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ABSTRACT

Subjects, differing in imagery ability, learned a list of paired associates with the presence of a verbal context related to the stimulus item, with a pictorial context related to the stimulus item, or without the presence of any context. Following testing for recall, the subjects were required to learn one of two transfer lists. Both lists were comprised of the original responses and new stimuli. In one list the new items were conceptually related to the original learning contexts, whereas in the other list they were not. The results supported the hypothesis that high-imagers would recall more words than low-imagers during acquisition, and that this effect would be most apparent when the learning context was pictorial. In addition, high-imagers were superior to low-imagers in transferring both verbal and pictorial contextual information to related and unrelated instances. These findings implied that imagery ability is a strong determinant of ability to learn and transfer contextual information presented in verbal or pictorial modalities. (Author)

Imagery Ability and Context Modality as Factors in the Acquisition and Transfer of Concepts

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Abstract

Subjects, differing in imagery ability, learned a list of paired associates with the presence of a verbal context related to the stimulus item, with a pictorial context related to the stimulus item, or without the presence of any context. Following testing for recall, the subjects were required to learn one of two transfer lists. Both lists were comprised of the original responses and new stimuli. In one list the new items were conceptually related to the original learning contexts, whereas in the other list they were not. The results supported the hypothesis that high-imagers would recall more words than low-imagers during acquisition, and that this effect would be most apparent when the learning context was pictorial. In addition, high-imagers were superior to low-imagers in transfering both verbal and pictorial contextual information to related and unrelated instances. These findings implied that imagery ability is a strong determinant of ability to learn and transfer contextual information presented in verbal or pictorial modalities.

The past decade has witnessed a renewed emphasis in the study of imagery. Not since the turn of the century during the heyday of introspective research has the interest in this construct been so visible (Palermo, 1970). For the most part, contemporary studies of imagery have either manipulated stimulus attributes in order to facilitate or inhibit imagery arousal (e.g., Paivio, 1969), or employed specific instructions designed to induce imaginal processes while encoding stimulus material (e.g., Bower, 1971). The mergent theoretical concerns have centered on such questions as why pictures are remembered more easily than words (Paivio, 1969), and whether verbal and nonverbal coding involve interconnected or mostly independent systems (Paivio, 1974; Pylyshyn, 1973). A related issue, which has received relatively little attention by researchers, concerns the implications of individual abilities (or predispositions) for using imagery in transformational processes. The aptitude by treatment interaction (ATI) framework, as proposed by Cronbach (1957; 1975) and others (see Berliner & Cahen, 1973), strongly supports this type of investigative approach, and emphasizes its potential for promoting an increased understanding of the basic processes underlying human learning.

The present investigation was designed to investigate the conditions under which individuals who differ in imagery abilities acquire and transfer concepts that are incidentally expressed by verbal or pictorial contextual cues. It had been shown in an earlier investigation (Di Vesta & Ross, 1970) that the relatedness or meaningfulness of a verbal context has clear effects upon the learning and transfer of paired-associates. Specifically, it was found that a related context, i.e., one which is similar in meaning or categorically relatable to the stimulus side of the pair, elicits conceptualizing tendencies in the learner that interfere with specific item learning, but facilitate conceptual transfer.

The present study extended the earlier one (Di Vesta & Ross, 1970) by treating context as a factor that differentially affects the perception and retention of stimuli, depending upon the form (modality) of the context and also upon the experiential history of the individual. Taken by itself, a stimulus will be subjectively encoded in terms of the learner's prior experiences. The more ambiguous a stimulus, the more likely will be the tendency to attend to non-focal (contextual) cues in an active attempt to provide structure and meaning to the focal input. Take, for example, the following sentence: "The cardinal delivered his sermon on Sunday." In this situation, the majority of readers would experience little difficulty in defining the stimulus, "cardinal," as a type of clergyman. However, without the presence of a supporting phase (i.e., the context), and depending on the person's previous experiences, he might be as likely to view "cardinal" as a type of bird. It appears intuitively obvious that, in these situations, context has an important influence on the perception, coding, and storage of the focal experience. Accordingly, context determines the potentiality of transfering what was learned to new situations. Earlier findings provide support for these notions, but further inquiry was suggested to determine the effects on learning and transfer of the interaction between context modality (specifically, pictorial vs. verbal cues) and individual differences in imagery ability.

