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# A replication of Bransford and Franks' (1971) "The abstraction of linguistic ideas"\*†

MURRAY SINGER

*Carnegie-Mellon University, Pittsburgh, Pa. 15213*

Experiment II of Bransford & Franks' (1971) "The Abstraction of Linguistic Ideas" was replicated in as great a detail as the description of the original procedure would permit. The present results are almost identical to those of Bransford and Franks: Ss frequently reported recognizing new sentences derived from the same complex ideas as sentences heard during acquisition, and their level of confidence in their reports of recognition increased as the complexity of the test sentences increased. These findings enhance Bransford and Franks' conclusion that Ss integrate complex semantic information as presented in related but nonconsecutively experienced sentences, and do not simply memorize the exact sentences which they have heard. The procedures seem appropriate for use in the investigation of other hypotheses concerning semantic memory.

One characteristic of psychological studies concerning memory, both semantic and nonsemantic, has been an emphasis upon one-to-one correspondence between experience and memory storage. Bransford & Franks (henceforth B-F) (1971), however, have conducted a series of studies that stress the integrative functions of semantic memory. They attempt to show that in attending to linguistic material, primary concern is not with the precise words or sentences employed, but rather with the wholistic ideas that may result from groups of sentences as well as single ones.

In the recognition phase of Experiment II of B-F (1971), Ss heard new sentences that were derived from the same complex ideas as the sentences that they had encountered in acquisition. The Ss' level of confidence in their "recognition" of these new sentences increased monotonically as the complexity of the test sentences increased, except that Ss almost uniformly rejected those sentences (NONCASES) which conflicted with the ideas expressed in the corresponding complex idea. The authors concluded that these results reflected the fact that the more complex of the recognition sentences more completely exhausted the relations embedded in the integrated, wholistic ideas stored by the Ss. The

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present study attempts to replicate Experiment II of B-F (1971).

## METHOD

Although the methods employed in this study approximate closely those of B-F, they will be briefly outlined here.

### Subjects

The Ss were 13 men and 1 woman enrolled in a section of introductory psychology at Carnegie-Mellon University. The Ss participated in this study in partial fulfillment of a course requirement.

### Verbal Materials

The verbal materials consisted of Idea Sets E, F, G, and H of B-F. The sentence corresponding to Complex Idea E, for example, was *The scared cat running from the barking dog jumped on the table*. This sentence could be analyzed into four underlying propositions (ONES): *The cat was scared; The cat was running from the dog; The dog was barking; The cat jumped on the table*. It was also possible to recombine the ONES to form two- (e.g., *The scared cat was running from the dog*) and three- (e.g., *The scared cat was running from the barking dog*) idea sentences (TWOS and THREES, respectively). The original sentence was referred to as a FOUR.

The acquisition list consisted of six sentences from each of the four complex ideas: two each of THREES, TWOS, and ONES. The order of the 24 sentences was random, with the constraints that (1) in successive sequences of four sentences, there was one sentence from each idea set; and (2) that no two consecutive sentences were from the same idea set.

The recognition list consisted of 30 sentences, shown in Fig. 1 and Table 1: 6 sentences derived from each complex idea (one FOUR, one THREE, two TWOS, and two ONES), and 6 noncase sentences, in which were embedded ideas that violated the relations expressed in acquisition (see Table 1). None of the sentences in this list had occurred in acquisition. Each successive group of five sentences contained one sentence from each idea set plus one NONCASE, and no two consecutive sentences were derived from the same complex idea.

### Procedure

The Ss were separated into two groups for the purpose of counterbalancing the order of presentation of the recognition sentences. There were nine Ss in Group I and five in Group II, and the two groups were tested separately.

