The Influence of Feedback on Two Versions of a Related Text: VI

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Abstract

This study is an extension of our efforts to assess the effects of feedback on situational memory. Two versions of a fictitious recreational park were developed. One described the location and order of 25 park landmarks as might be encountered by a driver (route version). The other (survey version) presented the same 25 landmarks using spatial or geographic referents. Both versions were 25 sentences in length.

Subjects read either the route or survey version first. The text was presented one sentence at a time. After reading the text, subjects were given one minute access to a map of the park. The route subjects were given the label map, which showed the location of park landmarks by name. The survey readers were given the icon map, which designated the same landmarks using pictures. After viewing the map, both groups a set of 20 inferential questions regarding the landmarks.

Subjects then read the same text version again, one sentence at a time. However, half the subjects for each text version viewed the same map, while the other half received the alternate map. So on the second trial, half the route readers viewed the label map again, while the other half now saw the icon map. Similarly, half the survey readers saw the icon map a second time, while the other half now viewed the label map. All groups answered the same set of inferential questions. A control group received no feedback on either reading.

The study was a repeated measures design, with 2 (text versions) x 2 (feedback types) x 2 (trials). The text and feedback variables are between subjects, while trials are within.

There were several statistically significant findings. First, as compared to the control group, the feedback subjects showed greater gains across trials. Second, survey text readers showed greater gains than route version readers. Third, for both
text versions, readers who were given access to the alternate map showed greater gains than those who viewed the same map twice. Moreover, the survey readers benefited more from the feedback change than the route readers.

The data supports prior research which suggests that the survey text base generated appears more flexible in terms of making greater use of available feedback, even if different from the original.
This study is a continuation of efforts to estimate more specifically the contributions of feedback to text comprehension, as assessed by qualitatively different levels of memorial representations. The development of our project has been described elsewhere (Langer, Keenan, Wetzel, Jacques-Griffin, & Chiszar, 1996). However, for the purposes of this report we shall briefly define our positions on feedback and text comprehension.

Feedback is generally defined as any assistance given after an answer, whether overt or covert. Generally speaking, within educational circles, such assistance is characterized as beneficial (Gagné, Yekovich, & Yekovich, 1993), although Holding (1965) pointed out feedback is an extremely complex construct. In support of Holding, recent research suggests such simplistic assertions of universal efficacy are not warranted (Langer, et al., 1996).

Our current text comprehension paradigm is derived from Kintsch's (1988) construction-integration model. Basically, he has argued that the text propositions are organized into a coherent base through iterative processes of reconstruction. The development of any text meaning, of course, is assisted by the amount of prior reader knowledge available (Ericsson & Kintsch, 1995).

The qualitatively different levels of memorial representation we have utilized were initially developed within the context of the construction-integration model (Kintsch, Welsch, Schmalhofer, & Zimny, 1990). The memorial representations are as follows: (1) surface memory, indexed by either direct recall of verbatim text, or by distinguishing paraphrases from original text sentences, (2) semantic memory, assessed by measures of propositional recall, and (3) situation memory, measured by inferential reasoning. Surface and semantic text memory are directly tied to the text, while situation memory is conceived of as a more general mental model, not as closely tied to specific content as the other two memorial representations (Kintsch, 1994).
During the last few years our research has employed passages derived from a study by Perrig and Kintsch (1985). In this study they used two descriptively parallel variants of a mythical town called Baldwin. One version presented locations in the order in which they might be encountered by a driver going through town (route version), while in the survey version the same locations were presented in the same order, using spatial or geographical referents. Again, the texts are comparative in that they describe the same locations in the same textual order.

We modified the original descriptions, emerging with two 25-sentence descriptions, presented one sentence at a time. This sentence by sentence presentation constrains individual reading strategies. We uncovered some differential effects for feedback on the text variants, both by type and amount of feedback. Situation memory seemed particularly sensitive to our experimental paradigms (Langer, Keenan, & Cumbo, 1992; Langer, Keenan, & Bergman, 1993; Langer, Keenan, & Schreiner, 1995; Langer, et al., 1996).

Differences in comprehension were considered to be the result, at least in part, of what we have designated as compatible or incompatible feedback. Compatible feedback is defined as procedurally congruent with the textual variant. Thus a map is considered as more compatible with respect to the survey version, while feedback strategies such as sentence review or reading the entire text, provides similar congruence with the route version. One question remained, however, if our findings could be generalized and compared to others doing similar work.

