

Signalling, Feedback, and Text Content

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## ABSTRACT

Subjects reconstructed two scrambled 26-sentence passages, one based more on semantic memory and the other on episodic. Assistance was provided in the form of feedback and three signalling sentences. There were statistically significant main effects favoring the semantic passage for recall and for concordance with the original order. There were no effects for signalling. However, a qualitative analysis of sentence clustering suggested that feedback and signalling were differentially more effective for the semantic passage.

For purposes of instruction, the problems associated with the impact of feedback on discourse processing are critical to achievement. At a minimum most learning situations involve a two-fold student task, i.e., the utilization of prior knowledge and learning skills as well as self-monitoring (Fischer & Mandl, 1984). However, the learner skills and knowledge bases are often unknown and idiosyncratic. Moreover, if externally provided feedback is added to the iterative processes associated with learning, the result may often be a set of highly unpredictable outcomes (Langer, Keenan, & Culler, 1986). The reasons are not all that difficult to discern.

First, while feedback is almost always associated with improved learning, the research evidence does not support the premise that there is a simple monotonic relationship between levels of assistance and achievement (Getsie, Langer, & Glass, 1985). Second, models of discourse processing have remained fairly isolated from instructional concerns, including feedback. The propositional analog of van Dijk and Kintsch (1983) or the main ideas model of Meyer's (1985) are two examples which rely on the outcomes of a logically determined set of interrelated processes. Interestingly, the major models for text comprehension seem to be moving away from structural analyses to processes and the impact of real-world knowledge (Britton & Black, 1985).

A third part of the problem is that text organization is supposedly related to comprehension (Reder, 1980). Yet Irwin (1982) pointed out that overall intersentential coherence does not assist memory. The problem is that text meaningfulness, which is considered critical to retrieval, is often determined within experiments as a function of text syntax and/or content.

Our research paradigm has involved the reconstruction of scrambled text as opposed to connected discourse. The feedback provided assisted the reader in

approximating the original ordering of sentences. We hypothesized that the extent of agreement (concordance) between the order of the reconstructed text sequence and the original would be significantly correlated with such measures of retrieval as recall and recognition. Historically 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 (1972) in which feedback was inadvertently provided, the readers of the scrambled prose received no assistance. In our studies we have used published prose rather than the artificial content usually provided (e.g., Bransford & Franks, 1971).

Based on previous data it appeared that feedback generally assists recognition rather than recall, although under the reconstruction process one might presume 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, 1986). If nothing else Clark's (1973) warning about treating content as a fixed variable was justified.

Our latest studies however have led to the premise that the successful processing of scrambled discourse may be related to the episodic-semantic dimension (Tulving, 1982; Langer, Keenan, & Culler, 1986). It would appear that within the parameters of our reconstruction paradigm, retrieval is superior for text assisted by semantically-based schemata as compared to episodic. In his recent work, Tulving (1982) has expanded considerably upon his original episodic-semantic distinctions. He still considers the two to be separate systems, although he acknowledges that there is significant interaction between the two, resulting in the possibilities of semantic

content embedded in episodic memory. Tulving still perceives episodic memory as being indexed by spatial-temporal qualities, while semantic content is more abstract. Hintzman's (1978) characterization of semantic memory as generic may not be too far-fetched.

In our most recent and relevant study, we directly compared the effects of feedback on recall and recognition using two passages distinguishable along the episodic-semantic memory-based dimension (Langer, Keenan, & Culler, 1986). One passage consisted of 26 sentences taken from "The Final Days" (Woodward & Bernstein, 1976), in which Nixon ordered his aides to stonewall the Watergate investigation (Appendix A). Based on Tulving's work we characterized the Nixon content as episodic. Our reasoning was that students were more likely to identify or recall specific sources for the content (i.e., texts, mass media, parents). We hypothesized since that the subjects would likely have developed the prior knowledge base using a wide variety of sources, they would have available adequate and alternative schemata to assist processing along a number of different conceptual pathways.

The second passage consisted of 26 sentences adapted from Brazelton (1974), dealing with Joan, a five-year-old who faces increasing familial pressures as her mother awaits the birth of a fifth child (Appendix B). While the content, per se, consists of common and generally-known problems and concepts, the Joan materials are not likely to be associated with specific sources. Such non-temporal acquisition is more closely tied to semantically coded information (Tulving, 1982). We hypothesized that the reader is more dependent on the sequence of the original text for meaning, and the

processing as defined by feedback and the reconstruction process would be critical for retrieval.

