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ABSTRACT
                This study was primarily intended to explain the
relationship between rated imagery, rated comprehension, and free
recall in a sentence context. An additional purpose of the
investigation was to examine the relationships between sentence
imagery (determined by summing the individual values of component
words), the rating of sentences as wholes, and the free recall of
sentences. Subjects, 80 volunteers from undergraduate educational
psychology courses, were presented with six sets of eight sentences;
sentences were varied systematically from low to high levels of
imagery. After each set of sentences, subjects were asked to recall
as many sentences as they could and to rate them on a seven-point
scale, first for imagery and then for comprehensibility. The
correlation of rated and additive imagery supported the assumption
that global imagery is the sum of the individual imagery levels of
sentence components. Both measures of sentence imagery were found to
correlate better with free recall than did ratings of comprehension.
(KS)

# ADDITIVE IMAGERY, COMPREHENSION

# AND FREE RECALL IN A SENTENCE CONTEXT

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In a recent study Osborne and Oddie (1975) obtained a rank order correlation $rs=.84$ between the total imagery level of eight types of sentences and their free recall. Sentence imagery levels were determined by summing the imagery values of individual words in the sentences. This approach to sentence imagery contrasted to the global rating technique usually employed. The above study left uncertain the possible involvement of comprehension as an influence upon free recall of sentences used.

The adequacy of the construct of imagery, as outlined in Paivio's dual encoding model and "conceptual peg" hypothesis, (cf. Paivio, 1971) in explaining almost a decade of research with paired-associates and phrases has been challenged by the possibility that the construct of comprehension may account for some of the results obtained by Paivio and other researchers.

While studies by Begg and Paivio (1969), Paivio and Begg (1971), and Klee and Eysenck (1973) support the prepotency of imagery over comprehension, Johnson, Bransford, Nyberg and Cleary (1972) have suggested

that comprehension, as well as measurement problems, may be responsible

for the apparent imagery effect in Begg and Paivio's (1969) study. There

has also been an increasing awareness of the role of the variability and

contextual determination of referential relations and semantic processing,

referred to by Paivio (1974) as "knowledge of the world and knowledge of

language," (of. Olson, 1970, Bransford & Johnson, 1973, Anderson &

Orthony, 1974) as factors which may be confounded with imagery.

The equivocal nature of the research so far (cited above), reinforces

the doubt raised by Pylyshyn (1973) about the explanatory adequacy of

the construct of imagery (the picture metaphor). It appears that this

construct may well need further reduction if in fact it is confounded

with comprehension. This study is not intended to address the question

directly but to ascertain whether comprehension can be excluded as a

possible explanation of data from a previous study by the present authors

which was accounted for by Paivio's imagery theory.

This study was intended primarily to explicate the relation between

rated imagery, rated comprehension and free recall in a sentence context.

An additional purpose was to examine the relation between sentence imagery

as determined by summing the individual values of component words, the

rating of sentences as wholes and their free recall. This summing operation

will be referred to as additive imagery, and is not to be confused with

the notion of additivity as contained in Paivio's assumption of

independence in the dual-encoding model (cf. Paivio, 1971).

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Method

Materials.  Simple active sentences were used of the type
"The (Subject-Noun) (Verb) the (Adjective) (Object-Noun)."  The imagery
levels of parts of speech were varied systematically from low to high
using Paivio, Yuille, and Madigan (1968) and Yuille (unpublished 1971)
word lists, except for the subject nouns which were held constant at a
high imagery level to restrict the number of sentences required.
Thorndike-Lorge (1944) frequency was held as low as possible.  The
eight sentence types comprised the eight possible combinations of low
and high imagery levels of the three remaining form classes after the
imagery level of the subject noun was held constant.

A total of 96 sentences were constructed, twelve from each sentence
type.  Each subject saw six sets of eight sentences.  Each subject
received a unique ordering of sentences and sets.  Sentences were randomly
assigned to sets.  Each sentence type occurred once in each set.  Each
sentence type appeared an equal number of times across subjects, and the
total sentence pool was equally distributed across Subjects.

Free Recall.  After each set of eight study sentences had been
presented, the subject was asked to free recall the sentences, or parts
thereof.  This procedure was repeated six times for each subject.

