

THE FACILITATIVE EFFECTS OF IMAGERY INSTRUCTIONS  
AND STIMULUS CHARACTERISTICS ON  
IMMEDIATE AND LONG TERM FREE  
RECALL AND CLUSTERING\*<sup>1,2</sup>

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SUMMARY

The effects of imagery on immediate and long term recall and organization (i.e., clustering) were studied with regard to high and low imagery concrete stimulus nouns from the same generic categories, imagery and no imagery instructions, number of recall trials, and two presentation rates. Three major aspects were involved: (a) establishment of imagery norms for 80 categorically related nouns, (b) behavioral analysis of these norms, and (c) a verbal free recall experiment conducted with 960 sixth and eighth grade boys and girls to compare the verbal and imaginal symbolic processes. Recall and organization were found to be facilitated by imagery nouns or instructions. Eighth graders not only recalled and organized better than sixth graders, but also used imagery more effectively. Four written trials were better than one, and a five second presentation rate was better than 2.5 seconds. These trends held in immediate and long term recall. Results were discussed in terms of the code availability hypothesis of Paivio's two-process theory. It was concluded that imagery is an important factor in free recall and organization and functions analogously to verbal processes.

A. INTRODUCTION

Theoretically, the organization of verbal material is important for storage and recall (1, 15, 31, 32). Verbal association theory has long maintained that

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<sup>1</sup> This is a much abbreviated form of the original study which was a dissertation submitted by the author to the Graduate School of Arts and Sciences of Columbia University in partial fulfillment of the requirements for the Ph.D. degree. Due to space constraints, a great amount of procedural and statistical detail has been omitted, but is available from the author upon request.

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<sup>2</sup> Requests for reprints should be sent to the author at the address shown at the end of this article.

associative structures are entirely verbal (2, 10). Likewise, the underlying process involved in theoretical organizational models (15, 16), as well as in empirical organizational phenomena such as clustering (1) and subjective organization (31), has been held to be verbal. However, recent evidence has led to the position that there are two principal symbolic processing systems, one verbal and one imagery (3, 21). Since traditionally the verbal process has been assumed to underlie free recall in general and organization in particular of verbal material, a thorough investigation of imagery's role concerning these has been neglected.

The arousal of either the imaginal or verbal symbolic process for mediational functioning in learning and memory is assumed (22) to be related to an abstract-concrete dimension which refers to the increasing order of concreteness extending from abstract nouns to concrete nouns to pictures and objects. Accordingly, the higher the degree of stimulus concreteness, the more likely it is to arouse an image to serve as mediator. The converse is also maintained. The significance of concreteness is that both the imaginal and verbal symbolic codes can operate on the concrete level. As the stimulus becomes more abstract the availability of the two systems is lessened, since theoretically only the verbal process is effective at the abstract level.

According to Paivio's (21) two-process theory of symbolic representation, the ease and probability of learning and recalling information are direct functions of the availability and coordination of both codes. Availability can be manipulated by varying stimulus concreteness, instructional sets, and stimulus presentation rates. These variables have not been experimentally manipulated to compare the verbal and imagery codes in free recall and organization of verbal material.

Imagery has been shown consistently to be an important variable in free recall ever since Kirkpatrick (13) found that free recall was higher for objects than for their names. Extending these results, others (6, 9, 14, 18, 28, 29) have reported the order of superiority in free recall to be objects, their pictures, and finally, their verbal labels. Likewise, nouns rated high in concreteness or imagery have been found (11, 20, 33) to be better recalled than abstract rated nouns. In addition, the effects of imagery instructions have also been found to be positive (12,13).