There is considerable evidence showing imagery to be a significant variable affecting the storage and retrieval of verbal and pictorial cues. Paivio (1970) employed the "conceptual-peg" hypothesis in interpreting the effects on associative learning of such variables as concretness-abstractness of stimuli, modality of stimuli, and context of stimuli. Rohwer (1970) has summarized results showing that "action" prepositional connectives evoke more memorable kinds of imagery than either "static" or "coincidental" connectives. In other investigations involving verbal and pictorial transformations of stimuli, Reese (1970) found imaginal and sentence connectives to be equally facilitative for adults, but that imagery was less effective in providing useful contextual cues for children. These studies suggest that materials presented in pictorial and verbal modalities are processed differently and possess unique potentialities for learning and transfer.

It has also been hypothesized that individual differences in specific attitudes or idiosyncratic predispositions for learning influence ability and preference in processing pictorial stimuli. Notions of this sort involving imagery have long been a subject of speculation by philosophers and scientists. The formal study of imagery differences seems to have originated with Galton's classic breakfast-table questionnaire (1883). More recent investigations have yielded other questionnaires and objective tests of spatial reasoning (see Richardson, 1969) designed for the purpose of classifying individuals on the basis of imagery ability.

It seems relevant for basic experimental inquiry and as an obvious extension of current imagery research, to more closely examine individuals who possess imagery skills as they interact with controlled environmental influences. In the present study, context was viewed as a pervasive and influential external (environmental) variable. Such cues provide the framework within which all experiences are embedded. By investigating context as an environmental factor and imagery as a distinctively biasing cognitive process, the present study was designed to provide further insights into the important question of how ATIs affect learning. Specifically, individuals classified as either high or low in imagery ability were compared on the basis of their performance in learning and, in transfering from, materials embedded within pictorial and verbal contexts.

Method

Design

The experimental sessions were conducted on an individual basis and consisted of: a) the presentation of 20 paired-associates to be learned to a criterion of one errorless trial in the learning phase; and b) the presentation of a similar list of 20 paired-associates for one recall and one study-recall trial in the transfer phase.

The design for the learning phase implied a factorial analysis of variance consisting of two between factors. The first factor, Learning Context, was comprised of three conditions involving contextual variations. In the verbal context condition, two accessory words were positioned between the stimulus and response elements of each word-pair. The accessory words were meaningfully related to each other and to the specific stimulus element, thus suggesting an inclusive concept category. In the pictorial context condition, the context was similarly positioned and identical in meaning to that described above, but was presented in a pictorial mode; and in the no-context condition, only item pairs, without context stimuli of any kind, were presented. The second factor, Imagery Ability, was comprised of two categories of imagers (high and low).

The analysis of data from the transfer phase included an additional between variable, Transfer Concept, based on the relationship between stimuli in the learning and transfer phases. In related-concept transfer, the stimulus element presented in the learning phase was replaced by a new word meaningfully related to the concept defined by both the original stimulus and its supporting context. In unrelated-concept transfer, the new stimulus word was also related to the stimulus element in the learning phase, but was from a different concept class than that expressed by the original supporting context. Other than these exceptions, all factors remained the same in the transfer phase as they were during the learning phase.

Subjects

The Ss were 120 undergraduates enrolled in an introductory educational psychology course at The Pennsylvania State University. All Ss were awarded points which were credited toward their class grade for participating in the experiment.

Prior to the conduct of the experiment proper, a battery of spatial relations and perceptual tasks were administered to a pool of 300 Ss. The test battery included: Flags: A Test of Spatial Thinking (Thurstone & Jeffrey, 1956); the Space Relations section of the Differential Aptitude Test (Bennett, Seashore, & Wesman, 1947); and the Gottschaldt Figures Test, as described by Thurstone (1944). An average standard score ($\bar{T}$) was obtained for each S by averaging the individual standard scores received on the three imagery tests. The 60 Ss with the highest average scores were characterized as high-imagers and the 60 Ss with the lowest scores were characterized as low-imagers. The resulting groups of 60 high-imagers ($\bar{T} = 59.19$) and 60 low-imagers ($\bar{T} = 38.96$) completed all phases of the experiment.

