THE PRESENTATION OF THEMES AS AN AID TO THE INTEGRATION OF MEANING IN READING: THE EFFECT OF THE DIVISION OF THEME INTO ITS CONSTITUENTS

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Four presentation strategies were adopted to examine the effects of theme on comprehension in stories. Subjects given a main theme only knew it before reading the passage. Simultaneous group read both the main and the subordinate themes on the first page. Alternate group read the main theme first and then was presented subordinate themes and their corresponding paragraphs alternatively. The results showed that these three groups which were given themes tended to include more ideas in their recall protocols than the Control group which was given no theme. There was no significant difference among the three groups given the themes. Similar tendencies were found in both reproductive and constructive measures on memory. These results showed that the readers encoded the given stories by integrating individual sentences with the theme, but such integration was difficult to occur for the materials of which the whole meaning could easily be extracted.

Many recent researches in sentence memory have increasingly begun to emphasize comprehending context and the underlying structure of connected discourse (Kintsch, 1974, 1975; Thorndyke, 1977). The most important and difficult problems in such study, however, are in identifying the units of analysis for the sentence meanings.

Recent theories on structure of long-term memory help us deal with the internal representations of meaning. Anderson and Bower (1973) assumed that information is represented in memory in terms of networks of propositions containing concepts. Kintsch (1977a) also defines a proposition as a set of concepts related to each other.

While he considered such a proposition as a whole unit, the HAM model of Anderson and Bower assumed that a proposition was an associated network. These theories which are based on propositional networks are the most important ones in analyzing the meaning of single sentences.

However, such theories are not available to the propositional analysis of a passage with many sentences. It appears that what the reader comprehends and memorizes is the context of the whole passage rather than the meanings of individual sentences. Kintsch (1977b) and Kintsch and van Dijk (1978) distinguished between the whole meaning and the meanings of each sentence and called the former macrostructure and the latter microstructure.

Other researchers have also adopted a similar notion of an underlying structure for prose and have used a variety of names, including "theme" (Dooling & Christiaansen, 1977), "surrogate structure" (Pompi & Lachman, 1967), and "schema" (Bartlett, 1932).
How a reader grasps the macrostructure from the whole passage appears to depend on various factors. Research on the effect of such factors will make the function of macrostructure clear. Such research will also help us understand the processes underlying the comprehension of the macrostructure of passage.

The present experiment is concerned with the role of theme as the main factor having great influence on grasping the macrostructure. As Dooling and Christiaansen (1977) pointed out, theme refers to the abstraction of whole meanings from passage. It also refers to what can be reduced to several words or a single sentence. This is explicitly expressed in forms like the chapter heading of books. The macrostructure which Kintsch defines refers to the whole inherent context of a certain passage. In this sense, both macrostructure and themes are assumed to have basically common function for comprehending the text.

The purpose of the present experiment was to test the effect of theme on comprehension and memory of passage, which was the first step in examining the functions of macrostructure. It is apparent from the studies of Bransford and Johnson (1972), Dooling and Lachman (1971) and Dooling and Mullet (1973) that the understanding of a passage is promoted by the presentation of a theme. The readers given the theme of a passage can progress in reading the text by relating individual sentences of the passage to the theme, and then be able to understand the content of text better. A passage usually has a main theme. However, it is insufficient to describe the passage only in terms of this main theme. Almost all passages have their respective subordinate themes. Therefore, giving only a main theme to the subjects would be insufficient presentation strategy. It was assumed in this experiment that subjects who were given both the main and the subordinate themes would have better opportunities to integrate the individual sentences into the theme, and to acquire a hierarchical structure of information that was arranged from the most to the least important. If this were the case, one could predict that performance of recall would be better for subjects who received both the main and the subordinate themes than for those given the main theme only.

In addition, two groups were distinguished in terms of the subordinate themes. One is a group which was given both the main and the subordinate themes simultaneously. The other group is given read the main theme and then successively presented paragraphs and their subordinate themes, each theme immediately preceding its corresponding paragraph. For both groups one can make the following different expectations. First, it can be argued that successive presentation would facilitate the subjects’ performance better than simultaneous presentation. When the subject tries to relate individual sentences with a subordinate theme, such integration would occur more easily in the group given the subordinate theme immediately before its corresponding paragraph. On the other hand, another argument can be made which predicts quite the opposite result to the first. That is, the group given both the main theme and the subordinate themes simultaneously would easily acquire to some extent the whole structure of a passage before reading it. But as the group given the subordinate themes successively had no such framework prior to reading, performance of this group would be at the lower level.