In terms of Tulving's (1982) more recent model, there are a number of functional and structural differences critical to our research. First of all, episodic memory is more loosely organized. We have argued in a somewhat similar manner that the schemata seem to have a much more idiosyncratic organization and content (Langer, Keenan, & Culler, 1986). Second, episodic memory seems much more vulnerable, i.e., is changed, modified, or lost more readily. This vulnerability fits in with our findings that there is less predictability as to the outcomes of episodically-based processing (Langer, Keenan, & Culler, 1986). However, we have not produced any statistically significant interaction effects establishing that the semantic system is more sensitive to the influence of feedback.

Since our feedback model has dealt with the ordering of sentences, we based the present study on some recent research by Lorch and Chen (1986), which dealt with the effects of text signalling. In this study they numbered target sentences within a passage in order to assess the impact on recall. The data suggests that not only were the signalled sentences better recalled, but signalling assisted both the amount and organization of the recalled text as compared to non-signalled passages. We felt that this phenomenon might provide additional information on how and why feedback assisted the reconstruction process as well as gain further insight into the effects of concordance on retrieval.

For this experiment we provided a signalling function for the reconstruction task by placing three of the 26 sentences in their exact original position. In effect, we provided three anchor points within the original text sequence. We hypothesized that



knowing where some of the sentences were precisely located in the original order would assist the reconstruction process, and subsequently retrieval.

Specifically, we postulated that recall, recognition, and concordance with the original order would be superior for the Joan passage. We also felt that signalling might differentially enhance the effects of feedback especially for Joan.

#### Method

Subjects were 64 introductory psychology students at the University of Colorado. Again, the materials were two previously used scrambled 26-sentence passages taken from "The Final Days," and from the Brazelton 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. Each of the three signalling sentences was placed in the correct slot for that sentence. For example, the sentence #8 card was located in the eighth slot. Subjects picked up one card at a time, read, and placed it in a slot. Cards could be rearranged freely, including the three signalling cards, 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. Our previous research (Langer, Keenan, & Culler, 1986) has suggested that 25 tokens represents a

limit to the effects of feedback availability for the number of sentences to be remembered. That is, subjects given unlimited requests for feedback made no statistically significant gains in retrieval.

The subjects were first given a practice passage, with three signalling sentences arbitrarily selected. These were numbers 1, 6, and 11 in the original order. 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 three sentences for the experimental passages were selected on the basis of previous research (Langer, Keenan, & Culler, 1986). In this previous experiment, part of the data analysis consisted of breaking up the passages into three clusters, consisting of sentences 1-9, 10-18, and 19-26. Within each cluster we located one sentence whose placement showed the least deviation from its order in the original sequence. That is, the average assigned placement most closely approximated original position. This was accomplished within passage (Nixon-Joan) and feedback condition (feedback-no feedback), yielding four triads of sentences. The sentences differed from group to group, and are referred to as correctly placed sentences (CPS) in our analyses. For comparative purposes, for each of these four groups we randomly selected a sentence within each cluster, with the constraint it was not one of the CPS. These we labeled randomly placed sentences (RPS). As in the case of CPS, each RPS was inserted in its appropriate slot in the board. The remaining randomized order of sentences was the same across all conditions.



The 26 Joan sentences are presented in Appendix A, and those for Nixon in Appendix B. Table 1 gives the CPS and RPS used for each passage and condition. As one can see, there was some overlap between groups.

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Insert Table 1 about here  
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The independent variables were selection (Joan-Nixon) feedback, (25 tokens- no feedback), and signalling sentences (CPS-RPS). The critical dependent measures were percent recall, percent recognition, and concordance ( $\tau$ ) with the original text. The result was 2x2x2 factorial design. 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, as distinguished from a paraphrase. Hence, the recognition test consisted of 26 pairs of sentences. All recall and recognition data are presented as percentages. While the subject took the retrieval measures, the final reconstructed sentence order of the subject was recorded by the experimenter. This was used to determine concordance (i.e.,  $\tau$ ).

Analysis

Percent recall was assessed by breaking the passages down into idea units, following the work of Bovair and Kieras (1981). Both the Joan and Nixon passages consisted of 78 units, which meant there was no difference along that dimension.

ANOVA for percent recall yielded a statistically significant effect for passage  $F(1,56) = 40.23, p < .001$ . The mean for Joan was 32.46 compared to 19.31 for Nixon. There were no other significant findings.

