This is the sixth in a series of studies designed to assess the impact of feedback on discourse processing, especially with regard to text sequence (Langer, Keenan, & Medosch-Schonbeck, 1986a). What started out initially as a series of studies on the efficacy of feedback in instruction (Keenan, Langer, & Medosch-Schonbeck, 1985), has evolved into a somewhat unique merger of as yet traditionally unrelated areas of research, i.e., feedback and discourse processing.

One axiomatic instructional tenet is that feedback, either as simple knowledge of results or more complex cognitive assessments, is conducive to improved student learning. Feedback is almost invariably response-dependent, contingent upon how well the answer matches the criteria set by the program of instruction (Bilodeau, 1969; Winne, 1982). Technically it is designed to either acknowledge an appropriate response or modify an erroneous answer so that subsequent learning will be enhanced (Langer, Keenan, & Medosch-Schonbeck, 1986a). The assumption is that by comparing the response to some predetermined criterion and informing the student of the results, learning tactics and strategies will either be redirected or maintained along some correct conceptual pathways (Frederiksen, 1984). However, the research evidence clearly supports the premise that feedback does not bear a simple and direct relationship to levels of conceptual achievement (Getsie, Langer, & Glass, 1985).

Discourse processing has remained fairly isolated from issues of instruction, including feedback. Whether one accepts a propositional analog (Kintsch & van Dijk, 1978; van Dijk & Kintsch, 1983) or the main ideas model of Bonnie Meyers (1985), the emphasis is on the systematic contributions of a single major processing determinant. While current theoretical positions recognize the influence of such factors as individual comprehension strategies, local coherence cues, syntax, and text sequence (van Dijk & Kintsch, 1983), the situational contributions are generally assumed to represent less significant sources of variance. That is, in the Kintsch and van Dijk (1978) model, development of the coherence graph is the product of an iterative process employing inferential networking. The idiosyncratic strategies and knowledge bases of the learner as well as the vagaries of the text are accepted as impacting processing, but not dominating the propositional basing of the text. Similarly Meyers (1985) would argue that her main ideas construct is not another term for serial order, but it is also equally true that the common rules which govern the construction and comprehension

of prose do depend on serial order. Interestingly, the major models for text comprehension of text seem to be moving away from structural analyses to processes and the impact of real-world knowledge (Britton & Black, 1985).

Assuming content organization plays some role in comprehension (Reder, 1980), we asked ourselves what role feedback played in assisting discourse processing. In terms of typical classroom instruction this text processing-feedback interaction is a common everyday experience. At a minimum most learning situations involve a two-fold learner task, i.e., the utilization of prior knowledge and learning skills as well as self-monitoring (Fischer & Mandl, 1984). Generally these are unknown and idiosyncratic (Keenan, Langer, & Medosch-Schonbeck, 1985). Hoping to maximize the conditions under which feedback would assist processing, we used a scrambled text paradigm. The feedback provided assisted the reader in approximating the original order of sentences. This measure of agreement between the order of the reconstructed text and the original sequence (concordance) we believed would be directly related to such measures of retrieval as recall and recognition.

Traditionally retrieval has been proved less effective under conditions of scrambled text (Kulhavy, Schmid, & Walker, 1977; Frase, 1969; Thorndyke, 1977). With the exception of a study by Schultz & Divesta (1973) in which feedback was inadvertently provided, the readers of the scrambled prose received no assistance. Generally, the text provided was specially designed for the experiment. However, in our studies we have used published prose rather than the artificial content usually provided (e.g., Bransford & Franks, 1971).

We found that subject agreement with the original text (i.e., concordance) was not systematically related to retrieval measures. We also determined that the amount of available feedback did not bear a simple monotonic relationship to levels of retrieval. In our studies feedback seemed to assist recognition rather than recall, although under the reconstruction process one might have presumed that recall would benefit more. In some instances, when the passage was short and the content familiar, subjects simply reading the scrambled material did about as well on retrieval as subjects reconstructing the text assisted by feedback (Langer, Keenan, & Medosch-Schonbeck, 1985; Keenan, Langer, & Medosch-Schonbeck, 1985; Langer, Keenan, & Medosch-Schonbeck, 1986a; Langer, Keenan, & Medosch-Schonbeck,

1986b). If nothing else Clark's (1973) warning about treating content as a fixed variable proved true.