Stimulus Materials

All lists used for study in the learning and transfer phases were comprised of 20 word-pairs, individually mounted on slides and presented by means of a carousel projector. An additional list, consisting of eight paired-associates, was arranged for the practice trial.

The words used in the learning and transfer lists were all one - three syllable concrete nouns. While normative ratings of imagery or concreteness were not available for many of these words, it was assumed on the basis of previous research (Paivio, Yuille, & Madigan, 1968) that all were relatively high in imagery-arousal.

The stimulus words were selected according to the criterion that they could relate to two separate and distinct concept categories. For example, among the stimulus words chosen were bat (relating to baseball and/or a type of animal), foot (relating to measurement and/or to a part of the body), boxer (relating to a type of athlete and/or type of dog), club (relating to a type of weapon and/or a playing card suit), and so on. The context words, two for each stimulus, were randomly chosen from one of the two concept-categories. As an additional restriction, it was required that all context words could be represented clearly and simply in pictorial form. The Battig and Montague (1969) category norms were referenced whenever possible to provide exemplars of appropriate categories. However, the lack of published norms specifically related to the selection criteria made it necessary to rely sometimes on intuitive judgement in selecting words. The Battig and Montague norms were again employed for the selection of all response elements and practice items from separate categories not containing the words designated for the above functions. The specific lists used in the learning and transfer phases were as follows:

Verbal context condition. In the list presented to the verbal context group, two context words were always positioned above and below the corresponding main pairs as in the following illustration:

diamond
CLUB PEPPER
heart

The context words were typed in lower case letters and were conceptually relatable to the stimulus side of the pairs.

Pictorial context condition. The lists and administrative procedures were identical for the pictorial condition except that the context words were replaced by similarly positioned line drawings as shown below:

CLUB  PEPPER

No-context condition. A separate set of items consisting only of stimulus and response elements, without contextual cues, were arranged for the no-context treatment condition.

Recall trial list. A recall trial was administered following each presentation of a study trial list. The list constructed for recall contained only the 20 stimulus words used as cues for the identification of the response words. The recall list was identical for the three learning conditions.

Transfer phase lists. The study lists presented in the transfer phase also contained 20 word-pairs. Each pair consisted only of an original response element and a new stimulus. In one transfer list, the new stimulus words were conceptually related to the original stimuli and to their supporting contexts (e.g., if the stimulus, CLUB, had been supported by the context, "diamond and heart," the new stimulus word was "SPADE"). In the other transfer list, the new stimulus elements also were related to the original stimuli, but within a different concept category from that expressed by the supporting context (e.g., the stimulus, "CLUB," was replaced by the new word, "BOMB," suggesting a type of weapon, but unrelated to CLUB within the category of "playing card suits"). The recall lists used in transfer contained only the related-concept or unrealted-concept stimulus items as cues for the original responses.

Procedure

The Ss were administered the tasks on an individual basis. The experimental sessions were from 45-55 minutes in duration.

Upon arrival at the laboratory, the S was seated at a table in front of a microphone and a large translucent screen. Standard instructions for the study-recall method of learning paired-associates were administered together with brief comments on the purpose and function of some of the apparatus (i.e., a microphone and timer to measure response latencies, and a carousel projector). The Ss were also informed about the importance of responding rapidly and accurately.

Following the preliminary instructions, a practice study-recall trial consisting of eight paired-associates was administered to familiarize S with the procedures and to reduce practice effects during the actual experimental trials. During study trials for both the practice and experimental tasks, each word-pair was projected onto the screen for a three-second exposure period. A recall trial was administered immediately after the complete list of pairs had been shown in succession. The maximum exposure period for each recall stimulus was 4 seconds.