ANOVA for percent recognition yielded no statistically significant findings, even for feedback, which was surprising in the light of previous work (Langer, Keenan, & Culler, 1986).

ANOVA for tau yielded a statistically significant finding for passage ( $F(1,56) = 74.03, p < .001$ ). The Joan tau was .79 compared to .36 for Nixon. Clearly the statistically significant findings were few, although in the predicted direction. What was surprising was the absence of any effects for signalling.

Following a method developed previously, we decided to use a more qualitative analysis of the sentence sequencing. We arbitrarily divided the passage into three clusters consisting of sentences 1-9, 10-18, and 19-26 in the original order. For all groups the maximum occurrence of the original first 9 sentences in the first 9 slots without respect to order is 72 (9 sentences x eight subjects). The second cluster also has a maximum occurrence of 72, while the third (19-26) is 64 (8 sentences x 8 subjects). This analysis permits us to examine the general groupings among sentences.

The totals for each cluster within each condition are presented in Table 2.

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Insert Table 2 about here  
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Figure 1 graphs the Joan cluster data, while Figure 2 depicts the Nixon cluster data.

While we were unable to obtain statistically significant differences, the qualitative analysis suggests some rather interesting trends.

First of all, regardless of condition, the Joan cluster percentages are higher than Nixon's. The pattern was identical to the previous study where we analyzed the data in a similar manner (Langer, Keenan, & Culler, 1986). The two studies appear comparable along these dimensions. Moving on to the findings for this study, however, similarities as well as differences began to appear.

For Joan, the feedback percentages are higher for the feedback conditions. Again, in our previous analysis the feedback agreement was superior. However in our previous analysis the feedback and no-feedback conditions never differed by more than a few percentage points across all three clusters (Langer, Keenan, & Culler, 1986). Specifically, for Joan-feedback the cluster percentages were (1-9) 92.6%, (10-18) 66.7%, and (19-26) 66.7%. The Joan-no feedback results were 86.1%, 60.1%, and 62.5% respectively. The curves were essentially parallel. In this study, however, there are some significant differences. First of all, the V-shaped functions for the two feedback conditions differ from the previous study in which the curves were essentially flat for the second and third cluster percentages. Moreover, the mean difference at the third clusters between the feedback and no feedback conditions is 17.7%, which is much greater than that for the previous study.

It would seem that the addition of the Joan signalling sentences appears to be more critical to concordance for the second and third clusters, especially within the feedback conditions. Indeed, all four second and third cluster percentages in this study are higher than for either condition in the previous study. These findings tend to support our belief that sentence ordering utilizing a semantically-organized memory

base may be more dependent upon and sensitive to such extrinsic forms of assistance as feedback and signalling.

The Nixon data presents a somewhat different picture. Not only are the curves between conditions basically dissimilar but there is a large percentage difference for the first cluster between the two feedback and two no feedback conditions. The average difference favoring the feedback conditions is 15.2% which reverses by the third cluster to a 6.3% advantage for the no feedback group. In our previous study the Nixon feedback cluster percentages were 66.7%, 49.1%, and 40.6%, while the Nixon no-feedback results were 50.9%, 51.9%, and 39.8% (Langer, Keenan, & Culler, 1986). In this study, with perhaps the exception of the no feedback third cluster, the differences do not appear to be significant. For the Nixon groups the third cluster results are exactly opposite to the Joan findings. The data support our assumption that student strategies based on episodically based schemata differ from semantically based schemata in terms of response to external assistance. However, we are not sure of the precise mechanisms. It is instructive to note that the product-moment correlation between tau and percent recall is .50 ( $p < .001$ ), while the corresponding correlation between tau and percent recognition is -.11 (n.s.). There was no main effect for tokens by passage selection or signalling. Again, while the relative effects of feedback and signalling for the semantic passage as opposed to the episodic passage has not yielded statistically significant findings, the more qualitative cluster analyses suggests that there are differences.

### Conclusions

Several conclusions emerge from these findings, which represent a convergence of previously established empirical phenomenon. Feedback and signalling appear to



be differentially more effective with semantically based content. This effectiveness improves concordance, which is associated with greater recall. While we have not yet been able to establish a pattern of statistically significant interaction effects, nevertheless our qualitative findings are encouraging.

