

VERB IMAGERY AND NOUN PHRASE CONCRETENESS IN THE RECOGNITION AND RECALL OF SENTENCES*

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ABSTRACT

The role of verb imagery and noun phrase concreteness in determining sentence imagery and memory were examined in two experiments. Semantic changes in sentences were recognized more often if the noun phrases were concrete rather than abstract. Free recall of sentences was affected similarly by phrase concreteness. Verb imagery, however, had no effect on either recognition or recall performance. Analysis of recall by type of word indicated that organization of recall centred upon the nouns. Implications of these results for the hypothesis of imaginal coding of concrete sentence meaning were discussed.

THE RESULTS OF SEVERAL STUDIES (Begg, 1971; Begg & Paivio, 1969; Sachs, 1967*a, b*; Wanner, 1968) suggest that Ss' memory for the meaning of concrete verbal material is superior to and relatively independent of their memory for its wording. Begg and Paivio (1969) found that recognition of semantic changes was superior to recognition of lexical changes when concrete sentences were used, but that in abstract sentences the reverse was true, with lexical changes being recognized more often. A related effect of concreteness was reported by Yuille and Paivio (1969), who found that the superior recall of thematic as opposed to non-thematic paragraphs was greater with highly concrete than with abstract material.

Begg and Paivio (1969) have hypothesized that Ss' superior memory for meaning with concrete relative to abstract sentences is due to the greater ease with which the meaning of concrete verbal material can be stored in the form of visual imagery. Specifically, they suggest that a concrete sentence "can be imaginally represented as an action picture in which the meaning of the entire sentence is summarized as one organized unit, or complex image ... The information contained in abstract material, on the other hand, is assumed to remain linked more closely to the sequentially organized verbal units themselves and can be summarized as a non-verbal unit only with difficulty ..." (p. 621).

If the greater probability of recognition of semantic changes in relatively concrete sentences is dependent on their ability to elicit imaginal coding,

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it should be possible to assess the role of the different syntactical units within such sentences in producing this effect. Experiment 1 of the present study was directed at establishing the role of verb imagery in the retention of sentence meaning. If the verb is in any sense a locus of sentence concreteness, manipulating the ease with which verbs elicit images within otherwise constant sentence frames should alter Ss' ability to detect changes in the meaning of such sentences.

The sentences used by Begg and Paivio (1969) were of the form "The (adjective) (noun) (past tense verb) a(n) (adjective) (noun)." In order to alter sentence meaning, the sentence was repeated with the subject and object nouns interchanged. An additional type of interchange was employed in Experiment 1 of the present study because of the manipulation of verb imagery. It is possible that if a low imagery (abstract) verb is employed to link two concrete noun phrases, Ss will still be able to imaginally code the subject and object phrases, but will have difficulty in presenting the interaction between subject and object described by the verb. Interchanging the nouns would then disrupt the meaning of the imaginally coded noun phrases, as well as reversing the direction of action; hence in the above situation, such meaning changes might be detected even though the abstract verb interfered with the storage of the sentence as an organized unit. To test this possibility, two types of meaning changes were introduced in the concrete noun-phrase conditions: sometimes only the nouns were interchanged, but at other times the entire noun phrases (adjective and noun together) were transposed. The latter change alters the direction of the subject-object relationship without disturbing the integrity of the noun phrases. Consequently, it would be expected that Ss' memory for verb meaning would primarily determine their ability to detect such changes.

Verb imagery also was varied within otherwise abstract sentence frames. As abstract noun phrases are unlikely to be stored imaginally, the possibility of recognition of meaning change on the basis of imaginal coding of the noun phrases alone, independent of the verb, was considered improbable. In the abstract noun phrase conditions, therefore, all meaning changes involved interchanges of the nouns only.

EXPERIMENT 1

Method

Design. An incomplete factorial design was employed, with verb imagery, noun phrase concreteness, and type of semantic change as factors. Phrase concreteness refers to whether the object and subject noun phrases were concrete or abstract. In the concrete phrase condition, Ss were presented with sentences composed of a concrete subject phrase and a concrete object phrase. Within this condition, verb imagery and semantic change were manipulated. Half of the sentences contained a high imagery verb, and

half a low imagery verb. For each of these conditions, semantic changes during the recognition procedure involved either interchanging the subject and object nouns from the study trial, or interchanging the subject and object noun phrases (the modifying adjective plus the noun). Each S in the concrete phrase condition received only one of the four combinations of verb imagery and type of semantic change.