Following the practice trial, S was administered a set of instructions corresponding to his assigned condition. The Ss in the no-context group simply were told that the procedure would be the same as in the practice session, except that they would be asked to learn 20 rather than eight word-pairs. The Ss in the verbal context group were administered similar instructions, but were informed that two accessory (context) words would be positioned between each word-pair in all study trials. As in the practice session, recall would involve the oral identification of the correct response to the stimulus cue. The instructions implied that S could ignore the context or use it in any way desired. The Ss in the pictorial context group received the same basic instructions as the verbal group except that the accessory stimuli were referred to as pictures rather than words. All Ss then were presented study and recall lists appropriate to their assigned condition. Different random orders of these lists were administered on adjacent trials. The learning phase was terminated when the S reached the criterion of one errorless recall trial.

A 10-minute rest interval was provided at the end of the learning phase. The purposes of the rest interval were to reduce short-term memory of the previously learned materials and allow S an opportunity to relax somewhat from the tensions of the learning phase. The Ss were cautioned that thinking about (or rehearsing) previous learning could adversely affect their performance on the subsequent experimental task.

A third set of instructions were administered at the completion of the rest interval. These instructions dealt with the procedures for the first transfer trial. The Ss were informed that 20 new words would be projected on the stimulus side of the screen for a maximum interval of 15 seconds per word. The S was told that he was to make an "educated guess" as to which of the 20 original response words went with the new stimulus. As in the learning phase, the instructions emphasized the importance of responding both rapidly and accurately. Each new stimulus element in the transfer list was categorically related to an original stimulus element, but depending upon condition, was either related or unrelated to the original "context-supported" concept. After all 20 stimulus items were presented, a study trial was administered in which the new stimulus items were paired with the proper responses. As in the learning session, each pair in the list was presented for a three-second exposure interval. A recall trial was then administered by the identical procedure employed during learning. That is, the exposure interval was contingent upon the latency of S's response, but never exceeded the maximum of four seconds.

Results

The major dependent variables in both the learning and transfer phases of the experiment were number of correct responses and average response latency. In addition, an analysis was performed on the number of trials to criterion in the learning phase. The analyses of these measures are discussed separately below.

Trials to Criterion -- Learning Phase

Performance was measured in this analysis by trials to criterion in the learning phase. The purpose of the analysis was to determine whether degree of original learning would differ as a function of Learning Context (verbal, pictorial, and no-context); Imagery Ability (high- and low-imagers); or as a function of the interaction of these factors.

The data were analyzed via a 3 x 2 between-groups analysis of variance. The results of the analysis revealed that neither the main effects nor the interaction were significant. Although the present data imply little about acquisition performance, they strongly suggest there were no differences between treatment groups in overall learning (as measured by trials to criterion). Accordingly, transfer could be assumed to depend upon the effects of treatments rather than on the degree to which the original paired-associate list was mastered in the learning phase of the experiment.

Number of Correct Responses -- Learning Phase

The analysis of data for the learning phase was based on the number of correct responses during the <u>first</u> recall trial. The purpose of this analysis was to determine the effects of Context Modality, Imagery Ability, and the interaction of these factors during the initial stages of acquisition learning. The data were analyzed via a 3 x 2 between-groups analysis of variance as employed in the analysis of trials to criterion.

The analysis yielded a significant main effect due to Imagery ability, F (1,114) = 4.83, $p < .05$, favoring the performance of high-imagers ($\bar{X}$ = 6.43) over that of low-imagers ($\bar{X}$ = 4.92) during the first trial of learning. The main effect due to Learning Context was not significant ($F < 1.00$). Since the interaction of Imagery Ability and Learning Context approached significance, F (2,114) = 3.03, $p < .10$, the individual means were inspected to determine whether they were in the predicted direction. The inspection of means indicated a slight difference in favor of low-imagers for the verbal context condition ($\bar{d}$ = .85), and substantially larger differences favoring high-imagers in both the picture context and no-context conditions ($\bar{d}$ = -3.05 and -2.34, respectively). These comparisons are graphically displayed in Figure 1.

Insert Figure 1 about here.