However the relationship between text processing and feedback is a complex one. We are beginning to view the problem as one involving more detailed analyses as to the precise kinds of processing used with the types of feedback available. Clearly there is no basis for a simplistic set of a priori assumptions regarding the effects of feedback. This represents a real dilemma from an educational (i.e., applied) perspective. Indeed Tulving (1982) is well aware of the educational implications of his semantic-episodic distinctions.

We have further extended the argument to instructional strategies and outcomes. The demand characteristics of preparing instructional materials require something be done to assist the learner, but we are also arguing that something could be worse than nothing. While our findings to date cannot provide algorithmic guidelines for instructional developers, it is equally true that feedback is not an exercise in arm-chair strategy or self-imposed tutorial logic.

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Appendix A

Joan Passage

1. The first year of Joan's life was a happy one for everybody.
2. Joan had been a gay, laughing baby.
3. She was round, chubby-faced, and dimples.
4. Everyone enjoyed being around her.
5. Her mother, father, and grandmother carried her around frequently, and her brothers played with her as if she were a doll.
6. The family was excited when she was learning to walk and say words, and cheered her on.
7. She developed quickly with all the positive attention, saying many words at a year, walking and even running.
8. When Joan was a year old, Mrs. Gary found out she was pregnant with the fifth child.
9. She became depressed and spent much of her time in bed.
10. When she was up and around, she was angry and quick with the children.
11. By the time Joan was 18 months old, Mrs. Gary was beginning to feel awkward and uncomfortable.
12. She resented the amount of care Joan required.
13. She wouldn't hide her feelings, and when Joan made an advance or a request, she wept openly or refused Joan with an abrupt, angry answer.
14. Since Joan had not met with anything like this before, she was stunned but not daunted at first.

15. She turned to her grandmother or her father or her brothers who tried to make up for the mother's withdrawal.
16. As the months wore on everyone in the household began to reflect the tension and Joan's world began to crumble.
17. Her father and brothers became quieter around the house and didn't play much with Joan.
18. Her grandmother was so concerned about her daughter-in-law's state of mind that she, too, left Joan more and more to herself.
19. Joan reacted with a combination of quiet sadness and a kind of showing off when others were around.
20. She didn't dare express herself in the loud, gay voice she had used when she was smaller for everyone called out "ssh."
21. On one occasion when she was tired at night she began to cry and lay down on the floor to kick her feet.
22. Her mother's eyes flashed and she picked Joan up by one arm angrily and threw her still crying into bed.
23. No one came to see her.
24. The next day her right arm seemed to be hurting her.
25. The family decided to have the arm X-rayed, and found she had a dislocated elbow.
26. The doctor recommended they find some help to relieve the strain on the family.



Appendix B

Nixon Passage

1. On Tuesday afternoon, July 9, Rodino shattered the President's show of business as usual.
2. He released the Judiciary Committee's version of eight tapes.
3. There were awesome differences between what the White House had managed to transcribe and what the committee staff, using superior equipment, was able to hear on the same recordings.
4. To Rodino, the differences demonstrated that the cover-up was still in progress, with the concurrence of Haig and of Nixon's lawyers.
5. The staff had prepared a 131-page side-by-side comparison of the texts.
6. Nearly a hundred major discrepancies and omissions were noted.
7. The White House editing proved to be predictable.
8. Changes seemed tailored for St. Clair's claim that the President knew nothing of the cover-up until March 21, 1973 and then had acted to end it.
9. According to the White House version of the meeting of March 22, 1973, the President told his aides that John Mitchell was recommending "that now we use flexibility in order to get off the cover-up line".
10. The committee transcript said that Nixon quoted Mitchell to the opposite effect, that "we use flexibility ... in order to get on with the cover-up".
11. Nixon's order that day to Mitchell, which Haig, St. Clair and Buzhardt had tried to hide from the committee, was also there.
12. "I don't give a shit what happens."

13. "I want you all to stonewall it."
14. "Let them plead the Fifth Amendment, cover up or anything else if it'll save it."
15. "Save the plan."
16. "That's the whole point."
17. St. Clair tried to justify the omissions and discrepancies.
18. That section had been left out, because it was not deemed relevant, he told reporters.
19. It concerned the Senate Watergate Committee.
20. Technically it did not involve an obstruction of justice, since it referred to a congressional, not a Justice Department, investigation.
21. The subpoena had called for a conversation among Nixon, Dean and Mitchell.
22. The omitted conversation occurred after Dean had apparently left the room.
23. It was therefore outside the bounds of the subpoena, St. Clair said.
24. "What about the other discrepancies?", the reporters asked.
25. "I would not look upon this as sinister."
26. "My experience has been that if you give these tapes to three people to listen to, you get three variations."