The other phrase condition presented Ss with abstract noun phrases. Half of these contained a high imagery verb and half a low imagery verb. Each S received only one verb type. Only noun interchanges were made for the recognition test of these sentences.

Materials. The procedure employed in this experiment required presenting Ss with ten sets of ten sentences each. For the concrete phrase condition, the phrases were adapted from the 50 sentences used by Begg and Paivio (1969). Their sentences were categorized by three judges as concrete and meaningful, and the nouns in each sentence have high concreteness ratings in the Paivio, Yuille, and Madigan (1968) norms. Ten of these sentences were selected as test sentences. Each was given two different verbs, one high in image evoking capacity, and one low in image arousal.¹ The mean rated imagery of the high and low verbs, respectively, was 5.00 and 1.94. Each sentence was of the form "The (adjective) (noun) (past tense verb) the (adjective) (noun)." Although Begg and Paivio used "an" in the object phrase, the article "the" was employed in the present study to eliminate any differential specificity between subject and object phrases. Both forms of each sentence (i.e., with high and low imagery verbs) were rated by three independent judges on a 3-pt scale from "makes no sense" to "makes good sense." Any sentence receiving a "makes no sense" rating by any judge was replaced.

Following the same procedure outlined above, 40 concrete sentence frames were constructed for use as filler items. These sentences were adapted from the remaining 40 concrete sentences employed by Begg and Paivio (1969). Each of these filler items was given a high imagery verb and a low imagery verb.

The 10 test sentences and 40 filler sentences were organized into ten sets of ten sentences each, such that each set contained one test sentence and nine fillers. The test sentence occupied one of the first three positions in each set, the first position in three sets, the second in four sets, and the third position in three sets. Each filler sentence was repeated either two or three times in the ten sentence sets. At least two sets intervened between the first and second (or third) occurrence of each filler sentence. Ten sets of this type were developed for the high imagery verb condition, and ten sets were developed for the low imagery verb condition.

A parallel set of abstract phrase sentences, with both high and low imagery verbs, was constructed in the same way as the concrete phrases. Thus, ten abstract test phrases and 40 abstract filler phrases were constructed from the Begg and Paivio (1969) sentences. These sentences had been rated as abstract and meaningful by three judges.

¹When possible, the same sentences as Begg and Paivio (1969) employed were used. However, since each sentence had to be "fitted" with a high imagery and a low imagery verb, some modifications in the sentences were made so that both verbs would serve as meaningful connectives. The verbs were selected from a pool of words supplied by A. Paivio. The words (including all parts of speech) were rated in terms of their image evoking capacity. These unpublished norms were obtained using the same procedure as employed by Paivio *et al.* (1968), and show a high correlation (for the common nouns) with those reported in the latter study. The verbs "canvassed" and "photographed" were used as high imagery verbs, although ratings were not available.

High and low imagery verbs were chosen (from the unpublished Paivio norms) for each sentence frame, the mean imagery ratings of the high and low verbs were 4.42 and 2.29, respectively. The sentences were rated as meaningful by the three judges. These sentences were organized into ten sets of ten sentences each as with the concrete phrase condition.

An example of a concrete and an abstract test phrase frame follows, with the high and low verbs included in each.

The spirited leader (slapped; became) the mournful hostage.
The final decision (shattered; nullified) the prior commitment.

The sentence sets were recorded on magnetic tape, with a 4.5 sec interval between each sentence within a set. After the ten sentences in a set, the phrase "Test A" was recorded, followed by the critical test sentence. Next on the tape were the words "Test B," followed by one of the filler sentences. Ten seconds of blank tape followed each test sentence. Five of the critical test sentences were played back in identical form, and five were changed. The same was true of the ten filler test sentences. The changes in critical sentences were appropriate to experimental condition (i.e., noun interchange or noun phrase interchange). Two of the filler sentences were changed by switching the subject and object adjectives, and three were modified by changing a high imagery verb to a low one, or vice versa.