**Method**

**Subjects.** Fifty-six undergraduate students of Miyazaki University served as the subjects. They were randomly assigned to one of four groups of 14 subjects each.

**Design.** The four experimental groups received different treatments of presentation of theme in written Japanese. One group was
given a main theme only. The second group was presented a main theme plus five subordinate ones simultaneously. The third group was successively given a main theme and one of five subordinate themes. The control group received no theme.

Materials. Materials for the four main themes were drawn from a popular science book in Japanese, *Pocket Science IV* (Leokum, 1970) which high school students can easily understand: "Nest of bees," "The death penalty," "Why we feel muscular pain," and "How to cure broken bones." They ranged in length from 246 to 262 words, each of which consisted of five paragraphs. Each paragraph was given a proper subordinate theme. Each paragraph was then written on a separate sheet of paper, thus a whole story covered five separate sheets. The main and the subordinate themes were printed on sheets of paper. Each subject was tested on all four stories.

A story formed a booklet, but the arrangement of the content varied among groups. For the condition of the main theme only (Main group), the main theme was written on the first page. The following pages contained the content of five short paragraphs. For the condition in which the main and the subordinate themes were presented simultaneously (Simultaneous group), the subjects read the main and the subordinate themes on the first page. The subjects in the Alternate group read a main theme on the first page. The subordinate theme for the first paragraph of that story was presented on the second page. Similarly, the subordinate theme and its corresponding paragraph appeared alternately. The subjects in the control condition (Control group) just read the story without seeing any theme.

Procedure. All four booklets were given to subjects at the beginning of the experiment. The subjects read the booklets on a table in a random order. The experimenter told the subjects to remember as much as possible the content of the story because they would be tested later. The subjects in the Main group read the main theme for 5 sec while the subjects in the Simultaneous group were allowed 30 sec to read both the main and the subordinate themes. In the Alternate group the time to read either the main or the subordinate theme was 5 sec. The time allowed for each paragraph was sufficient to read it slowly twice. The time to read the paragraph depended on the length of paragraph, and ranged from 40 to 55 sec. The reading time was controlled by the experimenter. After finishing to read a story the subjects were given a free recall test of 10 min. They were requested to write out as many sentences as they could. Following this the subjects received a recognition test, which involved two kinds of items; one (15 or 16 items) was to test whether the subjects retained detailed facts from the original story, and the other (two or three items) was to test subjects’ ability to infer from one or more sentences in the original story. The inference test item has, e.g., the form like “A is D” when the original story contained sentences like “A is B,” “B is C” and “C is D.” The subjects were told to respond “yes” if the test item was identical with one in the original story and “no” if it was not. Except that the number of the test items used varied among the four stories, essentially the same procedure was repeated for four stories.

Protocol analysis. Each subject contributed a free recall protocol and a recognition test protocol. The recognition test responses were scored as correct or incorrect. For inference items the subjects’ responses were considered correct. Lenient criteria for free recall were used. The unit of analysis was a single sentence with one or more ideas. For example, the sentence “The bees are in full activity from spring through summer” has one idea. As another sentence “Although Queen bee can breed a lot of bees, she cannot raise larvae” has a main clause plus subordinate one, it has two ideas. Likewise, the sentence “If the temperature in the nest becomes low, the bees swarm in order to raise the temperature” has three ideas. If a subject correctly recalled a sentence which had one idea, he received one point. In the case of a subject recalling only one of the ideas in
TABLE 1

<table>
<thead>
<tr>
<th>Groups</th>
<th>Mean proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main</td>
<td>.480</td>
</tr>
<tr>
<td>Simultaneous</td>
<td>.508</td>
</tr>
<tr>
<td>Alternate</td>
<td>.492</td>
</tr>
<tr>
<td>Control</td>
<td>.442</td>
</tr>
</tbody>
</table>

This way of analysis is similar to the method which Thorndyke (1977) adopted or the conceptual macrostructure Bower defined (1974). Scoring was lenient with respect to paraphrases and synonyms. However, scoring was done by two independent raters and there was considerable agreement (92%) between them. Scoring on which the raters disagreed was decided through discussion.

**RESULTS**

**Free recall test.** The number of sentences involved varied among the four stories: There were 34 sentences in "Nest of bees," 32 sentences in "The death penalty," 30 sentences in "Why we feel muscular pain," and 36 sentences in "How to cure broken bones." For the purpose of analysis, the proportion of a subject's score to the total number of sentences in each story was used as the data. Table 1 shows the mean proportion of correct recall for the four stories. An analysis of variance yielded the main effect of treatments, $F(3,52)=7.926, p<.01$. Newman-Keuls tests indicated that the significant difference was between the Control vs. Main, between Control vs. Simultaneous, and between Control vs. Alternate groups ($ps<.01$). The difference among the Main, the Simultaneous and the Alternate groups was not statistically significant.