### Acquisition

The Ss were told that their task was to answer simple questions about sentences. After reading each sentence, the E held up a sheet of paper showing four colored scribbles which the Ss were to "read" aloud in unison. This was intended to insure that the Ss were holding the sentences in memory for at least a few seconds. The E then read an elliptical question concerning the preceding sentence, and the Ss wrote down their answers. For example, after reading *The cat jumped on the table*, the E might ask, *What did, Did what, or Where?*

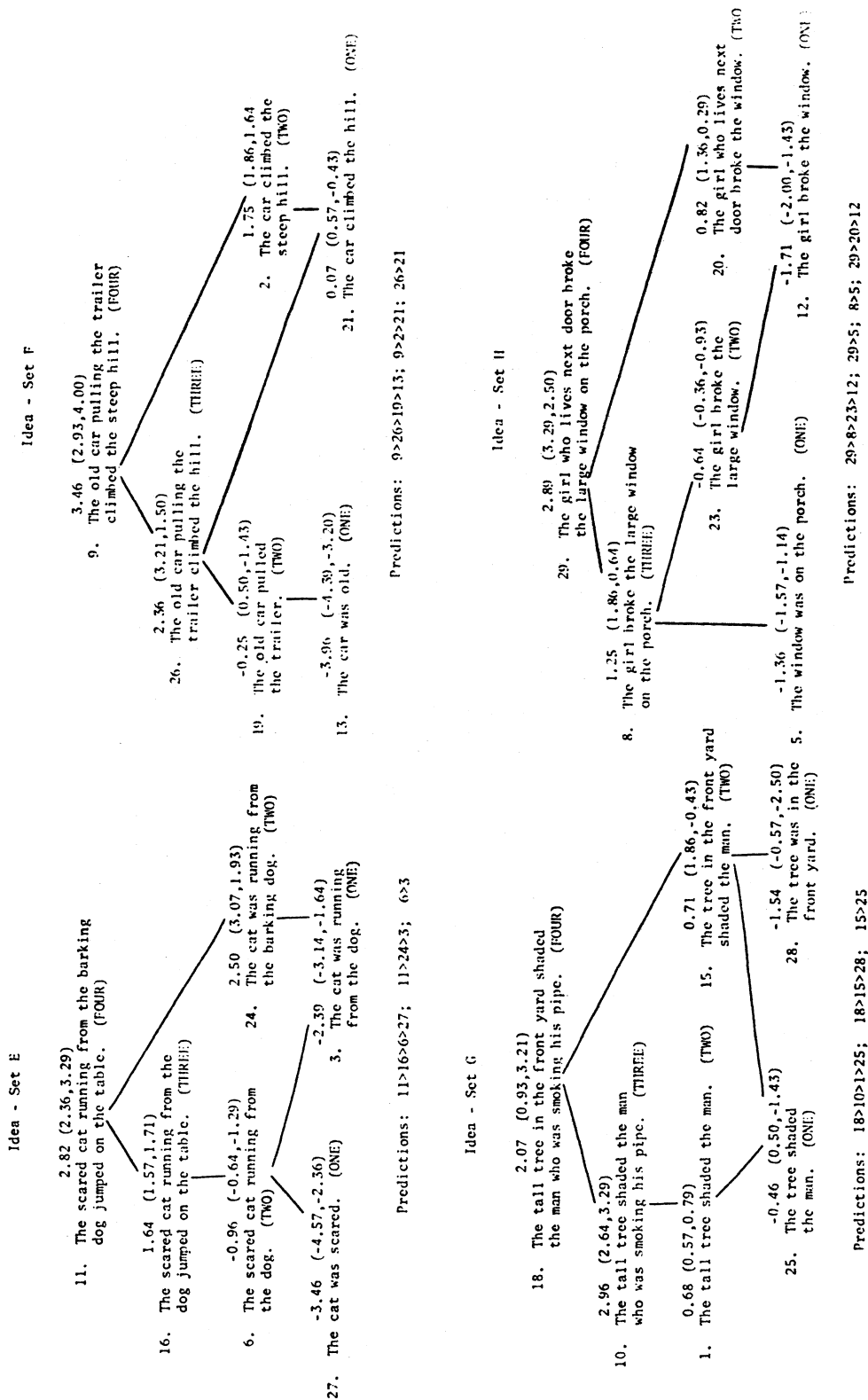


Fig. 1. Recognition confidence levels for sentences from the four idea sets from B-F (1971). Each sentence contains a subset of the relations expressed in the FOUR from which it is derived. The solid lines indicate pairs of sentences in which one sentence expresses a subset of the ideas contained in the other. The three confidence scores accompanying each sentence are its overall, Trial 1, and Trial 2 averages, respectively. The predictions concerning the confidence levels, shown at the bottom of each idea set, are expressed in terms of the sentence numbers, which in turn indicate each sentence's position in the recognition list.