It should be noted that the above arrangements represent departures from the Begg and Paivio (1969) procedure. A pilot investigation revealed that employing their procedure (five sentences per set and only one test sentence) led to ceiling effects with concrete noun phrase sentences. The greater number of sentences per set and the use of two tests per set were introduced to increase task difficulty. In addition, the inclusion of filler test sentences permitted adjective and verb changes during the test procedure. This assured that Ss did not attend exclusively to the noun phrases in each sentence.

Two playback combinations were recorded for each experimental condition, so that all test sentences were played back changed and identical for equal numbers of Ss.

Procedure. The Ss were tested in small groups of from three to seven Ss each. Each group was assigned to one of the twelve experimental conditions, and read a set of instructions modified from those used by Begg and Paivio (1969), which were a version of those used by Sachs (1967a). After the instructions, each group heard the appropriate tape of ten sets of ten sentences each, plus two test sentences per set. After each test sentence Ss marked "Identical" or "Changed" on an answer sheet, depending on whether or not they thought the test sentence was identical with the original presentation. They also rated their confidence in their judgment on a five point scale, where 1 defined a complete guess, and a 5 rating indicated absolute certainty. A total of 14 Ss served in each condition (seven within each group received one of the two playback combinations).

Subjects. The Ss were 84 male university student volunteers from university residences.

RESULTS AND DISCUSSION

Two dependent measures were derived from the recognition scores. These were the probability of a correct recognition of sentence change (probability of a hit), and the hits corrected for guessing $p(\text{HIT}) - p(\text{False$

TABLE I
 ACCURACY OF DETECTION SCORES AND CONFIDENCE RATINGS AS A FUNCTION OF
 NOUN PHRASE CONCRETENESS, VERB IMAGERY, AND TYPE OF SWITCH

(Verb type)	Concrete phrases				Abstract phrases	
	Nouns switched		Noun phrases switched		High imagery	Low imagery
	High imagery	Low imagery	High imagery	Low imagery		
Probability of a Hit	0.90	0.87	0.83	0.86	0.74	0.70
$p(\text{H}) - p(\text{FA})$	0.46	0.50	0.54	0.47	0.27	0.33
Mean number of guesses	1.07	0.79	0.57	1.14	1.29	1.93
Mean number of certain responses	3.93	4.50	3.93	3.29	1.86	3.00

Alarm). The means for both of these measures, for each condition, are found in Table I. In each of the analyses reported below, playback condition (i.e., counterbalancing) was included as a factor. Since this variable produced no main effects or interactions, it is not mentioned in the following discussion of results. Two analyses of variance were performed on the dependent measures for the concrete phrase condition with type of verb (high imagery *vs* low imagery) and type of change (noun phrase *vs* noun only) as factors. Neither analysis produced significant effects.

Two analyses of variance also were performed on the confidence ratings for the concrete phrase condition - one on the number of guesses (ratings of 1) and the second on the number of certain responses (ratings of 5). Once again, neither treatment main effect nor the interaction proved a significant source of variance.

The same four dependent measures were analysed, contrasting the concrete and abstract phrase conditions. In this case, the factors were type of phrase (concrete *vs* abstract) and type of verb (high *vs* low imagery). Only the noun switch condition data from the concrete sentence groups were included. A main effect of sentence type was found for both the probability of a hit, and the corrected probability analyses, $F(1,48) = 15.81$, $p < 0.01$, and $F(1,48) = 4.89$, $p < 0.05$, respectively. In each case, this represented higher accuracy in recognizing sentence changes when the subject and object phrases were concrete, as opposed to abstract. The main effects of verb imagery and the verb by noun phrase interactions were not significant.

The analysis of the two confidence ratings found no difference in the number of guesses. However, the number of certain ratings was greater in the concrete noun phrase condition, $F(1,48) = 11.96$, $p < 0.01$.

The results of this experiment suggest that the syntactical locus of the superior recognition of semantic change in concrete relative to abstract sentences resides in the subject and/or object noun phrases, with rated verb imagery having no apparent effect. The finding that detection of semantic change is more reliable, both objectively and in terms of Ss' high confidence responses, with concrete noun-phrase sentences rather than abstract noun-phrase sentences, agrees with the finding of Begg and Paivio (1969).