Clearly the results were generally not in accordance with the current literature in feedback and discourse processing, although a number of trends were beginning to emerge. That is, the nature of the problem was becoming clearer (Keenan, Langer, & Medosch-Schonbeck, 1985). Specifically, the effect of feedback on reconstruction seemed to revolve about a semantic-episodic distinction (Tulving, 1972). In a previous study (Langer, Keenan, & Medosch- Schonbeck, 1986a) we used a 26-sentence passage from "The Final Days" (Woodward & Bernstein, 1976) in which Nixon ordered his aides to stonewall the Watergate investigation. Given the episodic schema available, it was not surprising to find that retrieval was not heavily dependent upon reconstruction of the original text sequence. Our subjects would have available adequate and alternative schemata to assist processing along a number of different conceptual pathways.

In a more recent study we used a 26-sentence passage adapted from Brazleton (1974), dealing with Joan, a five-year-old who faces increasing familial pressures as her mother awaits the birth of a fifth child. While the content, per se, consists of common problems and language, the Joan passage is not historical and requires processing which is based more on a semantic memory task. Hence, the reader is more dependent on the sequence of the original text, and the processing as defined by the reconstruction process would be critical for retrieval.

Therefore, in this study we directly assessed the semantic-episodic hypothesis by comparing the effects of feedback on the reconstruction of the Joan and Nixon passages. Following our developing assumptions and previous research findings, we hypothesized that: (1) the Joan passage would yield higher percent recall scores than Nixon; (2) there would be no effect for feedback, (3) the Joan passage would yield higher percent recognition scores; (4) percent recognition scores would be enhanced

by feedback, (5) tau (concordance) would be higher under the feedback condition; (6) tau for Joan would be higher than Nixon; and (7) gist would be greater for the Joan passage.

Method

Subjects were 48 introductory psychology students at the University of Colorado. The materials were two previously used scrambled 26-sentence passages taken from "The Final Days," and from the Brazleton book. The sentences were presented to the subjects on a set of randomly ordered cards, with one sentence to a card. Subjects were informed that the purpose of the experiment was to determine how meaning is constructed. To assist subjects in reconstructing the text, sentence ordering was assisted using a wooden board with 35 slots. Subjects picked up one card at a time, read, and placed it in a slot. Cards could be rearranged freely, but always one at a time.

A move was recorded when a subject changed the sequence of a card relative to others. When feedback was provided it was either a "right" or "wrong," depending on whether a sentence was correctly placed with respect to the sentence immediately preceding it as determined from the original text. In this experiment subjects were given either no feedback or 25 tokens to be used for feedback. The subject gave up a token for each request for information up to a possible total of 25.

The subjects were first given a practice passage. The task was to reconstruct a scrambled 11-sentence passage comprising the fairy tale "The Goose that Laid the Golden Egg." One group of subjects reconstructed the materials without assistance, while the other subjects had 25 tokens to be used for feedback requests. The feedback conditions for the practice task were the same as those encountered in the subsequent experimental condition.

The independent variables were selection (Joan-Nixon) and feedback (25 tokens- no feedback). The critical dependent measures were percent recall, percent recognition, agreement with the original text (concordance), and gist (general meaning of the passage). Other dependent measures included time to completion, number of rearrangement moves, and number of tokens used. All testing was done immediately after the subject signalled that the reconstruction task was finished.

For recall, subjects wrote down as much as they could remember without regard

for order. Scoring was assessed as the number of idea units presented regardless of sequence. Recognition was measured by having subjects select from pairs of sentences the original sentence, as distinguished from a paraphrase. The recognition test consisted of 26 pairs of sentences. Again, all recall and recognition data are presented as percentages. Finally, to measure gist the subject was asked "What was the passage all about?" Scoring was based on a 4-point scale. While the subject took the retrieval measures, the final reconstructed sentence order of the subject was recorded. This was used to determine concordance (i.e., tau).

