

Contextual Prerequisites for Understanding: Some Investigations of Comprehension and Recall¹

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The present paper presents a series of studies showing that relevant contextual knowledge is a prerequisite for comprehending prose passages. Four studies are reported, each demonstrating increased comprehension ratings and recall scores when Ss were supplied with appropriate information before they heard test passages. Supplying Ss with the same information subsequent to the passages produced much lower comprehension ratings and recall scores. Various explanations of the results are considered, and the role of topics in activating cognitive contexts is discussed.

The present paper sketches a general approach to some problems of comprehension and memory. Several studies are reported which employ an experimental paradigm that seems particularly adaptable to such problems and that has been useful in developing the point of view proposed here.

Probably the most well-developed approach to comprehension stems from theories based on transformational linguistics (e.g., Chomsky, 1957, 1965, 1968; Postal, 1964). Sentences are assumed to have both superficial and underlying (deep) structures. The surface structure characterizes the phonological shape of the sentence, but the deep structural information is presumed necessary for characterizing sentence meaning (see Katz & Postal, 1964). According to Katz & Postal (p. 12), the semantically interpreted deep structural relations underlying sentences constitute a full analysis of their cognitive meaning. Comprehension thus involves the recovery and interpretation of the abstract deep structural relations underlying sentences.

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and sentence memory involves retention of the deep structural but not necessarily the surface structural forms. Many studies have demonstrated the importance of deep structure in sentence perception and memory tasks (e.g., Bever, Lackner, & Kirk, 1969; Blumenthal, 1967, Blumenthal & Boakes, 1967; Perfetti, 1969; Rohrman, 1968; Sachs, 1967; Wanner, 1968).

However, several lines of research support the notion that performance in comprehension and memory tasks has a broader base than simply the semantically interpreted deep structural relations underlying linguistic inputs. Kintsch (1972), for example, has shown that Ss often know more than a sentence specifies directly. The results of experiments by Bransford and Franks (1971), Bransford, Barclay, and Franks (1972) and by Johnson, Bransford, & Solomon (in press) indicate that the information Ss use in a sentence memory task may originate from the integration of information from several related sentences and may include ideas not directly expressed in the acquisition materials.

For example, Johnson, Bransford, and Solomon (in press) presented Ss with short passages like either (a) "The river was narrow. A beaver hit the log that a turtle was sitting beside and the log flipped over from the shock. The turtle was very surprised by the event"

or (b) "The river was narrow. A beaver hit the log that a turtle was sitting on and the log flipped over from the shock. The turtle was very surprised by the event." After acquisition, the Ss were read a list of recognition sentences and asked to indicate which sentences they had actually heard during the acquisition task. Those Ss hearing passage (b) were much more likely to think they had heard the novel sentence, "A beaver hit the log and knocked the turtle into the water," than those hearing passage (a). The Ss' understanding of the acquisition sentences apparently involved a realization of the probable consequences of the situations suggested by the input sentences; Ss frequently thought they had heard information which could only have been inferred.

The experiments mentioned above lend considerable support to the idea that Ss do not simply interpret and store the meanings of sentences per se. Rather, Ss create semantic products that are a joint function of input information and prior knowledge. The present paper focuses directly on the role played by prior knowledge in comprehension. Its purpose is to show that not only is prior knowledge reflected in the S's performance in tasks involving the comprehension of linguistic information, but that certain knowledge may be necessary for the meaningful processing of the information in the first place. In the experiments presented below, the availability of prior knowledge is manipulated in order to assess its influence on Ss' ability to comprehend and remember linguistic materials.

EXPERIMENT I

The information presented to the Ss consisted of a passage in which the sentences followed rules of normal English construction and the vocabulary items were used in non-metaphorical ways. The prediction tested was that Ss who received the appropriate prerequisite knowledge would be able to comprehend the passage quite easily, and hence would

subsequently be able to recall it relatively well. On the other hand, Ss who did not have access to the appropriate knowledge should find the passage difficult to understand and recall. The prerequisite knowledge was in the form of a picture that provided information about the context underlying the stimulus passage. The passage did not simply describe the contextual picture, but instead described various events that could happen given the context as a conceptual base.