Table 1. Sentences by passage and feedback condition

<u>Passage Sentences</u>	<u>Condition</u>			
	<u>Feedback</u>		<u>No Feedback</u>	
	<u>CPS</u>	<u>RS</u>	<u>CPS</u>	<u>RS</u>
Joan	8	2	8	1
	13	17	11	12
	20	19	20	19
Nixon	1	2	5	8
	17	18	13	17
	20	21	20	20

Table 2. Percent cluster agreement

<u>Condition</u>	<u>Cluster</u>		
	<u>1-9</u>	<u>10-18</u>	<u>19-26</u>
Joan, FB, CPS	91.7	81.9	87.5
Joan, FB, RPS	90.3	81.9	85.9
Joan, NFB, CPS	88.9	75.0	76.6
Joan, NFB, RPS	88.9	79.2	69.4
Nixon, FB, CPS	69.3	55.6	48.4
Nixon, FB, RPS	68.1	36.1	40.6
Nixon, NFB, CPS	52.8	59.7	54.7
Nixon NFB, RPS	54.2	41.7	46.9

Figure Captions

Figure 1. Joan passage: Cluster agreement percentages .

Figure 2. Nixon passage: Cluster agreement percentages.

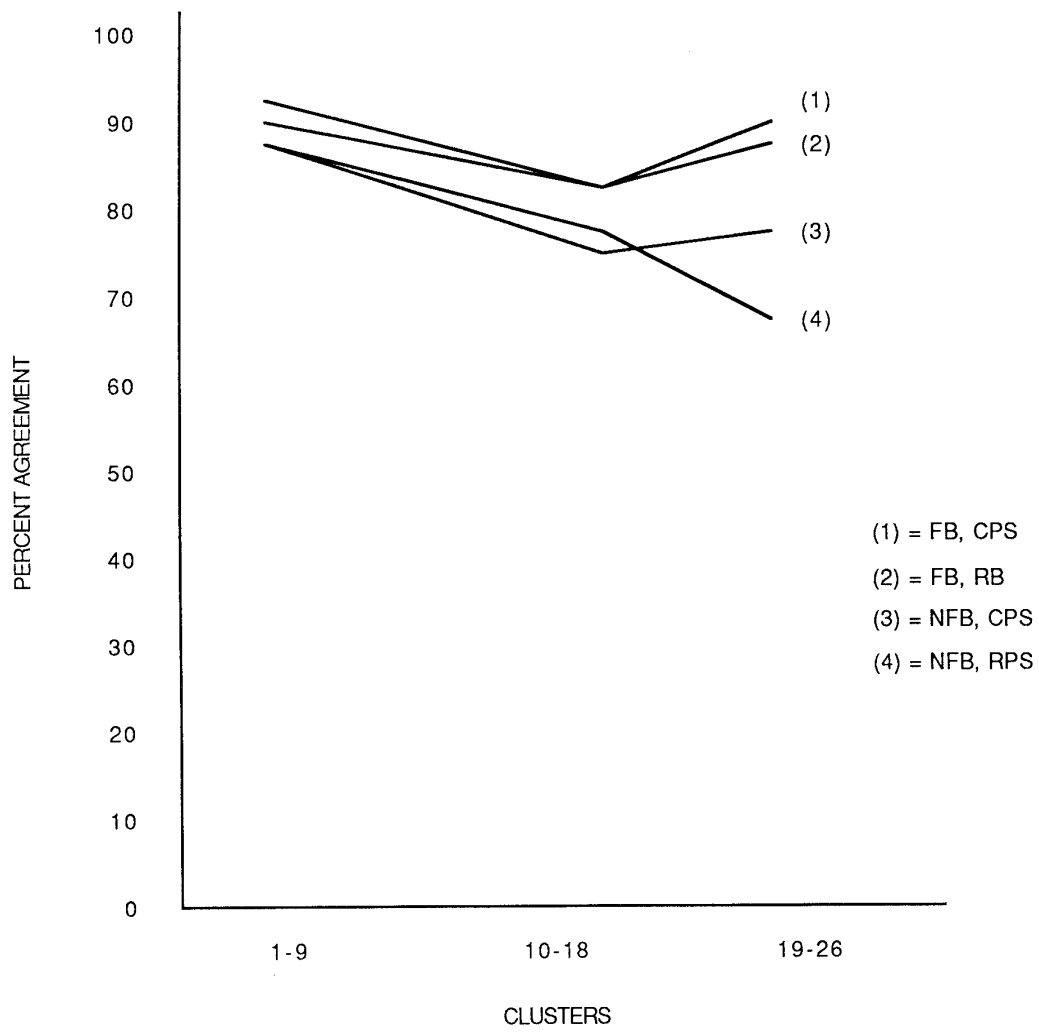


Figure 1



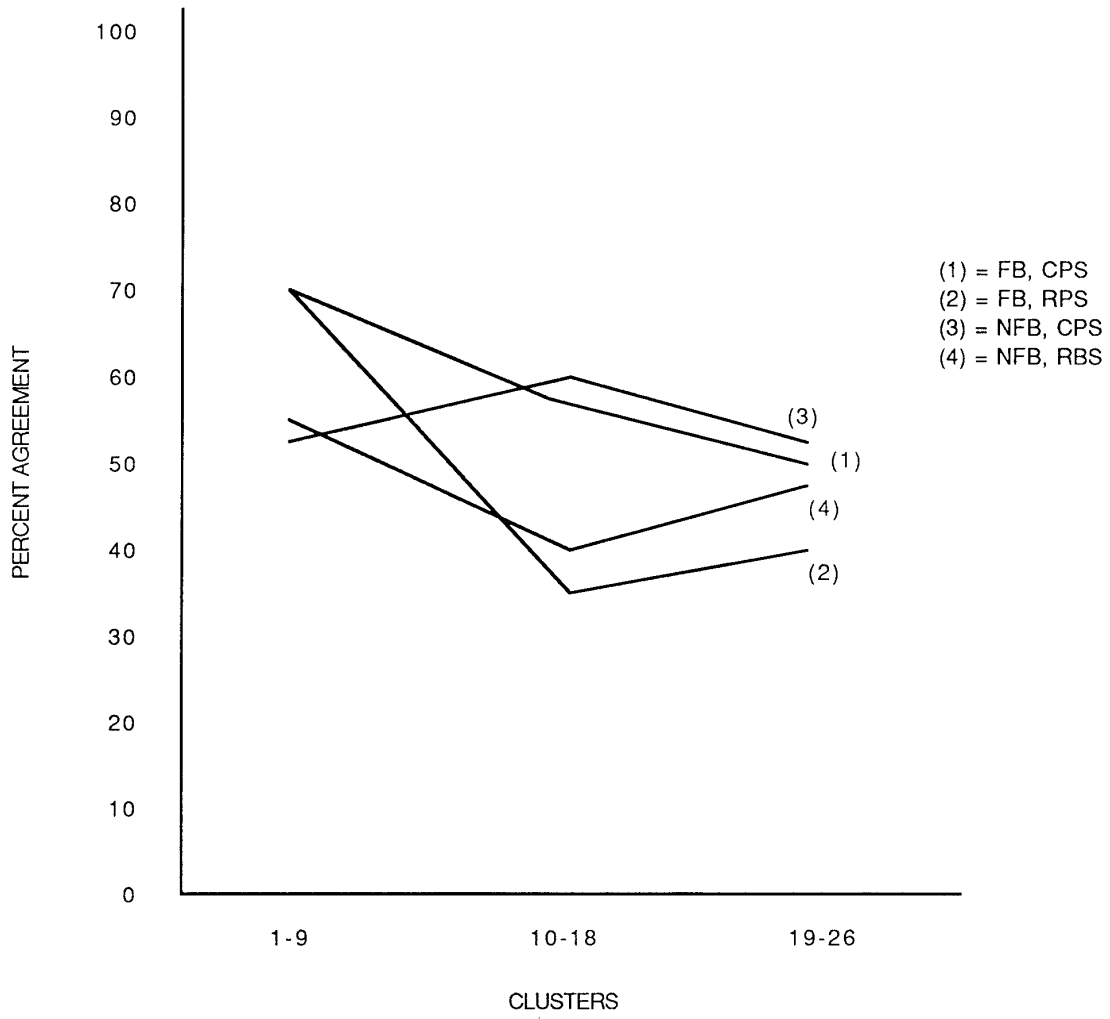


Figure 2