Analyses

Recall scores were based on the number of idea units, following Bovair and Kieras (1981). There were 78 idea units for both the Nixon and Joan passages, which meant that the two passages were identical along this dimension. ANOVA for percent recall scores is given in Table 1.

Insert Table 1 about here

There was a main effect for selection, $F(1,44) = 14.01$, $p < .001$. The mean percent recall scores for the Joan passage was 39.88 compared to 23.63 for Nixon. As we have determined from past research there was no statistically significant effect for feedback on recall.

The ANOVA data for percent recognition score is given in Table 2.

Insert Table 2 about here

Following our prediction, there was a main effect for selection, $F(1,44) = 5.46$, $p < .02$. The mean percent recognition score for Joan was 89.00, compared to 83.46 for Nixon. However, there was no effect for feedback on percent recognition scores, which was contrary to our expectations.

ANOVA for tau is presented in Table 3. Tau is a measure of agreement between the sentence order/sequence for the reconstructed text and the original. There was a statistically significant effect for selection $F(1,44) = 59.45$, $p < .001$. The mean tau for the Joan selection was .73, compared to .30 for Nixon. There was also a statistically

significant effect for feedback $F(1,44) = 6.53$, $p < .01$. The mean tau for the no-feedback group (0 tokens) was .45 compared to .59 for the feedback group (25 tokens). These findings are entirely consistent with previous research and the stated hypotheses.

Insert Table 3 about here

We speculated previously that the Joan passage would necessitate more orderly processing, since the Nixon content has a greater episodic base permitting more flexibility in organization. This meant that the actual sentence sequencing (as defined by tau) would be more critical to comprehension of the Joan passage. We decided to explore this issue further.

Besides the use of tau, we have employed a more qualitative procedure in the past to analyze sentence agreement (Langer, Keenan, & Medosch-Schonbeck, 1986a). Arbitrarily we divided the two 26-sentence passages into three clusters, consisting of sentences 1-9, 10-18, and 19-26 in the original order. For both the feedback and no feedback groups the maximum occurrence of the original first 9 sentences in the first 9 slots without respect for order is 108 (9 sentences x 12 subjects). The second cluster (10-18) also has a maximum occurrence of 108, while the third (19-26) is 96 (8 x 12).

What this analysis permits us to do is examine the general grouping of sentences. In particular, since we generally assume that the main ideas in a passage are likely to occur earlier in the sequence, it would follow that the highest agreement would occur in the first cluster, followed in descending order by the second and third clusters. Moreover, we would expect all the clusterings for the Joan passage to be more congruent with the original as compared to Nixon, since the Nixon passage would not be as heavily dependent upon sequential processing. The episodic content would not require the same adherence to sequence.

The results were generally in line with our predictions. In the Joan-feedback condition, the cluster percentages were as follows: (1-9) - 92.6%, (10-18) - 66.7%, and (19-26) - 66.7%. For Joan-no feedback, the percentages of agreement were: (1-9) - 86.1%, (10-18) - 60.1%, and (19-26) = 62.5%. In the Nixon-feedback condition, the percentages were: (1-9) - 66.7%, (10-18) - 49.1%, and (19-26) - 40.6%. Finally, in the Nixon-no feedback condition the results were: (1-9) - 50.9%, (10-18) - 51.9%, and (19-26) - 39.8%. The results are shown graphically in Figure 1.

Insert Figure 1 about here

The relatively flatter line for agreement for the Nixon-no feedback condition reflects the least success at sequencing. Even with the availability of feedback there was less agreement with the original sequence among the Nixon subjects compared to the Joan-no feedback subjects.

Sentence agreement is greatest for the first cluster (sentences 1-9), but the differences between the remaining clusters is not of any practical significance. This supports our belief that subjects do make some attempt using commmon rules for sequencing important ideas. The product-moment correlations between tau and percent recall (.57) and percent recognition (.52) are both statistically significant.

