Effects of embedding orienting stimuli in a prose passage*

RAYMOND W. KULHAVY†

Arizona State University, Tempe, Ariz. 85281

College students learned a 2,000-word prose passage that contained either deleted or formally identified orienting cues. Contrary to predictions from similar research, only formal cue identification, requiring no overt production of the critical units, promoted learning of noncued material. The results indicate that the disruption of S's scanning processes may prevent storage of noncued information.

One of the more impressive outcomes of research on the learning of written discourse has been the predictable manner in which one may control an S's inspection behaviors by using orienting stimuli (Rothkopf, 1966, 1969; Frase, 1968). The manipulated inspection processes have been collectively labeled "mathemagenic" activities (cf. Rothkopf, 1963), a term that refers to the functional properties of text acquisition.

Frequently, studies of mathemagenic activity have placed interrogative statements either before or after a prose segment, and sought to determine their effect on what is learned from the text. When such orienting stimuli (OS) refer to specific information units ("facts"), and are presented before reading, they serve to focus S's search activities on the corresponding critical content in the text. Prepresentation of OS consistently depresses the learning of noncued, or incidental, material. However, under conditions where OS are placed following the passage, they act to facilitate learning of both critical and incidental content. Apparently, when OS are seen before reading, they tend to restrict information search patterns to related material, whereas postpresentation acts to diffuse search behavior. Most likely, prepresentation defines an acquisition "target" for S, thereby increasing superficial scanning of adjacent text. Alternately, when S receives OS following reading, he is more likely to inspect the entire prose segment closely in anticipation of the interrogative to follow. Thus, the degree to which OS prompt the learner to search the passage for potential responses is directly related to the

amount of incidental content that is learned.

In most studies of mathemagenic processing, the OS are presented "outside" of the framework of the passage itself. An obvious question asks if the same inspection parameters hold when OS are embedded in the structure of the text proper. Under these conditions, reading the text is no longer a separate act from receiving the OS. It may be that the immediate presence of context factors (e.g., semantic and/or syntactical cues) might alter the effects of orienting cues on S's inspection behaviors. However, if these factors have little influence, we would expect embedded OS to yield essentially the same results as previous studies. For example, the mathemagenics data might predict that deleting critical information from the passage would force S to increase his search activity to locate an appropriate response. These conditions should lead to increases in the learning of material adjacent to the deleted unit. However, if the critical units were formally identified (for instance, underlined) rather than deleted, one would expect no increase in search behavior or in incidental learning relative to a "read-only" control.

In addition to the type of cue, we could make an alternate test of the search-diffusion hypothesis by requiring S to produce overtly critical units during learning. Instructions to construct overtly the cued information when it is encountered should increase the effects previously predicted for both critical and incidental content. The requirement of making an observable response should increase search behavior simply because S must demonstrate publicly that he has located the appropriate answer (Kulhavy & Parsons, 1972). If, however, it is necessary only to copy a formally identified unit, S should be less likely to attend to adjacent material.

GENERAL DESIGN

Two variables, type of cue (C) and

response requirement (R) were combined factorially to construct four experimental groups. Critical or incidental presentation (P) of an item was treated as a within-Ss variable for each factorial cell. The resulting design was a 2 (delete vs underline cue) by 2 (overt vs covert response) by 2 (critical vs incidental presentation) mixed analysis of variance with repeated measures on the P variable. A control group read the unaltered text.

SUBJECTS

The Ss were 80 undergraduate volunteers from Arizona State University. They were assigned randomly, 16 to each of the five conditions.

MATERIALS

The prose material used was a 2,305-word passage describing a fictitious African tribe, the Himoots (Anderson & Myrow, 1970). To assure that Ss in the deletion conditions could determine missing responses simply by reading, the passage was modified so that each embedded item was repeated twice in the same paragraph. The modification was accomplished by a careful rewriting of each text segment so that the repetition was integrated into the existing content and was not merely a "parroting" of the information. Testable material was distributed evenly throughout the passage. The criterion measure consisted of 72 items relating to the same number of specific "facts" within the passage. For the experimental groups, a separate text booklet was constructed for each S in which 36 testable units were either underlined, or deleted completely with black ink. The remaining 36 units in each booklet were not identified and served as incidental items. Which specific units were identified as critical or incidental was separately randomized for each S.

PROCEDURE

Ss participated in groups of 10 to 30, with Ss from all five conditions present at each session. Each S was assigned randomly a text booklet that contained instructions appropriate to one of the five conditions. Ss in the overt responding groups were told to write the cued items on the bottom of the instruction page as they read the passage. Ss in the covert conditions were instructed to read the material and "pay attention" to the cued items. Control Ss read the unaltered passage. All Ss were informed that they would be tested when they completed the text. As soon as S finished reading, his booklet was collected and he was given the criterion measure, the item order of which was randomized differently from the order in the text. No time limit was placed on completing the passage or test.