Method

The experiment consisted of an acquisition phase, followed by two tasks—comprehension rating and recall. There were five independent groups of Ss with 10 Ss per group. In addition to the No Context (1) Ss

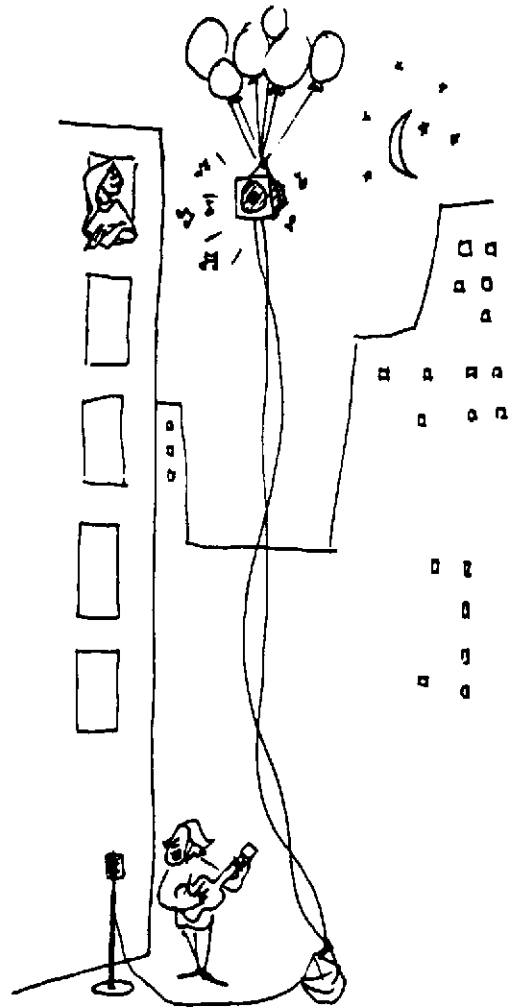


FIG. 1. Appropriate context picture for Experiment I.

(who simply heard the passage) and the Context Before Ss (who saw the appropriate context picture before they heard the passage), there were three other groups of Ss. Context After Ss first heard the passage and then saw the appropriate picture. Since it was assumed that contextual information is necessary for the ongoing process of comprehension, the Context After Ss were expected to assign lower comprehension ratings and recall less than the Context Before Ss. Partial Context Ss were shown a picture before the passage was presented. The partial context picture contained all of the objects represented in the appropriate context picture, but the objects were rearranged. It was assumed that the availability of concrete representations of the objects would be equal for the Partial Context and Context Before groups. However, the comprehension and recall performances of the former group were expected to be lower since the relations among the objects in the partial context picture constituted an inappropriate conceptual base for the passage. Finally, No Context (2) Ss heard the passage twice. This group was included to assess the effects of repetitions in the absence of context.

Materials. The passage was as follows: If the balloons popped, the sound wouldn't be able to carry since everything would be too far away from the correct floor. A closed window would also prevent the sound from carrying, since most buildings tend to be well insulated. Since the whole operation depends on a steady flow of electricity, a break in the middle of the wire would also cause problems. Of course, the fellow could shout, but the human voice is not loud enough to carry that far. An additional problem is that a string could break on the instrument. Then there could be no accompaniment to the message. It is clear that the best situation would involve less distance. Then there would be fewer potential problems. With face to face contact, the least number of things could go wrong.

The appropriate- and partial-context pictures are shown in Figures 1 and 2, respectively.