Each story had been divided into five paragraphs corresponding to five subordinate themes. The mean proportion of correct recall was determined for each paragraph of each story. The overall results are shown in Fig. 1. These data were subjected to a Theme $\times$ Serial Position repeated measures analysis of variance. The analysis revealed a significant Theme effect, $F(3,52)=6.149, p<.01$, and a significant Serial Position effect, $F(4,216)=6.844, p<.01$, and also the significant interaction was observed, $F(12,216)=3.056, p<.01$. The tests of simple effect were conducted to evaluate the significance of the differences among groups for each serial position. In the first, the second, and the third serial positions there were no significant differences among four groups. The differences among groups were significant in the fourth position, $F(3,215)=8.904, p<.01$, and also in the last position, $F(3,215)=4.107, p<.01$. Again, Newman-Keuls tests showed that the Control group was significantly worse than the other three groups in both the fourth and the last serial positions ($ps<.01$).

**Recognition test.** Inference items were regarded as the result of logical reasoning from the meaning of the sentences in the original passage. The proportion of test items correctly inferred by each experimental group was shown in Table 2.

The memory and inference test data were subjected to a two-way analysis of variance, involving the four experimental groups and the two types of test items.
The analysis revealed a significant difference among experimental groups, $F(3,52) = 3.746, p < .05$, and a significant difference between the memory and the inference test items, $F(1,56) = 10.772, p < .01$. Interaction between experimental group and type of test items did not approach significance. Newman-Keuls tests were used to compare the four theme groups. These tests showed that Control group performed significantly worse than each of the other three groups ($p < .05$ in all comparisons), but there were no significant differences among the three groups.

**DISCUSSION**

The experiment in this paper was designed to see whether the groups given both the main and the subordinate themes would show better performance than the group which received the main theme only. As can be seen in Table 1 and Table 2, the recall and the recognition tests indicated that there was no significant difference between the groups with or without the subordinate themes. However, these results do not directly mean that the subject did not encode the input sentences so as to relate them with theme. In both the recall and the recognition tests the groups which were presented theme performed better than the group without theme. This indicated that the subjects adopted the above encoding strategy.

In the present study it was assumed that the effect of such encoding strategy would be obtained particularly in the measure of constructive memory. According to the dichotomy of Tulving (1972), the subjects in this experiment should have encoded the content of passage into semantic memory rather than episodic memory. Organization and integration of individual sentences in the semantic memory system should increase with the amount of information about the theme. So in the present experiment a significant interaction between the experimental groups and types of test was expected, but the results showed the identical trend with both measures of memory.

One of the main reasons why the prediction was disconfirmed appears to be the nature of the materials used here. Each experimental passage was written briefly and accurately. As a matter of fact, the experimenter had little difficulty in preparing the test items of inference. The need to integrate information arises when new incoming event cannot be interpreted properly in currently active frame; that is, when the event does not fit well into the expected context. Such function of information integration was referred to as a “bridging structure” by Haviland and Clark (1974) or “inference” by Thorndyke (1976). The paragraphs in the present experiment were well-organized and did not involve any ambiguous relationships among the sentences. The fact that the present study used such paragraphs may explain why the presentation of theme did not produce differential effects with respect to different measures of memory.

A similar argument holds for the explanation why there was no significant difference between groups which were given the subordinate themes. If the Alternate group was superior to the Simultaneous group, it should have suggested that the subjects in the Simultaneous group had some difficulty integrating paragraphs.
which were separated in time and space. If the reverse results had been obtained, it would have meant that the subjects of the Simultaneous group grasped the whole structure of the story before reading paragraphs. However, when the materials used were easy to read and well-organized, the subjects could easily extract the whole structure without knowing subordinate themes. And also, the subjects could relate sentences to themes even if each paragraph and its theme were separated in time and space. However, the confirmation of such effect of the materials is left for future research.

The subjects' recall was considerably better for the earlier portion of the story. This phenomenon may be called the serial position effect of the story. A similar tendency was reported by Kintsch and Kozminsky (1977), who made subjects summarize a story with 2000 words in length into 60–80 words. They discussed the results as a bias in favour of the setting of story. But as the passage used in this experiment did not involve a story structure such as exposition, complication, and resolution, how to integrate their results with the present results is also a matter left for future research.

REFERENCES


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