*This research was supported by Arizona State University Faculty Research Grant No. 7805-837-15-8.

†The author wishes to thank Carol Mills for her assistance in the collection and analysis of data for this study.

Table 1
Mean Criterion Test Corrects for Type of Cue and Response
Conditions, Collapsed Across Presentation Mode

Response Requirement		Type of Cue		Controls
		Deletion	Underline	
Overt	Mean	56.67	55.60	56.07
	SD	9.29	8.02	8.97
Covert	Mean	53.00	61.59	
	SD	11.57	8.70	

RESULTS

Table 1 presents the means and standard deviations for criterion test corrects for the experimental groups collapsed across presentation mode and for the controls.

A Dunnett's test on criterion scores between the controls and the experimental groups showed that only the Ss making no response, with underlined cues, differed significantly from performance of the control condition ($t = 2.24$, $p < .05$). A 2 (C) by 2 (R) by 2 (P) ANOVA yielded significant effects for P ($F = 30.04$, $df = 1/60$, $p < .01$), and the R by P interaction ($F = 28.34$, $df = 1/60$, $p < .01$). No other main effect or interaction reached significance in this analysis. Table 2 shows the means and standard deviations contributing to the R by P interaction.

DISCUSSION

The results of this study do not agree with predictions derived from related research. Clearly, when OS are embedded within text they function in a manner different from when they are

presented as discrete units. In fact, the data are nearly opposite the direction predicted. Whether or not a cued item was deleted or formally identified made little difference in its probability of recall. More important, neither cuing procedure appeared to differentially influence learning of noncued material. When forced to locate and reproduce a critical unit, S's inspection behavior became highly selective, with a marked tendency to bypass adjacent content. On the other hand, if the OS did not require an explicit overt performance, the likelihood of attending to surrounding information was increased.

An adequate account of these data appears to pivot on the degree to which the treatment variables disrupted S's text-scanning processes. When Ss were not instructed to respond overtly, they seemed more likely to attend both to the cued unit and to its corresponding information matrix (the semantic framework in which it was embedded). Under these conditions, the learning of cued components is by primary intention, with adjacent content perhaps acting as a recall vehicle. However, when S must produce cued units during reading, the activity appears to disrupt inspection patterns and there is a decrease in the probability of adequately storing related semantic components. This hypothesis is supported when one notes that incidental acquisition was highest in the no-response/underline group—the condition providing minimum interference with S's inspection habits.

The no-response/underline Ss were the sole group to recall significantly more items than the read-only controls.

It is apparent that the embedding of OS within a passage leads to somewhat different predictions concerning inspection behaviors. When it is necessary for S to disrupt his "normal" reading patterns in order to determine a response and produce it, the disruption tends to reduce attention to adjacent material. These results suggest that the acquisition of information from prose is best served when embedded cues are constructed to interfere as little as possible with the smooth flow of in-process inspection.

It appears possible that the cuing procedures in this research may be potentially useful for studying acquisition processes in text. If one could quantify sizes of the information matrices used to store cued units under various conditions of presentation and content, it would do much to increase our understanding of the processes involved in prose learning.

REFERENCES

- ANDERSON, R. C., & MYROW, D. L. Retroactive inhibition of meaningful discourse. *Journal of Educational Psychology Monograph Supplement*, 1970, 62, 81-92.
- FRASE, L. T. Effects of question location, pacing, and mode upon retention of prose material. *Journal of Educational Psychology*, 1968, 59, 244-249.
- KULHAVY, R. W., & PARSONS, J. A. Learning-criterion error perseveration in text materials. *Journal of Educational Psychology*, 1972, 63, 81-86.
- ROTHKOPF, E. Z. Some conjectures about inspection behavior in learning from written sentences and the response mode problem in programed self-instruction. *Journal of Programmed Instruction*, 1963, 3, 31-46.
- ROTHKOPF, E. Z. Learning from written materials: An exploration of the control of inspection behavior by test-like events. *American Educational Research Journal*, 1966, 3, 241-249.
- ROTHKOPF, E. Z. Concerning parallels between adaptive processes in thinking and self-instruction. In J. F. Voss (Ed.), *Approaches to thought*. Columbus: Merrill, 1969. Pp. 299-316.

Table 2
Components of the R by P Interaction
for Mean Criterion Test Scores

Response Requirement		Presentation Mode	
		Critical	Incidental
Overt	Mean	61.78	50.48
	SD	9.68	7.63
Covert	Mean	59.10	55.49
	SD	10.87	9.40