This study compares our data to studies very similar to our own (Taylor and Tversky, 1992; Ferguson & Hegarty, 1994). In fact Ferguson and Hegarty in their 1994 study also adopted materials from the Perrig and Kintsch (1985) work. In particular, we became interested in Taylor and Tversky's (1992) study in which the mental organization of three different environments was examined.

These included fictional descriptions of an amusement park, a convention
center, and a town. What interested us most was that Taylor and Tversky (1992) found subject memory for landmarks was excellent. For example, of the 17 landmarks depicted in the amusement park, the mean number recalled was 16.8 when subjects were asked to draw a map, and 16.5 when a written description was requested. They found similarly high recall percentages for the other two environments.

Based on our own research these recall percentages seemed rather high. It occurred to us that the tasks may have been too simple for their subject pool. Still, we were intrigued by the possibility of comparisons. We therefore decided to incorporate a similar park description within our feedback-comprehension paradigm. However, given caveats regarding text simplicity, both the length of the park description and number of landmarks were increased. We again created route and survey variants.

To repeat, the ceiling effect for landmark recall was the basis for our elaboration of a park description. In addition, within our particular paradigm, we wanted to know if our differential feedback treatments would effect memorial representations, particularly for situation memory. Our study, therefore, was what Sidman (1960) has called systematic replication.

METHOD

Fifty undergraduate general psychology students at the University of Colorado participated in partial fulfillment of a course requirement. Out of the fifty participants, 24 were male and 26 were female. All subjects who participated were native English speakers, with the exception of one participant whose native language was German but who spoke English fluently.

Two text versions of a fictional park were developed. The number of words in the route version was 505 (see Appendix A), compared to 510 words in the
survey version (see Appendix B). The written description of both the route and survey versions of the park contain 25 sentences and 25 landmarks.

The feedback provided were two maps created using Click Art Clip Out and Aldus Super Paint. One map version, the label map, located each landmark by name (see Appendix C). The other map, the icon map, represented each landmark as a picture (see Appendix D). An arrow appears at the bottom right corner of each map, pointing north. The actual number of landmarks displayed on each map totaled 23 for the route/word version (see Appendix C) and 24 on the survey/picture version (see Appendix D). The trees shading the horse stables and the hidden drive were not shown on the label map, while the hidden drive was not presented on the icon map. However, those landmarks that were not displayed on the maps were not included in any of the twenty inferential questions asked about the park. These questions were designed to assess situation memory (see Appendix E).

Both the route and survey versions of the park were printed on 25 cards, one sentence to a card. Subjects were informed that the experimenter would ask them a series of questions about what they had read when they were finished. The participants were assigned to one of five experimental conditions, determined by the order of map presentation. There were ten subjects in each experimental condition.

Each experimental group was instructed to read either the route or survey version of the park description. They were given one minute to study either the label map if they read the route version, or the icon map if they read the survey version. The participants then responded "true" or 'false" to a set of twenty inferential questions; ten sequential and ten non-sequential, randomly ordered. As noted previously, we have consistently indexed situation memory through responses to inferential questions.

Sequential questions referred to locations which were close together; non-sequential questions referred to locations separated at some distance. The sequential
questions were: 2, 3, 4, 6, 9, 10, 13, 14, 15, and 17. The non-sequential questions were: 1, 5, 7, 8, 11, 12, 16, 19, and 20.

On the second trial half the subjects read the same text version of the park and were presented again with the same map. They studied the map for one minute, and were then asked the same twenty questions. The other half of the subjects read the same park description, but were presented with the other map version, which they studied also for one minute. That is, if they were reading the route version a second time, they were now given the icon map. If they had the survey version a second time they were given the verbal map. They were asked the same twenty questions. A control group received no map feedback. They either read the route or survey version, answered the twenty questions, and repeated the process.

It should be kept in mind that the internalized text representation developed from the 25 sentences represents the participant response, with map feedback designed to modify the representation as needed. That is, the subject can use the map to clarify or redefine their mental representation of the landmarks derived from the text.

The basic design was a three-factor repeated measures, with two text versions and two feedback types across trials. This yielded a 2 (text) x 2 (feedback type) x 2 (trials). The text and feedback variables are between subjects, and trials within. To compare the feedback and control groups, the text factor was eliminated and the feedback groups combined yielding an unbalanced 3 x (label-icon-control) x 2 (trials) design.
RESULTS

The first analysis compared test scores between the feedback groups and the control group. In addition, scoring the sequential and non-sequential items as separate subscales did not contribute to our findings. Hence, in all our analyses subscale scores were combined.