An additional analysis was performed to test the interaction between two of the three variations of Context Modality (i.e., the verbal and pictorial conditions) and Imagery Ability. The analysis yielded t (114) = 2.31, $p < .05$, indicating that the differences between imagery groups varied significantly across the two conditions of context: low imagers did not make significantly more correct responses than high-imagers in the verbal context condition ($p > .05$), but high-imagers made significantly more correct responses than low-imagers in the pictorial context condition, t (114) = 2.55, $p < .02$. These findings support the hypothesis that imagery ability relates to effectiveness in processing pictorial modes of context.

Number of Correct Responses -- Transfer Phase

The purpose of this analysis was to determine the ability of high- and low-imagers to transfer to materials differentially related to the original concepts employed in the learning phase. Of further concern was how these variables would affect performance before and after an opportunity for study was provided (Recall Trials 1 and 2, respectively).

On the basis of previous research (Di Vesta & Ross, 1970), it was hypothesized that related-concept stimulus items would result in positive transfer, whereas unrelated-concept stimulus items would result in negative transfer. A baseline from which to determine these effects was provided by the transfer task performance of Ss assigned to the control (no-context) condition. Since these Ss never viewed either type of context during original learning, variations in Transfer Concept (related vs. unrelated) were assumed to have no effect on their performance.

The number of correct responses on the transfer task were analyzed via a 3 x 2 x 2 x 2 mixed analysis of variance. The last factor, Trials, was the within variable. The between variables were three conditions of Learning Context, two levels of Imagery Ability, and two variations of Transfer Concept. The analysis yielded a significant main effect due to Imagery Ability, F (1,108) = 11.39, $p < .01$, showing high-imagers ($\bar{X}$ = 10.13) to be superior in recall to low-imagers ($\bar{X}$ = 8.52). Other significant main effects, due to Learning Context, Transfer Concept, and Trials, were qualified by the interactions described below.

The interaction between Learning Context and Transfer Concept was significant ($p < .001$). These factors were also involved in a significant higher order interaction with Recall Trials ($p < .01$), which is displayed graphically in Figure 2. There it may be seen that in Trial 1, and to a lesser extent in Trial 2, the picture context groups demonstrated the most related-concept transfer, but the least unrelated-concept transfer. In a comparison of cell means, the picture context was superior to the verbal context in Trial 1, *t* (108) = 4.66, $p < .001$, but there were no differences between those conditions in Trial 2.

Insert Figure 2 about here.

The transfer performances by *Ss* in the pictorial and verbal context groups were compared, in further analyses, with the baseline established by pooling the means of the experimentally equivalent control (no-context) groups across the two levels of Transfer Concept. The comparisons of groups against this baseline are depicted graphically in Figure 2. The representations of means above this baseline indicate positive transfer; those below indicate negative transfer. Individual comparisons revealed that related-concept transfer was positive for the pictorial context condition in both Trial 1 ($p < .001$) and Trial 2 ($p < .001$), and for the verbal context condition in Trial 2 ($p < .001$). However, unrelated-concept transfer was negative for the pictorial condition in Trial 1 ($p < .05$). None of the other baseline comparisons yielded significant differences.

These findings provide strong support for the hypothesis that the mode of context received during learning would affect transfer differentially. Although both modes of context produced positive transfer to related-concept instances, the effect of the pictorial context was significantly greater than that of the verbal context. In addition, unrelated-concept transfer was negative when the learning concept was pictorial, whereas it was zero when the context was verbal. In general, it can be concluded that the effects due to the verbal context were less pronounced than those due to the picture context.

The interaction between Imagery Ability and Transfer Concept, although not statistically significant ($p < .10$), suggested by the direction of means that differences between high- and low-imagers were greater for related-concept transfer ($\bar{d} = 2.31$) than for unrelated-concept transfer ($\bar{d} = .90$). These differences are more meaningfully expressed when the experimentally equivalent control groups are removed from the analysis, in which case $\bar{d} = 3.12$ and $\bar{d} = 1.00$, respectively. A comparison of these latter difference scores yielded $t\ (100) = 2.68$, $p < .05$.

The Imagery Ability x Learning Context Interaction was also of marginal significance ($F = 1.71$, $p > .05$). The direction of means, however, did indicate a tendency for greater differences between high- and low-imagers when the learning context was pictorial ($\bar{d} = 2.80$) than when it was verbal ($\bar{d} = 1.32$) or not present at all ($\bar{d} = .70$).