Procedure. The Ss assigned to a given condition were tested as a group in a single session. All Ss were told that they were going to hear a tape-recorded passage and were asked to attempt to comprehend and remember it. They were informed that they would later be asked to recall the passage as accurately as

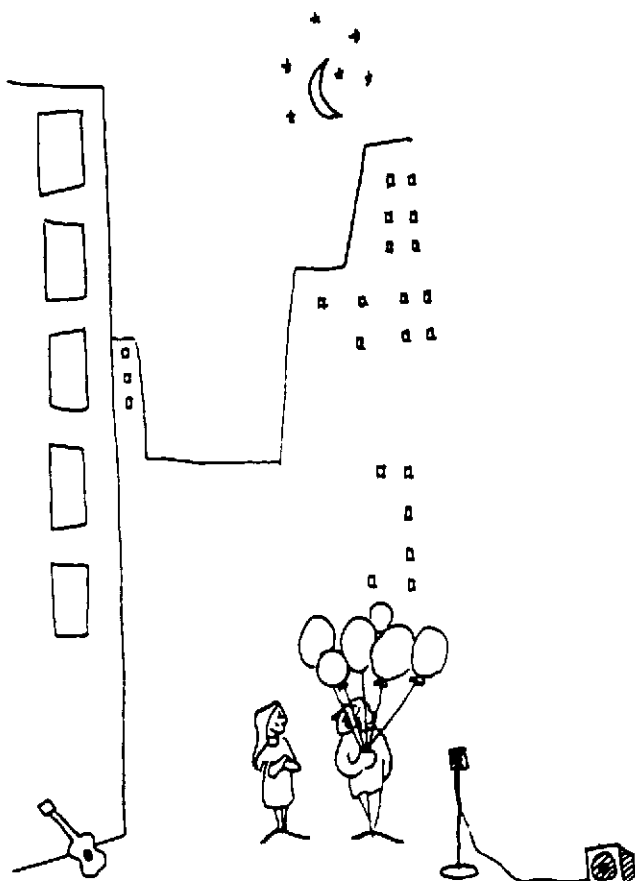


FIG. 2. Partial context picture for Experiment I.

they could. The Context Before and Partial Context Ss were given 30 seconds to inspect their respective pictures before the start of the recorded passage. The No Context (2) group heard the same recording twice. After acquisition, there was a 2-minute delay before Ss rated the passage. During this interval, Ss received recall sheets, Context After Ss were allowed 30 sec. to inspect the appropriate picture, and instructions about how to use the comprehension scale were given. A seven-point scale was used, with 1 indicating the passage was very difficult to comprehend, 4 indicating moderate, and 7 indicating very easy. Immediately after the rating task, Ss were asked to recall the passage as accurately as they could and were told that if they could not remember it word for word, they should write down as many ideas as possible. Seven minutes were allowed for recall.

Subjects. The Ss were 50 male and female high school students who volunteered to participate in the experiment.

Results

We have adopted the following standard procedure for scoring recall protocols of sentence materials or prose passages: Idea units are designated a priori and correspond either to individual sentences, basic semantic propositions, or phrases. Maximum possible scores for the materials used in Experiments I-IV are given in the appropriate tables. The protocols, which cannot be identified as to condition, are scored independently by two judges against the list of idea units. Paraphrases are allowed. Interjudge reliability for materials such as those used in the present experiments ranges from .91 to .99. Any differences in the assignment of scores to Ss are resolved by a third judge. These adjusted scores are then used in the final analysis of the data.

The mean comprehension rating and the mean number of ideas recalled for each group in Experiment I are given in Table 1. For both comprehension and recall scores, Dunnett's test was used to compare the Context Before condition with each of the other four conditions. The comprehension ratings were higher in the Context Before condition than in each of the other four conditions; all values of $d(5, 45) \geq 4.19$, $p < .005$. The Ss in the Context Before condition also recalled a greater number of ideas than Ss in each of the other four conditions; all values of $d(5, 45) \geq 4.12$, $p < .005$. An inspection of the data in Table 1 suggests that, relative to the No Context (1) condition, hearing the passage twice, receiving the context after or receiving the partial context before, increased comprehension ratings somewhat. Relative to the No Context (1) condition, these manipulations had little effect on recall scores.

Discussion

The presentation of the appropriate semantic context had a marked effect on both comprehension ratings and recall. All Ss presumably knew the lexical meanings of the words and were familiar with the sentence structures used in the passage. Comprehension ratings and recall were relatively low, however, when Ss did not receive the appropriate context before they heard the passage.