Evidence also reveals that free recall increases as measured organization increases (32), thereby indicating the essential role organization plays in learning and memory. Verbal association theory has maintained that the free recall of verbal items is primarily a function of their ability to be organized on the basis of language experience. Analogously, it seems feasible to posit theoretically (26, 33) that the importance of item imagery-concreteness in

free recall may also be due to the facilitative effects on organizational processes as a function of visual perceptual experience. Unlike the research concerning imagery and amount recalled, the small amount of evidence concerning the relation between imagery and organization in free recall is equivocal. It has been found that more vivid words show greater organization in recall than less vivid words (33), and that objects are better clustered than words (29). Finally, the amount of organization was found to increase from abstract words to concrete words to pictures (23).

Contrariwise, others have failed to obtain greater organization for pictures than for their labels, although the former were better recalled (24). Nor was any significant difference found, using an intertrial repetition index, between high and low imagery words (26). Finally, Walker (34) obtained equivocal results in support of either trend.

It can be argued that the equivocal results of these studies may be due to their limited comparability. For example, stimulus words, presentation rates, number of recall trials, and measures of organization vary across experiments. In some the level of stimulus concreteness is not empirically determined but assumed by *E*. Furthermore, some studies employ instructions to use imagery, while others rely solely on the level of stimulus concreteness to evidence the presence of imagery variables.

The purpose of the present experiment is twofold. First, it attempts to determine whether imagery can facilitate children's immediate and/or long term free recall and organization (i.e., clustering) of verbal material, and if so, under what conditions (e.g., stimulus imagery-concreteness levels, imagery instructions, stimulus presentation rate, and number of recall trials) is it effective. Second, it attempts to compare the effectiveness of both the imagery and verbal codes on free recall and organization under the same conditions.

Specifically, the questions are (a) Do noun concreteness, imagery instructions, number of recall trials, and/or rate of stimulus presentation facilitate immediate and long term effects on children's recall and clustering of concrete verbal material in free recall? (b) Are there differential effects of these factors on recall and clustering of concrete verbal material in free recall for different age groups of children?

## B. METHOD

### 1. *Subjects*

The *Ss* were 960 boys and girls from five parochial schools serving both urban and suburban communities in the New York area. Half of these were sixth graders and half were eighth graders.

## 2. Materials

a. *Construction of imagery nouns.* To develop a list of high and low imagery nouns from the same generic categories and age appropriate for grades 6 and 8, 50 elementary school teachers enrolled in a graduate education program rated each of 80 words, selected to comprise equally four generic categories—*musical, medical, weather, and educational*—for their visual imagery provoking value. The procedure for rating the nouns was derived from that of Paivio *et al.* (25), and used a 7-point numerical scale with the extremes Low Imagery at 1 and High Imagery at 7 accompanying each word.

b. *Stimulus lists.* Based on the ratings obtained from the teachers, two 20 word stimulus lists were constructed: one comprised High Imagery (HiI) words with five words from each of the four categories; the second comprised Low Imagery (LoI) words also containing five words from each category. The stimulus words and their mean imagery ratings for the respective *medical, musical, weather, and educational* categories for the HiI list were BANDAGE, BLOOD, DOCTOR, HOSPITAL, PILL (6.60); DANCER, DRUM, GUITAR, ORCHESTRA, RECORD (6.68); CLOUDS, LIGHTNING, RAINBOW, SNOW, SUN (6.50); BOOK, DESK, LIBRARY, TEACHER, UNIVERSITY (6.53). For the LoI list the respective words and means were FEVER, GERM, HEALTH, PAIN, PULSE (1.01); BEAT, ENTERTAINMENT, HUM, PERFORMANCE, TUNE (1.04); FAIR, FORECAST, HUMIDITY, THUNDER, WARM (.94); AVERAGE, GRAMMAR, LEARNING, SPELLING, STUDY (.92).<sup>3</sup> To be considered a HiI word, a word had to have a value of at least 6.00. A LoI word was one which had a value of not more than 1.50. Words were selected for stimulus list inclusion if they were age-appropriate according to the Thorndike-Lorge (30) frequency count, and unicategorical: that is, a word could not be readily considered as belonging to more than one category. For example, "cold" might be regarded as a medical or as a weather item.