There were no statistically significant findings for gist. We have come to the conclusion that this variable is basically a reliability measure for our procedures. That is, do subjects comprehend the general meaning of what they are reconstructing, regardless of more specific measures of memory retrieval?

Table 4 presents the means and standard deviations for number of tokens used and number of rearrangement moves. The Nixon-feedback subjects used more tokens (14.00) and made more moves (40.50) as compared to Joan-feedback (12.33 and 35.92 respectively), but this did not result in superior percent recall scores, percent recognition scores, or tau. In the no-feedback condition the Nixon subjects made 23.92 moves compared to 22.50 for Joan. This latter difference is within the error of measurement. It would appear that where the content familiarity may actually make the use of feedback relatively inefficient, one might conjecture that the text ordering for the Nixon subjects was conforming to highly internalized and idiosyncratic schemata, as

compared to the Joan processing which was proceeding along more orderly and commonly-held rules of prose organization.

Discussion

In a recent paper (Keenan, Langer, & Medosch-Schonbeck, 1986) we described the search for our problem domain. Our previous research has presented evidence supporting the hypothesis that the efficacy of feedback on retrieval using scrambled text was not a simple or systematic relationship. This latest study presents perhaps the clearest evidence we have that feedback may assist text processing provided that we are dealing with semantic rather than episodic knowledge bases. Even more critical is the finding that if learning a given content is a developmental phenomenon, then feedback needs will shift.

In a related issue, Kintsch (1986) emphasized the need for consideration of the feasibility and sensitivity to content that readers possess. He further argues that context does not facilitate or interfere with processing on a simple and direct 1:1 manner. While we are not prepared to deal with his concept of sequential activation phases, our findings do support his belief that the model of relatively fixed knowledge structures and strategies does not adequately portray the manner in which readers process discourse.

With the exception of the impact of feedback on percent recognition scores, our hypotheses held true. Text processing, as defined at the sentence level, appears to reflect a number of critical variables, dominated in part by the semantic-episodic dichotomy, as well as general knowledge base and strategies. Certainly our previous conclusions about the differential effectiveness of feedback as an instructional adjunct now appear to be much more supported by the data. Feedback may be helpful, but certainly in the area of text processing it must be more precisely defined as to text content, organization, and individual learning strategies and knowledge bases. All this is quite in keeping with current discourse processing theory (Britton & Black, 1985).

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Table 1

ANOVA: Percent recall scores.

Source	SS	Df	MS	F	Sig
Main Effects	3229.50	2	1614.75	7.14	.002
Selection (S)	3168.75	1	3168.75	14.01	.001
Feedback (FB)	60.74	1	60.75	.27	.61
2-Way Interactions	507.00	1	507.00	2.24	.14
S x FB	507.00	1	507.00	2.24	.14
Explained	3736.50	3	1245.50	5.51	.003
Residual	9954.50	44	226.24		
Total	13691.00	47	291.30		

Table 2

ANOVA: Percent recognition scores.

Source	SS	Df	MS	F	Sig
Main Effects	377.71	2	188.85	2.80	.07
Selection (S)	368.52	1	368.52	5.46	.02
Feedback (FB)	9.19	1	9.19	.14	.71
2-Way Interactions	2.52	1	2.52	.04	.85
S x FB	2.52	1	2.52	.04	.85
Explained	380.23	3	126.74	1.88	.15
Residual	2968.25	44	67.46		
Total	3348.48	47	71.24		

Table 3

ANOVA: Tau.

Source	SS	Df	MS	F	Sig
Main Effects	2.43	2	1.22	32.99	.001
Selection (S)	2.19	1	2.19	59.45	.001
Feedback (FB)	.24	1	.24	6.53	.01
2-Way Interactions	.01	1	.01	.36	.55
S x FB	.01	1	.01	.36	.55
Explained	2.45	3	.82	22.11	.001
Residual	1.62	44	.04		
Total	4.07	47	.09		