Table 1  
Noncase Sentences

Sentence Number	Recognition Confidence Levels			Sentence
	Average	Trial 1	Trial 2	
4	-4.62	-4.56	-4.67	The man who lives next door broke the large window on the porch
7	-3.86	-4.71	-3.00	The scared cat ran from the barking dog which jumped on the table.
14	-4.57	-4.79	-4.36	The scared cat which broke the window on the porch climbed the tree.
17	-4.68	-4.86	-4.50	The old man who was smoking his pipe climbed the hill.
22	-4.43	-4.36	-4.50	The barking dog jumped on the old car in the front yard.
30	-3.86	-4.29	-3.43	The tall tree in the front yard shaded the old car.

Table 2  
Mean Recognition Values: Idea Sets E, F, G, and H Combined

Study	Four	Three	Two	One	Noncase
B-F Study II	3.98	1.95	2.23	-0.21	-4.11
Replication	2.81	2.05	0.58	-1.91	-4.37

### Recognition

After a 2-min rest, the Ss were informed that they would now hear sentences which were very closely related to those in the original set. Their task was to decide, after hearing each sentence, whether or not it was identical to any sentence in the original set. If so, the Ss were instructed to answer "yes," but if they thought the sentence was new, they were to respond "no." In addition, the Ss were instructed to estimate the degree of confidence which they had in their responses, using a 5-point scale. On this scale, "5" represented a very high degree of confidence.

Approximately 5 min elapsed between the end of the acquisition phase and the start of recognition. The recognition list was presented twice to both groups, with no break between the two presentations.

## RESULTS

The results of this replication support the predictions and conclusions of B-F. The authors predicted that FOURS would be "recognized" at a higher level of confidence than THREES, THREES than TWOS, and so on, and that NONCASE sentences would be rejected at a high level of confidence. They compared two sentences only if the ideas embedded in one formed a subset of those expressed by the other. *The scared cat was running from the dog*, for example, was compared with *The cat was running from the dog*, but not with *The cat jumped on the table*, since no estimate of the relative conspicuousness of such phrases as *jumped on the table* and *was running from the dog* was available.

The scores referred to below are the recognition confidence levels of the sentences. The confidence ratings for YES and NO responses were recorded as positive and negative integers, respectively. Combining the two groups of Ss, 40 of the 41 ordinal comparisons between pairs of sentences were in the direction predicted by B-F, compared with 39 of 41 in B-F's Experiment II. These comparisons are illustrated in Fig. 1. The single reversal occurred in Idea Set G. The 41 comparisons include redundant comparisons of nonadjacent (e.g., ONES vs THREES) sentences which met B-F's criterion. The NONCASE sentences were all rejected at a high level (Table 1).

The means for the first and second presentations were

examined separately, and are presented in parentheses in Fig. 1. There were four reversals of the ordinal predictions in Trial 1, and one in Trial 2. These figures compare very favorably with B-F's results of six reversals in Trial 1 and two in Trial 2. According to B-F's Monte Carlo analysis, the number of predictions in the correct direction is significantly different from chance.

The present author suspected that the recognition levels would increase upon the second presentation, since the Ss might think that a particular sentence had occurred during acquisition when, in fact, they simply recalled it from Trial 1 of the recognition phase. It was found, however, that exactly 15 of the sentences were recognized with greater confidence during the second presentation while the other 15 were recognized at a lower level of confidence than in Trial 1.

B-F used the individual scores for the 30 recognition sentences to compute the product-moment (P-M) correlation between Trials 1 and 2. The P-M correlation calculated by B-F was 0.95. In the present case, this correlation between Trials 1 and 2 was 0.91.

The recognition confidence levels are generally lower in the present study than in B-F's Experiment II (Table 2). If procedural differences between the two experiments underlie this change, the fact that these differences did not introduce ordinal reversals as well could only enhance B-F's position.

## DISCUSSION

Bransford and Franks have proposed that linguistic information is integrated by the listener in such a way that complex, wholistic ideas are retained, rather than specific words or sentences. They predict, therefore, that, given new sentences of varying complexity, it is the more complex of these that will be reported as familiar, since they resemble more closely what has been stored in memory. The present replication confirms both the hypothesis and the results of the original authors. The procedures they developed seem to be very appropriate for further investigation of problems of semantic memory.

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