c. *Behavioral analysis of imagery ratings.* Since previous investigators have not attempted a behavioral analysis of imagery ratings to see if and in what way the ratings correlate with some behavioral measure, this was a major aspect of the present experiment. In effect, when asked to rate a word on its imagery value, does a person base his rating on the strength of the image evoked or on the number of images evoked by the word? An effort at

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<sup>3</sup> The final list of 80 nouns with their individual mean imagery ratings, number of images evoked, and Thorndike-Lorge frequency values is available from the author upon request.

such a behavioral examination was made by having an additional 50 teachers from the same training program write down the number of images each of the 80 nouns evoked. A correlation between the two groups (i.e., mean imagery rating and mean number of images evoked) was then calculated.

### 3. *Design and Procedure*

Half of the students of each grade level received the HiI stimulus list, while the other half received the LoI stimulus list. In turn, half of each of these groups (i.e., HiI List Group and LoI List Group) received standard free recall instructions, while the other half were instructed to use visual imagery. Next, each of these four groups (i.e., HiI Free Recall, HiI Imagery, LoI Free Recall, and LoI Imagery) were further subdivided into three sections: Condition 4 was given four written trials, one after each presentation; Condition 1 was allowed only one written trial, immediately after the fourth presentation; Condition 1½ was also given only one written trial after the fourth presentation, but the rate of stimulus presentation was one half that of the other two subdivisions. Thus, the experimental design involved 24 cells.

The students were randomly assigned to the experimental treatment until each had 40 Ss from each grade. Each class of each school was divided into 12 groups for each of the 12 conditions. Although all the children in the same condition from any one school were tested together regardless of their grade level, none of the experimental groups exceeded 20 Ss.

The appropriate instructions were read to each group. The Free Recall instructions informed the Ss that they were to try to remember the words read to them, while the Imagery instructions asked the Ss to form a mental picture of what was named. Both were informed that they would have to write as many of the words as they could remember after all the words were read.

Four randomizations of the two lists were prepared. For conditions 4 and 1, the words were read at a 5-second interval rate; for condition 1½ the rate was 2.5 seconds. A 4-minute interval between each of the four presentations was kept constant across all conditions during which informal conversation was conducted.

The above procedure served for obtaining the data for immediate recall (IR). Long term recall (LTR) data were obtained one week later when the Ss were again asked to write as many of the words as they could then remember. No stimulus presentation preceded the LTR trial.

Since the study involved two dependent variables—that is, number recalled and amount of clustering—but obtained at two different points in time (i.e., immediate and long term), four analyses of variance were computed. Thus, the mean number recalled in IR and in LTR and the mean amount of clustering in IR and in LTR were analyzed separately as four  $2 \times 2 \times 2 \times 3$  factorial designs. The factors were stimulus level (HiI vs. LoI), type of instruction (I vs. FR), grade (6th vs. 8th), and condition (4 vs. 1 vs. 1½).

Finally, the proportion of repetition (PR) index (17) which provides a measure of clustering according to *E* established categories was used.

### C. RESULTS<sup>4</sup>

High Imagery (HiI) nouns were recalled and clustered to a greater extent than were Low Imagery (LoI) nouns. Similarly, imagery (I) instructions facilitated better recall and clustering than did free recall (FR) instructions. Recall and clustering were greatest for those conditions (Condition 4) having four written trials, next for those conditions (Condition 1) having only one written trial. Those conditions (Condition 1½) which had one written trial but a more rapid stimulus presentation rate recalled and clustered the least. Overall, eighth graders recalled and clustered more than did sixth graders under the same conditions. Furthermore, these trends held for both IR and for LTR.