Table 4

Tokens and rearrangement moves: Means and standard deviations

	Tokens		Moves	
Condition	Mean	S.D.	Mean	S.D.
Joan-feedback	12.33	10.08	35.92	14.60
Joan-no feedback	0.00	0.00	22.50	12.84
Nixon-feedback	14.00	7.84	40.50	16.10
Nixon-no feedback	0.00	0.00	23.92	11.18

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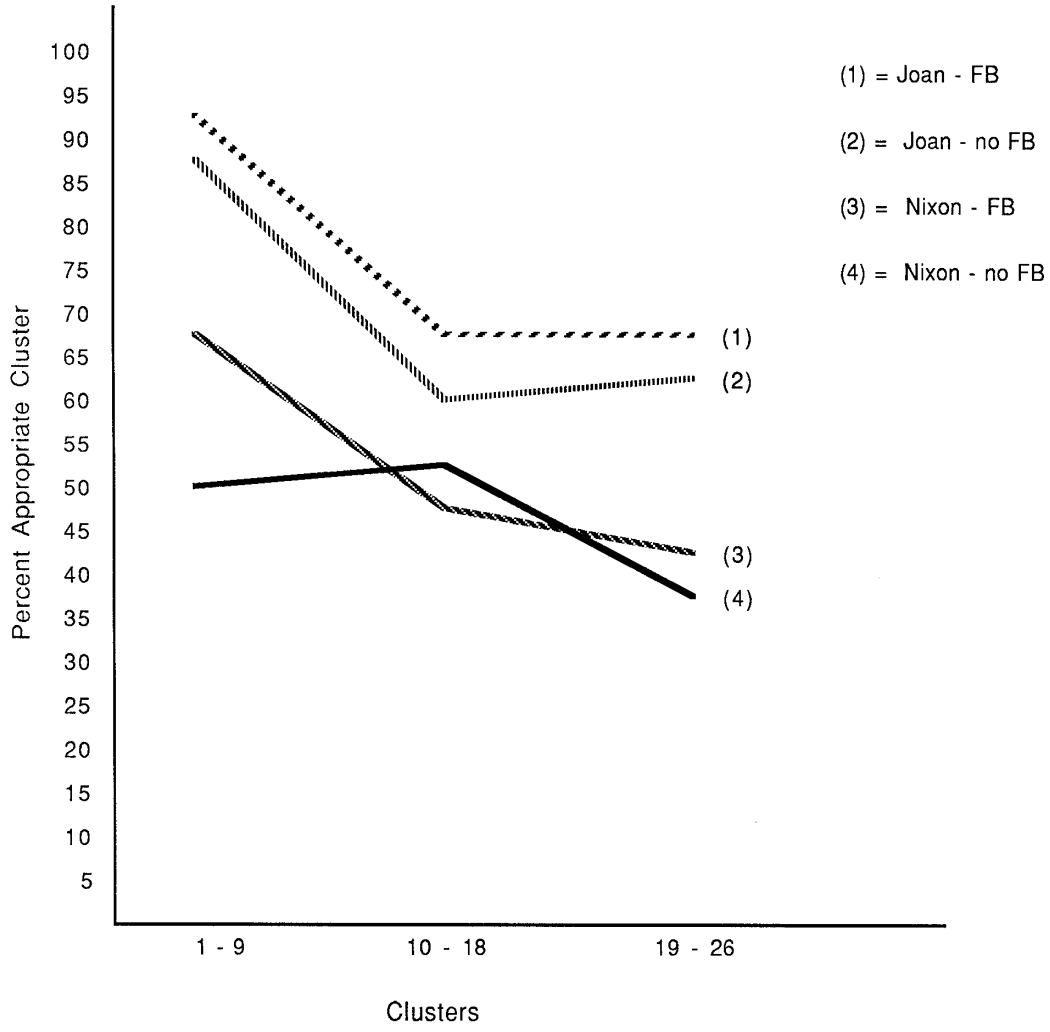
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
Percent Appropriate Cluster
1 - 9
10 - 18
19 - 26
Clusters
(1) = Joan - FB
(2) = Joan - no FB
(3) = Nixon - FB
(4) = Nixon - no FB
(1)
(2)
(3)
(4)

Figure 1.