

Comprehension Factors in Interpreting Memory for Abstract and Concrete Sentences¹

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Three studies are presented which suggest that previously reported evidence (Begg & Paivio, 1969) for different modes of storage of abstract and concrete sentences is more likely to reflect differences in comprehension of the abstract and concrete materials used. In Experiment I, Ss hearing concrete sentences were later able to distinguish between meaning-preserving and meaning-distorting sentences, whereas Ss hearing abstract sentences did not respond to these two types of sentences significantly differently. Experiments II and III present rating data which indicate that the abstract and concrete materials used in Experiment I and in Begg and Paivio's original experiment were not equivalent in comprehensibility or in the sensitivity of the recognition items.

Begg and Paivio (1969) found that subjects (Ss) who heard concrete sentences were later more likely to detect changes in meaning (subject-object reversals) than changes in wording (synonym substitutions). Conversely, Ss who heard abstract sentences were more likely to detect changes in wording than changes in meaning. Begg and Paivio concluded that this differential memory for aspects of the sentences (meaning vs. exact words) reflects differential forms of coding of abstract and concrete sentences at input. Concrete sentences are coded in an imaginal-spatial manner, and abstract sentences are coded in a verbal-sequential form.

The studies presented here suggest an alternative interpretation of the Begg and Paivio data. This alternative interpretation emphasizes the role of comprehension rather than mode of storage in producing the above pattern of results. Begg and Paivio assumed that their abstract and concrete sentences were equally comprehensible on the basis of the finding that the overall sensitivity to change (detection of subject-object reversals plus detection of synonym substitutions) was

¹ Senior authorship was decided between the first two authors by the toss of a coin.

about the same in abstract and concrete groups. Logically, adding these two performance measures together yields a questionable index of comprehension since the ability to detect change per se does not necessarily imply initial comprehension of the original sentence.

A more direct measure of comprehension would involve asking the S whether a sentence means the same thing as one he heard before, rather than asking him whether the test sentence and the original are identical. Regardless of how the S processed the original, if he understood the original and retained its meaning he would be expected to accept a synonym substitution which preserved the meaning and to reject a subject-object reversal which distorted the meaning. Consequently, Experiment I below was designed to assess the relative availability of meanings of abstract and concrete sentences.

EXPERIMENT I

Method

Design and materials. A 2 × 2 design was used, with type of sentence (concrete or abstract) represented by independent groups and type of change (subject-object reversal and synonym substitution) represented within

Ss. Each *S* heard an acquisition list consisting either of the 10 concrete or the 10 abstract sentences used by Begg and Paivio. Each *S* then heard a test list in which all of the original sentences had been changed. Half of the changes involved synonym substitutions for either the subject or the object of the sentence, and half involved subject-object reversals. These changes were also taken from the Begg and Paivio materials. There were two test lists (I and II) for both abstract and concrete conditions; each original sentence occurred in one list with a subject-object reversal and in the other list with a synonym substitution. The order of the sentences was random with respect to type of change and order of presentation of the original sentences.

Procedure. The *Ss* were tested in four sessions corresponding to Abstract-Test I, Abstract-Test II, Concrete-Test I and Concrete-Test II. Prior to acquisition, the *Ss* were told they would hear 10 sentences and that they should try to understand and remember each one. There was a 45-sec interval between the end of the acquisition list and the beginning of the test list. The test instructions indicated the *S* was to listen carefully to each sentence and for each one was to write "Yes" if the sentence had the same meaning as one of the original sentences and "No" if the sentence did not have the same meaning as an original sentence. The acquisition and test lists were presented via tape-recorder; sentences began at 8-sec intervals.

Subjects. The *Ss* were 42 (21 each in abstract and concrete conditions) male and female undergraduates at the State University of New York at Stony Brook enrolled in an introductory psychology course.

Results and Discussion

The mean number of "Yes" responses for each type of sentence and each type of change is shown in Table 1. The interaction between type of sentence and type of change indicates that, as in the Begg and Paivio study, the pattern of the *Ss* responses to synonym substitutions and subject-object reversals depended on whether the *Ss* heard abstract or concrete sentences: $F(1, 40) = 58.86, p < .001$. From Table 1 it is apparent that this interaction

TABLE 1
MEAN NUMBER OF "YES" RESPONSES

	Concrete	Abstract
Synonym substitution	3.90	3.05
Subject-object reversal	.71	3.14

reflects the finding that *Ss* hearing concrete sentences were more likely to accept synonym substitutions than subject-object reversals, $t(20) = 13.57, p < .001$, whereas *Ss* hearing abstract sentences were about equally likely to say "Yes" to these two types of changes, $t(20) = .27$.

The results indicate that only for concrete sentences were *Ss* able to distinguish between meaning-preserving and meaning-distorting sentences. These data suggest at least three possible (but not necessarily independent) interpretations: (a) the meanings of abstract sentences may be forgotten more rapidly than those of concrete sentences; (b) abstract sentences may be initially more poorly comprehended than concrete sentences; (c) the abstract and concrete test items used by Begg and Paivio (and in Experiment I) may not be equally sensitive measures of what *Ss* know. Experiments II and III were conducted under conditions that minimized memory requirements. Experiment II investigated the comprehensibility of the original abstract and concrete sentences, and Experiment III compared the adequacy of the abstract and concrete test items.