#### 1. Number Recalled/IR

ANOVA yielded significance ( $p < .01$ ) for all of the main effects. Individual comparisons using the Tukey method indicated that the differences among the three conditions were all significant in the following order of decreasing value: 4, 1, 1½. Comparisons of the means for the interaction effects for the number recalled in IR evidence the same general trend. The significant Stimulus  $\times$  Condition interaction ( $p < .01$ ) indicated that the HiI nouns were recalled significantly better than the LoI nouns for each of the three conditions in the decreasing order of 4, 1, 1½ for both lists. The significant Grade  $\times$  Condition interaction ( $p < .05$ ) indicated that eighth graders recalled more than sixth graders on all three conditions, and that the decreasing order of recall for both grades was 4, 1, 1½.

Two triple interactions were significant. Individual mean comparisons for the Stimulus  $\times$  Instruction  $\times$  Grade interaction ( $p < .01$ ) demonstrated that eighth graders recalled more than sixth graders of both lists with I instruc-

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<sup>4</sup> For the sake of brevity, the data are presented in summary form. Similarly, *F* and *df* values are omitted. The raw data, *F*s, and *df*s will be provided by the author upon request.

tions and of HiI words with FR instructions. No difference was found between the two grades for LoI words with FR instructions. Thus, again, HiI nouns were recalled more than LoI words, eighth graders recalled more than sixth graders, and I instructions were more facilitative than FR instructions for IR.

For the Stimulus  $\times$  Instruction  $\times$  Condition interaction ( $p < .05$ ) the recall order was 4, 1, 1½ regardless of stimulus list or instructions. I instructions facilitated better recall than did FR instructions for both lists. Finally, HiI nouns were better recalled than LoI nouns on each condition.

## 2. *Number Recalled/LTR*

ANOVA yielded significance for all of the main effects ( $p < .01$ ). The order of the condition effects was again 4, 1, 1½. The Stimulus  $\times$  Instruction interaction ( $p < .05$ ) indicated that I instructions were more facilitative than FR instructions for both lists and that HiI words were recalled better than LoI words. The Stimulus  $\times$  Grade interaction ( $p < .01$ ) showed HiI words to be better recalled than LoI words and eighth graders to be superior to sixth graders.

Comparison of the individual means for the Stimulus  $\times$  Condition interaction ( $p < .01$ ) showed HiI nouns to be better recalled than LoI nouns for each condition, while the decreasing order for recall was 4, 1, 1½ for each stimulus level. However, there was no significant difference between conditions 4 and 1 for HiI words. Thus, where the availability of codes was highest, recall was greatest. Individual comparisons of the means for the Grade  $\times$  Condition interaction ( $p < .01$ ) indicated no difference between conditions 4 and 1 for the sixth grade. Only for condition 4 did eighth graders recall significantly more than sixth graders; no differences were found for the other two conditions.

Three triple interactions were significant. Mean comparisons for the Stimulus  $\times$  Instruction  $\times$  Grade interaction ( $p < .01$ ) indicated that HiI words were better recalled than LoI words regardless of instructions or grade; I instructions yielded better recall than FR instructions for each grade; and eighth graders recalled more than sixth graders on HiI words with both types of instructions. The reverse was found for LoI words with I instructions, and no difference was found between the two grades for FR instructions. As in IR this interaction suggests that the knowledge of a strategy to be used with a stimulus type aids recall. The Stimulus  $\times$  Instruction  $\times$  Condition interaction ( $p < .01$ ) indicated that HiI words were recalled better than LoI words with either type of instruction regardless of

condition. The Instruction  $\times$  Grade  $\times$  Condition interaction ( $p < .05$ ) revealed the decreasing order 4, 1, 1½ for each grade and type of instruction; I instructions were better than FR; and eighth graders recalled more than sixth graders using either type of instruction, and for all conditions except condition 1½.

### 3. Amount of Clustering/IR

ANOVA yielded significance ( $p < .01$ ) for three main effects: Stimulus, Grade, and Condition. Although the order was 4, 1, 1½, four individual comparisons revealed that the difference between conditions 4 and 1, and between 4 and 1½ were significant but the difference between 1 and 1½ was not. Finally, the type of instruction had no differential effect on clustering IR.