As expected, the repeated measures ANOVA yielded a significant effect for feedback (F=9.52, df=2, 47, p=.001. The means are shown in Table 1. The label group gained 3.55 points, while icon subjects gained 5.80 points. The control group increase between trials was 2.30 points.

Insert Table 1 about here

On the basis of these findings, the control group was dropped from further analyses. All following data analyses were based on a 2 (texts) x 2 (feedback types) x 2 (trials) repeated measures design.

Table 2 presents the ANOVA data.

Insert Table 2 about here

There were several statistically significant findings. As one might expect, test inference scores increased between trials (F=102.30, df=1,36, p=.001). The mean score for Trial 1 was 13.73 (S.D.=2.80), as compared to 17.40 (S.D.=2.10) for Trial 2.

The text version by trial interaction was statistically significant (F=3.98, df=1,36, p=.05). The means and standard deviations are shown in Table 3.

Insert Table 3 about here
The mean between trial difference for the survey version was 4.40 points, i.e., 13.05 on Trial 1 and 17.45 on Trial 2, as compared to 2.95 points for the route version. For the route version the mean was 14.40 on Trial 1 as compared to 17.35 on Trial 2.

Perhaps of greatest significance to us was the significant triple interaction effect between text version, feedback type, and trials (F=3.98, df=1,36, p=.05). The means and standard deviations are shown in Table 4.

We find that the larger score gains were obtained when feedback type was shifted. For the route version, the difference in scores when the label map was used twice was 2.10 points, with a mean of 15.40 on Trial 1 and 17.50 on Trial 2. (15.4-17.5). However the difference increased to 3.80 points when the icon map was given on the second trial instead of the label map. The mean on the first trial was 13.40 compared to 17.20 on the second trial. In similar fashion the repetitive use of the icon map for the survey readers yielded a difference of 3.80 points, with a mean of 12.70 on Trial 1 and 16.50 on Trial 2. However, presenting the label map on the second trial yielded a difference of 5.0 points. The mean on Trial 1 was 13.40 as compared to 18.40 on Trial 2. As in prior research survey text readers seemed to benefit somewhat more from a change in feedback.

Conclusions

On the basis of previous research by Whitney, Ritchie, & Clark, (1991) and McDaniel, Epstein, Dunay & Cobb, (1986) the assumption can be made that feedback contributes to subsequent achievement by reducing the effort needed for processing, perhaps by decreasing demands on short-term memory. However this does not axiomatically support the educational belief that feedback is facilitative of
As in previous studies, the survey version produced a superior performance on our measure of inferential reasoning. Moreover, under certain circumstances this performance increment was enhanced by changes in the feedback type provided (Langer et al., 1996). The data suggest that once construction or modification of the internalized text base is initiated, additional assistance may be helpful regardless of compatibility of the feedback.

It must be kept in mind that in our studies assessing the contributions of feedback to situational memory, as indexed by the verification of inferential statements, that our subjects probably start with a prototypical mental model of a town or a recreational park. This prototype consists most likely of a loosely constrained set of attributes. The text descriptions provided can be characterized as containing primarily spatial rather than non-spatial information (McNamara, Halpin, & Hardy, 1992). It is possible that the survey text base representation generated, as a consequence of the survey version's characteristics, may be fluid enough to allow greater use of whatever feedback is provided. Conversely, the route version which may yield a more linear and less flexible representation.

It can be argued, of course, that part of the difference in score gains represents a product of dual encoding (Paivio, 1986). After all, the subjects received both a verbal description and visual representation of the park. It appears though that while we know a great deal about verbal encoding, visual representation is less well-understood (Healy & McNamara, 1996). While dual encoding may indeed account for part of the gain, again we still believe that there are significant differences in the mental models derived from the route and survey texts, such that there is a possibility of greater use of assistance by subjects developing their text base from the survey version. At this point this is essentially a matter of speculation.