The large difference in recall between the Context Before and the No Context (1) groups could be due to various factors. For example, knowledge of the appropriate context could

TABLE 1
MEAN COMPREHENSION RATINGS AND MEAN NUMBER OF IDEAS RECALLED, EXPERIMENT I

	No context (1)	No context (2)	Context after	Partial context	Context before	Maximum score
Comprehension	2.30 (.30)*	3.60 (.27)	3.30 (.45)	3.70 (.56)	6.10 (.38)	7
Recall	3.60 (.64)	3.80 (.79)	3.60 (.75)	4.00 (.60)	8.00 (.65)	14

* Standard error in parentheses.

simply provide information that allowed Ss to generate (at recall) ideas based on pre-experimental experiences, and many of these ideas could have overlapped with those in the passage. If this were an important factor, the Context After Ss should also have been able to augment recall by guessing or generating ideas from the picture. Providing the Ss with the appropriate context after they heard the passage did not, however, produce an increment in recall.

One might also argue that the Context Before group benefited from a more available set of retrieval cues (i.e., the elements of the picture—balloons, wire, window, etc.) relative to the No Context group. There are data to suggest that retrieval cues are important for recall and that it is important that these cues be present at input (e.g., Tulving & Osler, 1968). The elements of the picture were available to the Partial Context Ss before they heard the passage, yet their recall was far below that of the Context Before group. What the partial context picture lacked was the appropriate information about the relations among the concrete elements. Understanding the relations in the appropriate context was a prerequisite for understanding the events suggested by the passage. Although considerable research is needed to assess the relative contributions of comprehension versus retrieval processes to remembering, it seems clear that there is little reason to expect retrieval cues to augment recall for prose appreciably if Ss have not understood the meaning of a passage. On the other hand, comprehension per se does not necessarily guarantee subsequent recall. Pilot studies using the passage in Experiment I indicate that recall scores for the Context Before Ss can be increased by supplying them with key words as retrieval cues.

The comparison of the No Context (2) and Context Before groups can be viewed as a transfer of training design, where the No Context (2) group receives Learn A, Learn A, Test A and the Context Before group receives Learn B, Learn A, Test A where Learn B

represents time taken to study the prerequisite context. For Ss in the present experiment, it was more beneficial to transfer from B to A than it was to spend time trying to learn A. Generally, this should be the case if the context in question is truly a prerequisite for comprehension.

The finding that neither Context After, nor Partial Context, nor No Context (2) groups showed augmented recall relative to No Context (1) Ss was somewhat surprising, although these groups were expected to be clearly inferior to the Context Before group. Eventually, it will be important to characterize those situations under which these types of treatments will benefit the Ss' performance. For present purposes, however, the major points are the clear advantage of the Context Before group and the resulting picture of the comprehension process that is supported by the general pattern of the results.

In Experiment I, it was very unlikely that the appropriate prerequisite context was (in all its details) part of the preexperimental knowledge of the Ss. If one generally characterizes comprehension as a process requiring appropriate semantic contexts, then the conditions under which existing structures become activated are extremely important. If a passage does not provide sufficient cues about its appropriate semantic context, the S is in a problem-solving situation in which he must find a suitable organization of his store of previous knowledge. Experiments II, III, and IV involve materials for which the appropriate contexts should be part of the preexperimental knowledge of most Ss. Some Ss are given a cue (a topic for the passage) that should help activate a suitable context.

It should be noted that the experiments to follow are similar to a set of studies that became available in the literature at the time the present paper was being written: Dooling and Lachman (1971) found that providing the topic of a passage affected subsequent recall. The present studies are included here, however, because (a) the passages used are

relatively straightforward linguistic descriptions whereas those used by Dooling and Lachman were explicitly metaphorical; and (b) the present studies include conditions where Ss receive knowledge of the topic after hearing the passage in order to determine whether recall increments are simply due to Ss' abilities to generate probable statements about familiar topics.