Mean comparisons for the Stimulus  $\times$  Grade interaction ( $p < .01$ ) indicated that eighth graders clustered HiI nouns more than LoI nouns, while sixth graders showed no difference between stimulus lists. Eighth graders also clustered HiI words more than did sixth graders but no difference between grade was found for the LoI words.

The Stimulus  $\times$  Instruction  $\times$  Condition interaction ( $p < .05$ ) showed that HiI words were more greatly clustered than LoI words on each condition. Clustering order was 4, 1, 1½ for both lists with I instructions but not with FR instructions.

The means of the Stimulus  $\times$  Grade  $\times$  Condition interaction ( $p < .01$ ) demonstrated that in general, HiI nouns were clustered more than LoI nouns and that eighth graders clustered HiI words more than LoI words. Sixth graders clustered LoI words more than HiI words on condition 4, while this was reversed for condition 1, and no difference was found for condition 1½. Finally, the Instruction  $\times$  Grade  $\times$  Condition interaction ( $p < .05$ ) revealed that I instructions facilitated more clustering than did FR instructions on conditions 1 and 1½ for sixth graders and on condition 4 for eighth graders. In addition, eighth graders clustered more than sixth graders with either type of instruction and clustering order was 4, 1, 1½ for both grades regardless of conditions.

### 4. Amount of Clustering/LTR

ANOVA yielded significance for three main effects: Stimulus ( $p < .01$ ), Instruction ( $p < .05$ ), and Grade ( $p < .01$ ).

Mean comparisons for the Stimulus  $\times$  Grade interaction ( $p < .05$ ) revealed that eighth graders clustered more than sixth graders on both lists.



For both grades HiI nouns showed a greater amount of clustering than did LoI nouns. This is consistent with the above findings. The Stimulus  $\times$  Condition interaction ( $p < .01$ ) indicated that HiI words were clustered more than LoI words for each condition. While no differences were found among the LoI means, all of the HiI means differed significantly in the decreasing order 1, 4, 1½.

The Instruction  $\times$  Grade interaction ( $p < .05$ ) showed eighth grade clustering to be more than sixth grade with I instructions. Also, I instructions were more facilitative of clustering than were FR instructions for the eighth grade. Comparisons of the Grade  $\times$  Condition interaction ( $p < .01$ ) showed that eighth graders clustered more than sixth graders on each condition. For the sixth graders the order of clustering was 1, 1½, 4.

The Stimulus  $\times$  Instruction  $\times$  Grade interaction ( $p < .05$ ) revealed that eighth graders clustered more than sixth graders regardless of list or instructions. I instructions facilitated more clustering than FR instructions on both lists for eighth graders and on the LoI list for sixth graders. The reverse was found for sixth graders on the HiI words. The Stimulus  $\times$  Instruction  $\times$  Condition interaction ( $p < .01$ ) indicated that HiI nouns were clustered more than LoI nouns for each condition regardless of instructions. Again, there is evidence that the expected 4, 1, 1½ ordering was not found for clustering in LTR. Finally, the Stimulus  $\times$  Grade  $\times$  Condition interaction ( $p < .01$ ) demonstrated that eighth graders generally tended to cluster more than sixth graders for each condition and stimulus level. Also, HiI nouns were clustered more than LoI nouns regardless of grade or condition.

##### 5. *Analyses Separating Trial and Rate Variables*

Examination of the ANOVAs revealed several unexpected interactions, which may have been due to a compounding of variables, specifically the variables trials and rate. In other words, the only difference between conditions 4 and 1 is the number of written trials. Between 1 and 1½ the basic difference is presentation rate. Consequently, the difference between conditions 4 and 1½ lies in both variables. Therefore, some may contend that it was this mixing of the two variables and treating them as equal that produced the significance among interactions. For this reason, two additional  $2 \times 2 \times 2 \times 2$  ANOVAs were computed, separating the two variables. Thus, if the significant interactions were no longer present, then it could be concluded that the equalizing of the variables had produced the interaction effects. However, if the interactions remained, then their significance could be attributed to factors other than the mixing. The ANOVAs were con-

ducted on the number recalled scores in IR. For the most part, the interactions remain significant; hence, the combining probably has not produced the interaction effects.

