Bulletin of the Psychonomic Society
1991, 29 (1), 31-32

Sentence-order feedback during processing of sequential or spatial texts

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This study is a continuation of work on the effects of feedback on text processing. Subjects reconstructed scrambled versions of two qualitatively similar texts. One version was based on the sequential order of locations encountered on a drive through a town (route); the other described the same place in geographical terms (survey). The results confirmed previous research, which showed the following: (1) Readers can develop a surface memorial representation of the text without further processing; (2) readers can recall significant amounts of fragmented ideas; and (3) feedback seems to differentially assist recall rather than recognition of original text. The implications for instructional assistance are discussed.

This study is part of an experimental program designed to examine the effects of instructional assistance on the comprehension of text. Among the types of assistance provided in previous research have been objectives (Rothkopf & Kaplan, 1972), text signaling (Lorch & Chen, 1986), and, especially, feedback (Barringer & Gholson, 1975). The dependent variables have generally been some form of achievement measures.

Our data have not been uniform in the direction of outcomes (Langer, Keenan, & Culler, 1987). Nevertheless, researchers in the field of classroom instruction have attested to the general efficacy of instructional assistance (Berliner & Rosenshine, 1977). Their underlying assumption that assistance is better than no assistance appears to be supported as much by a somewhat biased perception of the literature as by a set of axiomatic beliefs held by educators. The data from our own laboratory especially suggest that there may be significant limitations with regard to the effectiveness of such instructional assistance as feedback and text signaling, at least with regard to synthesizing meaning from text (Langer, Keenan, & Culler, 1986).

In our previous studies, subjects reconstructed scrambled passages with confirming-disconfirming feedback as the primary form of assistance. Comprehension was assessed by comparing the order of reconstructed text to the original sentence or paragraph sequence, as well as employing more common retrieval measures such as idea recall and sentence recognition. Our choice of sentence order as a variable was based on the premise that reconstruction from scrambled text is a *process* and is therefore sensitive to instructional influences. Although scrambled text has been used extensively in the past as a parameter in research, comparatively little has been done recently (Langer & Keenan, 1984).

Interestingly, our reconstruction paradigm fits in with a recent article by Kintsch (1988), who postulated a bottom-up processing model for discourse processing. He argues that the initial text propositions are formed directly from the text itself, but are then elaborated upon and subsequently integrated into a coherent text representation from the knowledge base available. Comprehension is an iterative construction-integration process, and obviously both the knowledge and text bases change as a result of the processing.

The model suggests that several layers of knowledge interact simultaneously with the task of understanding discourse. Evidence for the model may show a surface representation of verbatim text, a propositional representation of semantic meanings, and a situational representation of pragmatic interpretations.

The situational model has been tested in a series of experiments by Perrig and Kintsch (1985). In that investigation, there were two descriptions of a mythical town called "Baldwin," one in terms of a linear set of instructions for driving through the town, and the other in terms of the town's spatial layout; their results show clearly that subjects can recall the surface features of the text without being able to make inferences from that form of memory. Recall was good, but verifications of true inferences were not better than chance. This evidence of distinct levels of knowledge leads to questions about the thought processes in reading that are of vital concern to educational researchers and practitioners. In terms of our own research on feedback, it is urgent that we know what kinds of intervention are most facilitative for the distinct memorial representations. In this study, the first in a series, we attempted to determine whether feedback has different effects on retrieval from different texts that describe the same situation.

METHOD

Two descriptions of a small midwestern town called "Mapleton" were used; they were adaptations of the texts used by Perrig and Kintsch

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(1985). The *route* version is a set of instructions that will guide a drive through the town. The *survey* version gives a spatial (i.e., geographic) description of the layout of the town. Each version was presented in a 24-sentence passage. The actual canonical order in which features were described was determined by the route version. In the route version, the driver approaches the town from the west, notes the main features of the town at each intersection, and leaves town from the east on the same major highway. In the survey version, the features of the town appear in the same order, but they are described relationally, just as one would do with a map.

The route version contains 504 words forming 185 atomic propositions. The survey version is shorter by 8 words and 1 proposition. The sentences for each version were typed singly on 3×5 in. cards, using two random orders for each version. The subjects were asked to rearrange the cards so that the reconstructed order made sense to them. A slotted board was provided to aid the subjects in sorting the cards.

The subjects were 72 general psychology students who participated as part of the course requirements. They were randomly assigned to the six treatment cells created by the two passages (route/survey) and three conditions. The three conditions were *sort-feedback*, *sort-only*, and *read-only*.

In the sort-feedback condition, the subject was given 25 tokens. While arranging the cards, the subject could use 1 token, up to a total of 25, to confirm the placement of a card. If the order of placement was such that the sentence placed on the slot did follow the one preceding it on the board in the original passage, the subject was told that the placement was correct.

For example, if the subject placed Sentence 12 in the original order immediately after Sentence 10 on the slot, the placement was termed "correct." If the subject placed Sentence 12 before Sentence 10 on the board, the placement was designated as "incorrect." The subject could continue to reconstruct after the tokens were used up, but could get no further information.

The sort-only subjects reconstructed the text sequence without feedback, using the slotted board. The read-only subjects were asked simply to read through the set of cards in one order, and then to read through an equivalent set in another order.

Following processing, the subjects were first asked to recall as much as they could remember, and then to take a recognition test consisting of sentences from a list in which half the sentences were paraphrased.

RESULTS

Recall scores across all three conditions, determined as proportions of propositions correct, were higher for the route version (.42) than for the survey version (.35) [$F(1,66) = 10.2, p < .01$]. This difference parallels the results obtained in the Perrig and Kintsch (1985) experiment, which they attributed to the greater coherence of the route version as well as to the use of personal pronouns. Recognition scores, devised as the proportion of original sentences correctly labeled "old" (i.e., original), were not statistically different across versions. This finding suggests that a surface form of representation was available for the recall and recognition of original text.

Feedback in the sort-feedback condition reliably assisted recall (.40) as compared with sort-only (.33) but did not differ from the read-only condition (.41). That is, these two conditions differed reliably from sort-only [$F(2,66) = 6.9, p < .01$]. There were no differences across all three versions for recognition, and the feedback × text version interaction was not significant. We had assumed that there would be an interaction effect, with feedback helping in the route version (which is intrinsically sequential) but not in the survey version.

In the sorting conditions, the final sentence order for each subject was converted to a tau coefficient (representing an approximation to the original sentence order). Tau, as expected, was higher for the route (.69) than for the survey (.43) version [$F(1,44) = 7.7, p < .01$]. The greater sentence-order agreement associated with the route version is compatible with the idea of different representations at the surface and semantic levels, even though the pragmatic or situational knowledge should be qualitatively the same for both versions. It is possible that, under certain conditions, processing may suffer a loss in reconstruction (Langer, Keenan, & Medosch-Schonbeck, 1986).

DISCUSSION

Our more recent work, along with the findings in this preliminary study, seem to be converging with the Kintsch (1988) model. We have found that our subjects can produce a surface memorial representation of discourse without necessarily any further processing in depth. Furthermore, although we are not certain as to how the material is stored in long-term memory, clearly subjects can reproduce a significant number of fragmented ideas.

Critical to our search for appropriate models of assistance in discourse processing is the growing belief that previous strategies based on management principles rather than insight into the precise learning mechanisms may be hindering the student. Indeed, Sternberg and Ketron (1982) found that a predetermined assistance model may hinder student-generated strategies. In short, this study further questions current instructional practices regarding assistance in the form of feedback, and suggests that any general statements of strategy should be delayed until further research provides clearer direction.

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(Manuscript received June 5, 1990.)