In the past we have remarked somewhat facetiously about the survival skills
of our college subjects, which enable them to recall text without necessarily processing in depth. This surface level of recall, at the expense of significant processing, may explain why programmed instruction succeeded so often at reproduction of text at the expense of transfer (Langer et al., 1996). This failure may represent a distinction between learning and comprehension (Kintsch, 1994). In short, too much assistance may direct the learner away from the necessity of more elaborate processing to satisfy demands of the task which stress surface or perhaps semantic representation. On the other hand, a judicious choice of feedback based on content and the level of memorial representation sought could lead to a more complex processing of text.
REFERENCES


**Table 1**

Comparison of Feedback & Control Means Across Trials

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<th>Feedback Condition</th>
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Table 2

ANOVA: Inferential Comprehension

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Table 4

Means and Standard Deviations: Versions x Feedback x Trial

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<td></td>
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<td>(2.76)</td>
<td>(2.88)</td>
<td>(2.15)</td>
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<td>(1.95)</td>
<td>(1.96)</td>
<td>(2.76)</td>
<td>(0.97)</td>
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APPENDIX A

DESCRIPTION OF PARK: 
ROUTE VERSION

1. You may enter the park (at its only entrance) from route 9N.
2. Turn left into the park on to a two-way street.
3. After traveling a short distance on this road, you must pay a park use fee at 
the small white toll booth.
4. The road divides to form a circle around this booth, and then merges again to 
become a two-way street.
5. Continue straight ahead until you approach a stop sign.
6. You will see a wooded area in front of you.
7. Here you must choose to turn right or left (although the road will lead you 
around in a circle either way).
8. Turn right at the sign.
9. Soon you will see two wooden cabins on your right; men's and women's rest 
rooms for park patrons.
10. Continue past the rest rooms and you will see a large gravel parking lot on 
your left.
11. If you pull into the lot and look straight ahead, you will see a trailhead; this 
breaks off into three separate trails.
12. A wooden sign at the trailhead posts the following information: The right 
most trail leads you into a steep wooded area where a short hike will take you 
to the head of a beautiful waterfall, the beginning of the small white water 
stream which flows back down toward the road.
13. The middle trail, on more level yet wooded ground, leads you to a quiet 
picnic area in the woods.
14. Here you will see a large pavilion and several picnic tables.
15. The left-most trail is a trail to be used by serious hikers, for a steep mountain 
climb.
16. If you were to continue past the gravel lot around the parks circular drive, 
you would drive over a wooden bridge (under which the rapids run).
17. After the bridge, on the right hand side of the road, is an ice-cream stand 
where ice cream and beverages are sold.
18. Further down the road, also on the right hand side, you are able to see three 
tennis courts followed by a basketball court, which are all available to park 
users on a first-come/first-serve basis.
19. Directly across the street from the athletic courts, you may find another set of 
rest rooms.
20. If instead you had decided to turn left at the T in the road, you would first 
encounter horse stables, shaded by trees, on the left, as well as the park's 
Ranger Station where you may ask directions, seek assistance of any kind, and 
receive first-aid care.
21. Continuing around the circle in this direction, there is another gravel lot on the right hand side of the road.
22. This lot is surrounded by a metal fence due to the fact that the lot is in front of a baseball field.
23. Behind the baseball field, there is a soccer field equipped with two nets.
24. Directly across the field from the parking lot is a hot dog stand.
25. At this stand, you can purchase sandwiches, hot dogs, snacks and cold beverages.
26. But in between the hot dog stand and the courts, you can take a left turn onto a hidden drive, which will take you to a scenic overlook of the lake on the left side of the park.
APPENDIX B

DESCRIPTION OF PARK:
SURVEY VERSION

1. You may enter the park (at its only entrance) from northbound route 9N.
2. Turn west into the park on to a two-way street.
3. After traveling a short distance on this road, you must pay a park-use fee at
the small white toll booth.
4. The road divides to form a circle around this booth, and then merges again to
become a two-way street.
5. Continue west until you approach a stop sign.
6. You will see a wooded area in front of you.
7. Here you must choose to go north or south (although the road will lead you
around in a circle either way).
8. Turn right at the sign to head north.
9. Soon you will see a pavilion and some picnic tables to the east.
10. Continue past the picnic area and you will see a large gravel parking lot to the
west.
11. If you pull into the lot and face west, you will see a trailhead; this breaks off
into two separate trails.
12. A wooden sign at the trailhead posts the following information: The
northern trail leads you into a wooded area where a short hike will take you
to the head of a beautiful waterfall, part of the small white water stream
which flows back down toward the road.
13. The southern trail is a trail to be used by serious hikers, for a steep mountain
climb.
14. If you were to continue past the gravel lot around the parks circular drive,
you would drive over a wooden bridge (under which the rapids run) and you
begin to head west.
15. After the bridge, to the north, is an ice-cream stand where ice cream and
beverages are sold.
16. Further down the road, (now heading south), looking west you are able to see
a set of tennis courts followed by a basketball court, which are all available to
park users on a first-come/first-serve basis.
17. Directly across the street from the tennis courts, you may find two wooden
cabins; men's and women's rest rooms for park patrons.
18. If instead you had decided to head south at the T in the road (turning left),
you would first encounter horse stables, shaded by trees, to the east, followed
by the park's Ranger Station where you may ask directions, seek assistance of
any kind, and receive first-aid care.
19. Continuing around the circle in this direction, (now heading west) there is a
another gravel lot to the north.