#### 6. *Comparison of HiI and LoI Words Across Trials*

The means for the number recalled and for the amount of clustering in IR for each of the four trials of condition 4 for HiI and LoI words were compared. For HiI words I instructions facilitated better recall on each trial than did FR instructions for both grades. Eighth graders consistently recalled more than did sixth graders having the same instructions. In general, the same trends held for the LoI words as well. Concerning the amount of clustering over the four trials, I instructions were consistently more effective across trials than were FR instructions for both HiI and LoI words. Finally, an increase over trials was seen throughout.

#### 7. *Behavioral Analysis of Imagery Ratings*

The third aspect to the present experiment involved conducting a behavioral analysis of imagery ratings. For this purpose a correlation was performed between the imagery ratings of one teacher group and the number of images evoked by each noun of the second group. A correlation equal to .51 was computed, suggesting that as the imagery rating of a noun increases so does the number of images evoked by that word.

#### 8. *Correlation Between Recall and Clustering*

In view of its theoretical significance, one final analysis of the data was conducted. According to traditional verbal free recall experimental evidence not only do recall and organization correlate (7), but organization is a necessary condition in free recall (15). To investigate whether this holds under imagery conditions as well, the mean number recalled and the mean amount of clustering were correlated for each of the two grades according to the stimulus and instruction variables. The eight coefficients for the sixth and eighth grades, respectively, according to list and instruction are HiI/I, .10 and .29; HiI/FR, .24 and .52; LoI/I, .15 and .08; finally, LoI/FR, .08 and .03. Important to note is that the only substantial correlation found was for the eighth grade when presented with HiI nouns under standard free recall conditions. This situation corresponds most closely with that of traditional free recall experimental conditions.

## D. DISCUSSION

Comparing imagery with traditional free recall under the same conditions, the current study demonstrated that recall and organization (i.e., clustering) can be facilitated by imagery either in terms of stimulus characteristics or instructions to use imagery. While in general, eighth graders recalled and organized better than did sixth graders, they also employed imagery more effectively. Four written trials facilitated better recall and organization than did one written trial and a 5-second stimulus presentation rate was more effective than a 2.5-second rate for both ordinary free recall and imagery conditions. These general trends held in both immediate and long term recall.

The significance of the present experiment lies in finding that the imaginal process can function in recall and organization of categorical verbal material analogously to and more effectively than the verbal process under the same conditions. Consequently, support was given to Paivio's (21) contention that neither recall nor organization can be accounted for by verbal processes alone. At least on the concrete level, imagery facilitated free recall despite the fact that a verbal response was required. Moreover, the results are contrary to Bruner *et al.*'s (4) assertion that organization is characteristic only of linguistic symbolic structures. It may be that since organization is characteristic of perceptual experience upon which language is based (27), it is therefore characteristic of imagery as well.

That imagery facilitates free recall and organization suggests the possibility that verbal material may be stored spatially and organization may take place during retrieval. Theoretically, it also seems reasonable to state that there may be some inherent structure or relationship not in the words *per se* but in the referent of the words. The learner is thus capable of in a sense "perceiving" and utilizing this underlying structure in organization possibly independent of language at least on the level of concrete stimuli. The notion is similar to that of Piaget's that to be able to relate on the linguistic level is dependent upon the ability to relate things on a more elementary internalized sensory level. Whereas words can signify concepts and relations and are essential for communicating these, images are essential for mentally representing and effectively thinking about these relations. It is in this way, then that images and words complement each other in their distinct symbolic functions.