Ratings.  After the six sets had been tested for free recall, the
sentences were re-presented in four random orders, and subjects were
asked to rate the sentences on a seven-point scale, first for imagery
and again for comprehension.

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Procedure. Study sentences used in the free recall paradigm were
presented by carousel AV 900 projector. Each study sentence appeared
for eight seconds. Three minutes were allowed for recall. Ratings
for imagery and comprehension were unpaced. Imagery ratings for the
entire 48 sentences were presented first, followed by comprehension
ratings. Study sentences and the two rating scales appeared on typed
sheets in the test booklet given to each subject containing a set of
instructions describing the study-free recall, and imagery-comprehension
rating tasks. Response sheets and rating sheets were provided after the
appropriate instructions. The subjects were tested individually. The
instruction sheet for the recall test was read aloud by the experimenter
and silently by the subject. Any questions were answered. A familiarization
trial then followed to prepare the subject for the free recall procedure.
The experimental sets followed this familiarization trial. Upon
completion of the free recall test, instructions for rating the sentences
were read to the subject and questions answered regarding the procedure.
Instructions were modified to conform as much as possible to those used
by Paivio et al.(1968). Completion of imagery ratings was followed by
instructions for comprehension ratings. These instructions again conformed
as much as possible to those of Paivio et al. (1968), and also incorporated
the modification used by Paivio (1971, Exp. II). Subjects in the present
experiment were told that it was not necessary to agree with, or to make
logical sense of, the sentence in order to understand what the speaker
was trying to communicate to them. For example, the sentence. "The green

snow covered the roof of the house" may not make sense when compared to past experience or knowledge of the world, but this artificiality does not prevent one from understanding (comprehending) the sentence.

Subjects. The subjects were eighty unpaid volunteers from courses in Educational Psychology at the University of Alberta.

Results and Discussion

Table 1 shows the correlations of rated imagery, rated comprehension, sentence free recall and additive imagery for the 96 sentences used in this experiment.

. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

Insert Table 1 about here

. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

The correlation of rated and additive imagery (r=.83) supports the assumption that global imagery is the sum of the individual imagery levels of the sentence components in regard to its effect upon free recall. This supports the validity of the excensive use of global ratings in earlier research. The results also support the validity of Paivio's and Yuille's original imagery ratings.

The prepotency of imagery is suggested by these results. Both measures of sentence imagery correlate better with free recall than rated comprehension in spite of the high correlation of rated imagery and comprehension (r=.71).

The difference in standard deviations for rated imagery (1.39)

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and rated comprehension (.73) suggests that the present findings may be relative to the range of imagery and comprehension used here: that is, while the sentences were constructed to represent a full usage of imagery range, they were not constructed to range from non-comprehensible to completely comprehensible. All sentences in fact were comprehensible. However, if differences between sentences in terms of comprehension were small then imagery may have been responsible for the observed differences in free recall. The problem of how small is small and how large is large in terms of comprehension differences remains an empirical question unanswered by this study.

One explanation of the difference in variance is that it reflects the contribution of abstractness in the sentences. This supports the dual encoding model which predicts that comprehension ratings for mixed stimulus material should be higher than imagery ratings inasmuch as the comprehension process receives input from both imaginal and verbal processes.

It must be noticed that the comprehension rating used here is just one index of comprehension. Asking the subject to produce another sentence which extends the meaning of the sentence or asking him to paraphrase its meaning are others. A levels of processing approach to comprehension (Craik & Lockhart, 1972; Mistler-Lachman, 1974) suggests that the more active the orienting task demanded of the learner with respect to stimulus input information, the deeper the level of processing required to complete such a task, and the easier it is to make an objective assessment of whether or not the subject correctly comprehended the

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stimulus material. In this study, imagery ratings were validated against a priori additive imagery values. Because comprehension ratings were not validated against another comprehension measure conclusions regarding comprehension need to bear this in mind. However, within this experiment rated and additive imagery were superior predictors of free recall and correlated highly with each other.

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TABLE 1

Correlation of Rated Imagery, Rated
Comprehension, Free Recall and Additive
Imagery Across Sentences.

| | 1. Rated Imagery | 2. Rated Comprehension | 3. Free Recall | 4. Additive Imagery |
|---|---|---|---|---|
| 1 | | .71 | .70 | .83 |
| 2 | | | .43 | .64 |
| 3 | | | | .58 |