously unrecalled information, important in terms of the recall perspective, had a probablility of .35 of being produced on the second attempt when the shift happened immediately and .11 when the shift was delayed for two weeks (see Table 3). The comparable values for the no shift groups were .06 and .05. Looking at the data in another way, 87% of the subjects who shifted perspective immediately

recalled at least one additional piece of now-important information on the second attempt while 50% who shifted perspectives two weeks later did so. The figures for the no shift groups were 47% and 38%. Significance tests showed that the increment of the immediate shift group was reliable whereas that of the delayed group was not. Thus, our initial conjecture that the increment in recall of previously unrecalled information might be reduced or eliminated by a delay received some support. It should be cautioned, though, that by the time the data had been partitioned according to time of second recall, importance to the reading perspective, and recall or non-recall on the first attempt, there was not much power left with which to challenge the null hypothesis.

One of the oldest findings in the prose literature (cf. Newman, 1939) is that important information is better remembered, not just better learned, than unimportant information. This fact could be attributable solely to the retrieval process demonstrated in our perspective shift studies. But there also may be an additional enhancement of information important during reading. It may benefit from greater "strength" or "goodness" of learning because of more rehearsal, greater depth of processing, greater breadth of processing, or whatever. The result would be a more enduring memory trace, and, hence, a slower rate of forgetting for initially important as opposed to initially unimportant information.

Experiment 2 provided some support for this hypothesis. The pertinent data involved the change over the retention interval in recall of information that assuredly had been learned because it had been recalled on the first

attempt (see the second and fourth columns of Table 3). Over the retention interval there was a decline of .42 in recall of already-recalled information of low importance to the reading perspective. The parallel figure for information of high importance to the reading perspective was only .33. This difference in rate of forgetting, which was independent of level of importance to the recall perspective, proved to be statistically significant, $t(63) = 2.38$, $p < .05$. Thus, it appears that the schema operative during reading affects not only the likelihood certain information will be learned but also its durability in memory. Notice that this conclusion cannot be discounted on the grounds that already-recalled text elements of low and high importance to the reading perspective were not comparable. If anything, there was a bias against finding a difference in rate of forgetting, for elements that were learned even though they were unimportant to the reading perspective must have been especially salient for some intrinsic reason and, therefore, one would have thought, especially memorable.

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Footnotes

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James W. Pichert is now at the University of Colorado at Denver.

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Table 1

Mean Proportions of Text Elements Recalled

Importance to Recall Perspective	Importance to Reading Perspective	
	Low	High
High	.41	.51
Low	.32	.43

Table 2

Mean Proportions of Text Elements Recalled

Importance to Second Recall Perspective	Importance to Reading Perspective			
	Low		High	
	Recall 1	Recall 2	Recall 1	Recall 2
High				
Immediate	.47	.60	.62	.64
Delay	.41	.29	.64	.50
Low				
Immediate	.36	.38	.59	.50
Delay	.51	.29	.58	.29

Table 3

Means Proportions of Text Elements Recalled on Second Attempt Given Recall or Non-recall on First Attempt

Importance to Second Recall Perspective	Importance to Reading Perspective			
	Low		High	
	Not Recalled	Recalled	Not Recalled	Recalled
High				
Immediate	.35	1.00	.12	.98
Delay	.11	.57	.15	.67
Low				
Immediate	.06	.92	.19	.79
Delay	.05	.51	.10	.46

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READING EDUCATION REPORTS

No. 1: Durkin, D. *Comprehension Instruction—Where are You?*, October 1977. (ERIC Document Reproduction Service No. ED 146 566, 14p., HC-$1.67, MF-$.83)

No. 2: Asher, S. R. *Sex Differences in Reading Achievement*, October 1977. (ERIC Document Reproduction Service No. ED 145 567, 30p., HC-$2.00, MF-$.83)

No. 3: Adams, M. J., Anderson, R. C., & Durkin, D. *Beginning Reading: Theory and Practice*, November 1977. (ERIC Document Reproduction Service No. ED 151 722, 15p., HC-$1.67, MF-$.83)

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