The complementary relationship between symbolic functions is clearly presented in Paivio's (21) two-process theory which involves the availability

of codes hypothesis. Two symbolic modes of representation are assumed. The imaginal functions on the perceptual and concrete levels, while the verbal functions on both concrete and abstract levels. The effectiveness of recall depends upon and increases with the availability of the two codes. Thus, the more concrete the stimuli the more available the two codes are to facilitate better recall.

The present results lend themselves to interpretation based on the availability hypothesis, since the availability of the memory codes was manipulated by varying instructions, stimulus characteristics, rate of stimulus presentation, and number of written trials. Since a verbal response was necessary, the superiority of the high imagery nouns over the low probably was due to the higher availability of codes. Furthermore, that imagery instructions were shown to be more beneficial than ordinary free recall instructions seems to suggest greater code availability. Similarly, it was found that four written trials were more effective under imagery conditions; the availability of both codes here seems obvious. In addition, the rate of presentation is additionally supportive.

The slower presentation rate of 5 seconds was more beneficial than the more rapid rate of 2.5 seconds for both recall and organization. This was in direct agreement with Bugelski's (5) findings that from 4 to 8 seconds are needed for an image to be formed. Similarly, others (23) found that concrete and abstract words differed very little in ease of learning when presented at 5.3 items/second, but that concrete words were learned faster than abstract at 2.0 items/second, concluding that the slower rate allowed more time for developing imaginal mediators. If, as it appears, time is critical in developing imaginal mediators, the facilitative effects of imagery may be limited to situations in which adequate time is permitted for their development.

While the availability of codes hypothesis seems reasonable in short term memory, its appropriateness in long term memory is questionable on the basis of the present data.

Furthermore, developmental trends in the use of code availability was evidenced. Older children seem better able to utilize both codes for learning and memory. It may be that they have better storage and retrieval strategies which may even include imagery.

Finally, parallel trends were found under imagery conditions as under ordinary free recall conditions. Specifically, recall and organization increased over trials, high imagery nouns were better recalled and organized.

### 1. *Behavioral Analysis of Imagery Ratings*

The significance of the correlation between imagery ratings and the number of evoked images lies in the precedence of an attempt at a behavioral analysis of imagery ratings. The positive correlation indicates that as the imagery rating of a noun increases so does the number of images evoked by that noun. An explanation of this relationship is based on the concept that any word heard or employed is a learned response with its own history. Thus, imagery ratings are related to past experiences with the word as a response. If words are responded to in terms of one's own experiences, then a word rated as abstract or low in imagery is rated so because there is less familiarity. Likewise, a word may be rated as concrete or high in imagery because there are more experiences with it and consequently more visual representations of it. This explanation is offered tentatively until more sophisticated designs for behavioral analyses are developed in subsequent investigations.

### 2. *Correlation Between Organization and Recall*

Generally, a positive correlation exists between measures of organization and the number of words recalled. Human memory is viewed by Neisser (19) as an active process of organization imposed on the stimulus input by the learner. Memory and organization are not only correlated, but organization is considered necessary if memory is to exceed the limit of individual items.

Present examination of this notion yielded correlation coefficients between recall and organization which caution against such general causal interpretation of the relationship. A substantial coefficient was obtained only when high imagery nouns were recalled under ordinary free recall instructions. Of note is that this is the one set of circumstances which most clearly correspond with those of the traditional free recall paradigm out of which evolved the position that recall is dependent upon organization (15, 32).

For the most part, however, the data suggest that organization and recall may also be independent processes and that imagery may be facilitative of both but independently of each other. This is also in agreement with previous evidence (7, 8) that shows that at least under certain conditions measures of organization and recall can vary independently. The conclusion seems to be that only when high imagery or concrete words are presented within a traditional free recall paradigm do recall and organization correlate. Of course, that not all experiments have found a relationship between recall and organization does not mean that the individual is not organizing. It only

suggests that he is not organizing according to *E* defined organization. Although it should be realized that the degree of relationship depends on the unit of analysis used, situations in which recall and organization can vary independently raise serious question as to the validity of organizational interpretations of free recall.

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