At the same time, the present study indicates that inserting a low imagery verb in an otherwise concrete sentence does not impair Ss' ability to detect semantic changes. This conclusion is qualified by a ceiling effect in the uncorrected number of hits obtained by the concrete noun-phrase groups; however, the correction for guessing removed all ceiling effects, without revealing any trace of a verb imagery effect. The fact that verb imagery did not influence task performance even when the noun phrases were transposed as intact units, rather than being disrupted by switching of the nouns only, suggests that low verb imagery does not interfere with storage of the meaning of the sentence as a unit; Ss still remember at least the direction of the relationship between the noun phrases, rather than simply remembering subject and object noun phrases separately. The results of Experiment 1 further demonstrate that including a high imagery rather than a low imagery verb in an otherwise abstract sentence does not make its meaning any easier to remember.

If verb imagery does not influence the storage or recognition of sentence meaning, what conclusions should be made concerning the hypothesis of imaginal coding of concrete sentence meaning? Does verb imagery have an effect on sentence imagery which is not translated into performance on memory task, or does it, in fact, have no influence on the ease of forming an image to the entire sentence? Experiment 2 was an attempt to answer these questions by obtaining ratings of overall imagery for sentences in which verb imagery was varied. At the same time the investigation of verb and noun-phrase imagery was extended to include another measure of sentence memory, free recall.

EXPERIMENT II

Method

Design. The procedure employed in this experiment required Ss to rate the image evoking capacity of a subset of the sentences employed in Experiment 1. The sentences represented the four types defined by the factorial combination of phrase concreteness (concrete vs abstract) and verb imagery (high or low). After rating each of a set of sentences, Ss were required to free recall as many sentences or parts of sentences as they could remember. The latter can be considered an incidental recall task, since Ss were not informed about the recall requirement until the rating task was complete.

Materials. Forty of the sentences used in Experiment 1 were randomly selected and divided into two mixed lists. Each 20-sentence list consisted of five each of the four sentence types. Each sentence was typed and mimeographed on a page with a 7-pt low imagery-high imagery scale beneath it. Ten sentences appeared on each page. Each sentence was used with one of its verbs in one list and the alternative verb in the other.

Procedure. The Ss were tested in groups of up to eight each. They were read instructions adopted from those used by Paivio *et al.* (1968). These required S to rate each sentence on a scale defined from 1 (sentence elicits no imagery) to 7 (sentence elicits an image with ease). Equal numbers of Ss were given each list of sentences to rate.

After all Ss had completed the rating task, they were asked to recall as many of the sentences, or parts of them, as they could remember. This task was done on a prepared sheet of paper which gave the "the's" and the correct number of blanks for each sentence. No time limit was given for the recall.

Subjects. The Ss were 40 volunteer students (17 female) from university residences.

RESULTS

Table II presents the mean ratings and the recall data for each of the four sentence types. No main effects or interactions were found as a function of the two lists. The analysis of variance of the ratings revealed that higher ratings were given for the concrete as opposed to the abstract phrase sentences, $F(1,38) = 306.74$, $p < 0.001$. Verb imagery also affected the ratings, $F(1,38) = 4.98$, $p < 0.05$; however, this effect was qualified by a significant

TABLE II
MEAN RATED IMAGERY AND MEAN TOTAL WORDS
RECALLED FOR EACH SENTENCE TYPE

	Concrete noun phrase		Abstract noun phrase	
	High verb imagery	Low verb imagery	High verb imagery	Low verb imagery
Rated imagery	6.03	5.45	2.56	2.72
Word recall	6.95	5.90	0.65	1.23

interaction, $F(1,38) = 9.98$, $p < 0.01$. An analysis of the simple main effects of verb imagery indicated that within concrete sentence frames, high imagery verbs resulted in higher ratings than low imagery verbs, $F(1,38) = 12.47$, $p < 0.01$. When the noun phrases were abstract, verb imagery did not influence the ratings.

The free recall results were scores for the number of correct words within each syntactic category – subject adjective, subject noun, verb, object adjective, and object noun. Synonym intrusion errors were also noted. The most obvious result was the overwhelming superior recall of concrete as

opposed to abstract noun-phrase sentences. Mean words per S recalled correctly were 6.43 and 0.94, respectively, for the two sentence types.