Response Latency -- Learning Phase

In the analysis of data for the learning phase, response latency was computed as the average latency of all 20 responses during the S's criterion trial. The data were analyzed via a 3 x 2 factorial analysis of variance with the factors being the three conditions of Learning Context and the two levels of Imagery Ability.

The analysis did not yield significant effects due to either of the above factors or to the interaction between them ($p > .05$). These results, particularly when considered in conjunction with those obtained in the analysis of trials to criterion, strongly imply that the various treatment groups did not differ in degree of learning before entering the transfer phase. Any differences between these groups in transfer thus can be attributed to the way in which the original materials were learned (i.e., treatment differences) rather than to the strength of the individual word-pair associations.[1]

Response Latency -- Transfer Phase

In the analysis of transfer data, the dependent variable was defined as the average latency of all correct responses on Trial 2. Trial 1 was not included in this analysis because the number of correct responses was generally low, and because the 15-second response interval allowed for extremely large variabilities in correct response latencies. The Trial 2 data were analyzed via a 3 x 2 x 2 analysis of variance consisting of three conditions of Learning Context, two levels of Imagery Ability, and two conditions of Transfer Concept.

The main effects of Learning Context and Transfer Concept were both significant ($p < .05$). These two factors were also involved in a significant first order (p < .05) to be described below. No other main effects or interactions were significant.

Tests for simple effects of the Learning Context x Transfer Concept interaction indicated that the pictorial context condition resulted in shorter response latencies when transfer was to related-concept stimuli ($\bar{X}$ = 1.58 sec.) than when it was to unrelated-concept stimuli ($\bar{X}$ = 1.88 sec.), t (108) = 2.83, $p < .01$. In contrast, the differences in response latency between related- and unrelated-concept transfer were not significant for Ss who learned in the verbal and no-context conditions. The latencies for the no-context condition significantly exceeded those for the picture, t (108) = 4.10, $p < .001$, and the verbal, t (108) = 3.42, $p < .01$, conditions, indicating positive transfer to related-concept stimuli in both instances.

These data thus imply that the related contextual cues influedced the ways in which the focal materials were coded and stored. This effect was shown to be greater for the pictorial than for the verbal mode of context.

Discussion

The results of this experiment clearly support the notion that related contextual cues induce conceptualizing tendencies in the learner which facilitate "related-concept" transfer, but inhibit "unrelated-concept" transfer. The strength and stability of these effects were shown to depend upon the mode of context and the imagery ability of the learner.

Context

The present findings replicated, in part, those obtained in an earlier study by Di Vesta and Ross (1970), by showing that related contextual cues are actively employed in cognitive transformations of focal input. The procedures used in the present investigation offered the additional advantage of providing a baseline (no-context) condition from which the effects of context could be ascertained more clearly.

An important finding in the Di Vesta and Ross (1970) study was that a context unrelated to the focal input was ignored, at least to the extent that it did not inhibit acquisition learning. Furthermore, when an unrelated contextual item was inserted as a main element during the transfer phase, the result was zero or negative transfer. In contrast, related contexts inhibited acquisition learning, but facilitated transfer to contextually related stimuli. These results imply that learners do not passively receive the stimulus input, or encode it as isolated pieces of information. Rather, they actively select stimulus components (both focal and contextual) perceived as meaningful, and incorporate or organize them into a functional stimulus pattern. Irrelevant features of the nominal input are sorted out and ignored on later trials.

Of particular interest was the suggestion that learners, for the most part, are unaware of these selection processes. Few Ss in the present experiment reported any conscious or purposeful attempt at processing the contextual items.

Nor is it necessary for Ss to be coerced in any way to use the context. The task instructions stated explicitly that recall of contextual items would not be tested. Thus, the extent to which and how the context was to be employed was left entirely to S's personal discretion. Apparently, Ss made implicit use of the related contextual items, and in a manner that increased the meaningfulness of the to-be-learned stimuli.