EXPERIMENT II

Method

Each *S* was asked to rate the comprehensibility of each of the 20 original acquisition sentences used by Begg and Paivio. Four different orders of the sentences were constructed; each order included both the 10 abstract and 10 concrete sentences, randomly intermixed. Across the four orders each sentence occurred once in each quarter of the list, and any two sentences were never adjacent more than once.

Each *S* received a mimeographed list of the 20 sentences. Under each sentence was a 7-point scale, with 1 indicating the sentence was "very hard" to comprehend, 4 indicating "moderate" and 7 indicating "very easy." The *Ss* were instructed to read each sentence carefully and then to rate it by circling one of the numbers on the scale. The *Ss* were allowed as much time as they needed to complete the task. Orders of the list were assigned randomly to *Ss*.

The *Ss* were 27 male and female undergraduates enrolled in a psychology course at the State University of New York at Stony Brook.

Results and Discussion

Over all *Ss*, the mean comprehension ratings were 5.70 and 4.41 for concrete and abstract sentences, respectively. For 24 of the 27 *Ss*, the mean rating given to abstract sentences was lower than the mean rating given to concrete sentences. These results are significant by a sign test: $N = 26$ (with one tie), $z = 4.12$.

The results of Experiment II indicate that the abstract sentences were more difficult to comprehend than the concrete sentences, even when memory requirements were minimal. Experiment III assessed the equivalence of the abstract and concrete test sentences. The basic questions were: (a) Does the operation of reversing the subject and object change the meaning equally in abstract and concrete sentences? (b) Does the operation of substituting a synonym preserve the meaning equally in concrete and abstract sentences?

EXPERIMENT III

Method

Each *S* was asked to rate 20 pairs of sentences with respect to how much the two sentences in the pair differed in meaning. The *Ss* were randomly assigned to two independent rating conditions—subject-object reversal and synonym substitution. Each pair consisted of an original sentence and a corresponding test sentence. The specific changes were always taken from the original Begg and Paivio materials.

Four orders of the 20 pairs of sentences in each condition were constructed according to the pattern used in Experiment II. For each sentence pair, the original sentence came first in the pair in two of the orders and second in the other two orders. Within each order, original sentences were presented first in the pairs half of the time. The *Ss*, of course, did not know which were the original and which were the changed test sentences.

Each *S* received a mimeographed list of the 20 pairs of sentences. Under each pair was a 7-point scale, with 1 indicating the two sentences were "very similar" in meaning, 4 indicating "moderate" and 7 indicating the sentences were "very different" in meaning. The *Ss* were instructed to read each pair of sentences carefully and then to rate them by circling one of the numbers on the scale. The *Ss* were allowed as much time as they needed. Orders of the lists were assigned randomly to *Ss*.

The *Ss* (28 and 26 in subject-object reversal and synonym substitution conditions, respectively) were male and female undergraduate students enrolled in a psychology course at the State University of New York at Stony Brook.

Results

First, we will consider the subject-object reversal condition. Over all *Ss*, the mean ratings were 5.56 and 4.47 for concrete and abstract pairs, respectively. Each *Ss* mean rating for abstract pairs was subtracted from his mean rating for concrete pairs. The mean rating given to concrete pairs was larger than that given to abstract pairs for 23 of the 28 *Ss*: $N = 27$ (with one tie), $z = 3.46$.

Next, in the synonym substitution condition, over all *Ss*, the mean ratings were 3.23 and 3.35 for concrete and abstract pairs, respectively. The mean rating given to abstract pairs was larger than that given to concrete pairs for 16 of the 26 *Ss*: $N = 25$ (with one tie), $z = 1.20$.

DISCUSSION

The results of Experiment III indicate that subject-object reversals changed the meaning less for abstract than for concrete sentences. This trend, along with the data from Experiment II, suggests that any interpretation of the outcome of Experiment I must include two important considerations. First, Experiment II indicated that the abstract sentences are more difficult to comprehend than the concrete sentences. Poorer comprehension of the abstract sentences should operate to produce a decreased ability to distinguish valid paraphrases from meaning-distorting sentences. Second, even if the meanings of the abstract and concrete sentences were equally well understood, Experiment III points out that the abstract and concrete test items may not be equally good indices of what the *S* knows. This differential sensitivity would stem from the problem of guaranteeing that the same operations performed on various sentences will have equivalent effects. For example,

subject-object reversals may cause large meaning changes in some sentences (e.g., Bill hit Sam) and have much less effect on other sentences (e.g., Bill is riding with Sam). It therefore seems probable that Begg and Paivio's abstract and concrete materials were not equivalent either in the comprehensibility of the original acquisition sentences or in the sensitivity of the recognition test sentences. Either one or a combination of these two factors could easily account for the pattern of results obtained here in Experiment I as well as in Begg and Paivio's original experiment.

The above argument does not necessarily contradict the notion that Ss may initially represent concrete and abstract materials

differently. However, it seems likely that if one used abstract sentences that were more comprehensible than those used by Begg and Paivio, one would find a greater proportion of meaning-preserving errors. Therefore, the presence of a high rate of meaning-distorting recognition errors may indicate more about the S's understanding of the meaning of the input than about the way that input is "stored."

REFERENCE

- BEGG, I., & PAIVIO, A. Concreteness and imagery in sentence meaning. *Journal of Verbal Learning and Verbal Behavior*, 1969, 8, 821-827.

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