Because of the large number of zero scores recorded in the abstract noun phrase conditions, only the concrete noun phrase data were analysed statistically. A 2×5 analysis of variance was applied to repeated measures of verb imagery and syntactic category. The effect of syntactic category was highly significant, $F(1,152) = 11.98$, $p < 0.01$. In terms of mean correct recall the five categories were ordered as follows: object noun (3.28), subject noun (2.93), subject adjective (2.28), verb (2.23), and object adjective (2.15). *Post hoc* analysis revealed that the two nouns were significantly superior to the other three categories ($p < 0.01$), which did not differ among themselves. The small difference between the two nouns was also significant ($p < 0.01$), but was entirely attributable to a greater number of synonym errors in subject noun recall; when synonyms were added to the number correct, this difference disappeared. Neither the main effect of verb imagery nor the interaction approached significance.

The relationship of sentence structure to recall was examined in more detail within the concrete noun phrase sentences, ignoring the type of verb. Recall of the sentence was not all-or-nothing. Given that one word was recalled, the probability of complete sentence recall was only 0.25. However, words tended to be recalled in groups more often than chance alone would predict. The relationships between recall of sentence parts was examined by using 2×2 contingency tables for each possible word pair. Two of these analyses revealed significant departures from chance. The subject adjective and noun tended to be recalled together, $X^2 = 13.69$, $p > 0.001$; and the object adjective and noun were likely to be jointly recalled, $X^2 = 33.72$, $p < 0.001$. Thus the subject, and object phrases, were coded as units. Another indication is that the probability of recall of an adjective alone was only 0.06.

While each noun phrase seemed to be coded as a unit, verb recall was related to a lesser degree to recall of other words in the sentence. However, verb recall was found to be related to recall of the subject noun, $X^2 = 3.95$, $p < 0.05$, and to object noun recall, $X^2 = 6.14$, $p < 0.05$.

DISCUSSION

The findings reported above suggest that the verb plays a minor role in the storage of sentence meaning. This is consistent with a study reported by Bobrow (1970), in which he found that cued recall of sentence embedded nouns was unimpaired by changes in adjective and verb meaning, as long as these changes did not alter the meaning of the nouns. However, Jurca (1971) has criticized this study, and reported an experi-

ment in which verb meaning changes were detrimental to noun recall. It is our feeling that Jurca's sentences may not have been equally meaningful across her experimental conditions. More specifically, from the example sentences supplied, it appears that the verb changes she employed made her sentences anomalous. Since the sentences employed in the present experiments were rated as equally meaningful, these results could be interpreted as supporting Bobrow's (1970) conclusions concerning the minor role of the verb in the formation of noun-noun associations. In addition, Yuille (1973a, 1974) has reported two experiments which indicate no effect of verb changes on the recall of verb-linked noun pairs in children.

The present results offer several implications concerning the processing of meaning of concrete sentences. First, it appears that Ss can image the meanings of concrete sentences very easily. At least, the high imagery ratings obtained in Experiment II for concrete noun phrase sentences are consistent with this idea. Furthermore, the relationship of the ratings of individual words (i.e., the nouns from the Paivio *et al.*, 1968, norms, and the verbs from the unpublished Paivio norms) to the ratings of sentences composed of these words adds further support to this hypothesis. That is, sentences containing high imagery (concrete) nouns were given high imagery ratings, and rated verb imagery also was correlated with rates sentence imagery. Related to this is the second point, that the relative contributions of nouns and verbs to the rated image evoking capacity of sentences reveals a much more potent effect of noun concreteness ($F = 306.74$) than verb imagery ($F = 4.98$). No doubt this difference in effectiveness of the two types of words is, in part, a reflection of the greater imagery variability between concrete and abstract nouns than between high and low imagery verbs. Yet this is insufficient to account for the large difference in the potency of nouns and verbs to affect image arousal. Thus not only does the image evoking capacity of verbs have no effect on sentence memory, it also has little effect on the image evoking capacity of a sentence.