21
This lot is surrounded by a fence due to the fact that the lot is in front of a baseball field.

North of the baseball field, there is a soccer field equipped with two nets.

Continuing west on the main road, you will encounter a hot dog stand.

At this stand, you can purchase sandwiches, hot dogs, snacks and cold beverages.

As you continue on the road, you will see the aforementioned tennis courts to the west.

But in between the hot dog stand and the courts, you can turn west onto a hidden drive, which will take you to a scenic overlook of the lake on the west side of the park.
APPENDIX E

INFERENTIAL QUESTIONS: ROUTE VERSION

1. Had you taken a right at the stop sign, the men's and women's rest rooms would be on your left hand side.

2. The first visible wooded area in the park can be seen before you reach the toll booth.

3. Taking a right at the sign, you would first encounter the basketball court, followed by the men's and women's rest rooms.

4. Turning left at the stop sign, you encounter the ranger station and then the horse stables.

5. From the baseball diamond parking lot, you can see the soccer field only by looking away from the diamond.

6. Turning right at the stop sign, one first encounters the pavilion to the left, and then the park trails on the same side.

7. The hidden drive leading to the scenic overlook is at the same end of the park as the hot dog stand.

8. The soccer field is easily accessed by crossing the street from the horse stables.

9. Had you turned right at the stop sign, you would encounter the hot dog stand and then the ice cream stand.

10. Taking a right, you would first encounter the pavilion and then a stop sign.

11. The ranger station has a food service station as well as a first aid station.

12. There is a stop sign at the small white toll booth.

13. After turning right at the stop sign, you would first encounter the parking lot for the hiking trail and then the wooden bridge.

14. Turning left at the stop sign, you would encounter the baseball field, the basketball court, and the hidden drive, in that order.
15. Had you turned left at the sign, you would first encounter the tennis courts and then the basketball court.

16. The hot dog stand is directly across the street from the tennis courts.

17. As you turn left into the park, you are required to stop two times; first at the toll booth and then again at the stop sign.

18. Turning right at the stop sign, the pavilion/picnic area is on your left.

19. A wooded area is across the street from the only stop sign in the park.

20. A fence surrounds both of the parks’ parking lots.
1. Facing south, the men's and women's rest rooms are to the east.
2. The first visible wooded area in the park can be seen before your reach the toll booth.
3. Driving north, you would first encounter the basketball court, followed by the men's and women's rest rooms.
4. Heading south from the stop sign, you encounter the ranger station and then the horse stables.
5. From the baseball diamond parking lot, you must face south to see the soccer field.
6. Turning north at the stop sign, one first encounters the pavilion to the west, and then the park trails, also to the west.
7. The hidden drive leading to the scenic overlook is at the southern end of the park, as is the hot dog stand.
8. From the horse stables, you would head east (in a straight line) to get to the soccer field.
9. Had you gone north at the stop sign, you would encounter the hot dog stand and then the ice cream stand.
10. Driving north, you would first encounter the pavilion and then the stop sign.
11. The ranger station has a food service station as well as a first aid station.
12. There is a stop sign at the small white toll booth.
13. As you drive north, you would first encounter the parking lot for the hiking trail and then the wooden bridge.
14. Turning south at the stop sign, you would encounter the baseball field, the basketball court, and the hidden drive, in that order.
15. Had you gone south at the stop sign, you would first encounter the tennis courts and then the basketball court.

16. The hot dog stand is directly across the street from the tennis courts.

17. As you head west into the park, you are required to stop two times; first at a toll booth and then again at a stop sign.

18. Heading north from the stop sign, the pavilion is to the west.

19. A wooded area is due-west of the only sign in the park.

20. A fence surrounds both of the parks' parking lots.