The vastly superior recall of the concrete noun-phrase sentences, which aroused images readily, is in agreement with previous research demonstrating the higher recall of concrete material (Paivio, 1971). This result is particularly interesting in the present study as Ss presumably spent more time with the abstract noun-phrase sentences during the rating task, while attempting to produce an appropriate image. While latencies of image arousal were not obtained in this experiment, Yuille (1973b) has reported that Ss do take longer to report discovering images to abstract than concrete noun pairs, and, more important to the present discussion, that within each noun type, recall is unrelated to latency of mediator discovery. In other words, it seems that generation of the imaginal code is

central to improving subsequent recall, but the time required to generate the code is not (by itself) a determinant of subsequent recall. The results of the present experiment are consistent with this view.

Both experiments support the conclusion that sentence imagery and memory are determined primarily by the image-evoking capacity of the noun phrases, with verb imagery playing a very minor role. A low imagery verb makes it a little more difficult to form an image of the meaning of an otherwise concrete sentence, but this difference is apparently too small to cause any detectable decrement in sentence memory, as measured either by recognition of change or free recall. A high imagery verb in an abstract context is insufficient to increase either sentence imagery or memorability. The present study suggests that in a sentence, verb imagery does not even determine the recall of the verb. High and low imagery verbs were recalled equally well if the noun phrases were concrete, and equally poorly if they were abstract.

The analysis of recall organization of the different syntactic categories in concrete sentences (Exp. II) suggests that to conceptualize imagery as serving to integrate a sentence's meaning into "one organized unit" (Begg & Paivio, 1969) may be an oversimplification. Anderson and Bower (1971) found incomplete sentence recall to be more common than complete recall when cued by the subject or subject and verb, and argue that this is inconsistent with any Gestalt-type theory of sentence memory. Similarly, the present study demonstrated the absence of all-or-none recall of sentence meanings for which Ss reported (by high imagery ratings) finding complete images. Partial recall was probably increased because of the incidental nature of the recall task; the important point is that a more atomic model of the process of image construction at the sentence level seems necessary.

When S forms an image of a sentence's meaning he may tend to centre on the word or words whose referents are most easily visualized, which will likely be the nouns. The noun which most readily elicits an image (or often both nouns if they are highly concrete) will first be visualized. This basic image will then be modified in order to incorporate the meaning of the dependent adjectives and verb. Each adjective will probably be most often symbolized by the physical characteristics or activity of the visualized noun it modifies, and the verb by a combination of the relative locations of the noun images and/or the activities in which they are engaged.

The resulting complex image of sentence meaning may sometimes be "levelled" (Reese, 1970) in the direction of a more rudimentary configuration, which would generally be the unelaborated image of subject and/or object nouns. This process might occur during the retention interval, or possibly even before long-term storage took place. The fact that in the

present study the meanings of the two nouns were recalled more frequently than the meaning of other parts of the sentence agrees with this model, as does the fact that at least one noun's meaning was included in almost all instances in which any correct recall was made. The particular dependency of the recall of adjective meaning on recall of the meaning of the associated noun is supported by the high degree of overlap in the recall of the two word meanings within each noun phrase, and the rarity of recall of adjective meaning alone. It is interesting to note that the psychological unity of the noun phrase has also been suggested by research concerned with the early grammar of children (cf. Brown, 1965). As noun phrases used by young children are likely to be highly concrete, it is possible that imagery is the underlying unifying mechanism involved.

The verb, which the present model suggests might be symbolized by the elaboration of either or both noun images, or their interaction, is consequently dependent on both noun loci, but in each case less so than the associated adjective. This does not exclude the possibility that a verb will evoke an exceptionally vivid image for S; the verb, rather than the nouns, might then form the basis of the image of sentence meaning. However, in general, the results of this research suggest a relatively minor role for the verb in the coding and retrieval of sentence meaning.

RÉSUMÉ

Deux expériences sur l'influence qu'exercent la valeur imagée des verbes et le caractère concret des noms sur la représentation imagée et la mémorisation de phrases. Les résultats indiquent que la détection des changements sémantiques est plus fréquente si les noms sont concrets plutôt qu'abstraits. Le libre rappel des phrases est également affecté par ce même facteur. En revanche, la valeur imagée des verbes n'exerce aucun effet ni sur la reconnaissance, ni sur le rappel. L'analyse du rappel en fonction du type de mots indique que l'organisation du rappel est axée sur les noms. La discussion évoque la portée de ces résultats sur l'hypothèse de l'encodage imagé de la signification des phrases concrètes.

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