What was stored during learning and transfer is a matter of some interest. Since treatment groups did not differ significantly during the learning phase in either trials to criterion or criterion trial latency, it must be assumed that they were reasonably equivalent in degree of initial learning. Thus, differences between groups can be attributed mostly to the way in which the stimulus items were processed and stored rather than to how well they were learned originally. Further ellaboration of this notion would require some understanding of the nature of these transformations, a matter beyond the scope of the present study. Neisser's (1967) description of the constructive process would suggest that contextual features of the stimulus input comprise a conceptual framework (i.e., cognitive structure or schema) from which the appropriate response is constructed. The specific identities of the contextual and focal stimuli may be sacrificed to the framework, but the underlying concept is retained. Some additional support for this interpretation was provided in the earlier study by Di Vesta and Ross (1970).

In summary, the major effect of related contextual cues appears to be that of inducing conceptualizing tendencies in the learner which reduce uncertainty about the focal stimulus. The specific identity of the stimulus, along with any alternative meanings it may connote, are lost to the conceptual pattern, but the underlying concept is retained. As a consequence, transfer to related-concept instances is facilitated, whereas transfer to unrelated-concept instances is inhibited.

Context Modality

Although the results of the present comparison between pictures and words are in agreement with those obtained in previous studies, they uniquely relate to the effects of these modes in contextual arrangements. On this basis, it seems unlikely that the more traditional interpretations of picture-word differences could provide an adequate account of present findings.

One possible explanation of the finding that pictorial contexts are more influential than verbal contexts could relate to what Jenkins et al. (1963) have called "response generalization." Words are generalized symbols which refer to idealized attributes or qualities. As a result, they are more generalizable than pictures, which refer to relatively specific and concrete experiences. Pictures, relative to words, are more meaningful in the sense that they provide more information (reduce more uncertainty) about their referents.

In these terms, pictorial contexts constitute a source of relatively specific, unambiguous information. As the present findings suggest, the pictorially-expressed information becomes easily transferable to new instances of the same concept category. This may be attributable to the fact that the transfer words were concrete and likely to evoke images as well as verbal coding. (Paivio et al., 1968). In the case of "related-concept" transfer, these images should be structurally similar and easily relatable to the encoded images or "templates" of the original stimulus pattern. The "response generalization" notion also is consistent with the finding of comparatively little transfer to words conceptually related to original stimuli, but unrelated to the pictorial contexts. If, for example, the word, "cardinal," were received and encoded as an image representing a type of bird due to the influences of a pictorial context, the possibilities for generalization to the word, "priest," would be delimited significantly. The word, "priest," although related to "cardinal" within another conceptual framework, presumably would evoke an image totally different in form and connotative meaning from that associated with the above perception of "cardinal." Verbal contexts, on the other hand, should less readily induce imaginal coding of stimulus words. In the absence of clear and well-defined images, there would be less certainty regarding the referents for focal stimuli. On this basis, it does not appear surprising that only the pictorial mode of context produced negative transfer to unrelated-concept words.

Imagery Ability

The present data is consistent with contemporary interpretations of imagery differences. Until recently, high-imagers were thought to use imagery more effectively than low-imagers, whereas low-imagers were thought of as better abstract reasoners than high-imagers (see, for example, Stewart, 1965). The results from recent studies have presented a severe challenge to this interpretation (e.g., Di Vesta & Ross, 1971). Although it is generally agreed that high-imagers are more able and likely than their low-imagery counterparts to think and solve problems by use of imagery, there is, at present, no justification for assuming low-imagers will not profit from pictures or that they are better in verbal ability than high-imagers (e.g., Cronbach, 1975, p. 119). According to Di Vesta and Sunshine (1971), "... low-imagers are not really to be considered verbalizers. It is not clear what their dominant strategy is except that they are people deficient in some strategy (i.e., in imagery ability) without knowing their strengths" (p. 154).

From the aforegoing, it would be expected that the learning differential between high- and low-imagers would be less in the case of verbal contexts than in the case of pictorial contexts. This assumption is consistent with present findings: High-imagers correctly identified more words on the first trial of learning than did low-imagers when the context was pictorial, whereas there were no differences between groups when the context was verbal. Also, as implied by the direction of data from the transfer phase, the superiority of high-imagers over low-imagers was less in the verbal than in the pictorial context conditions.

A final point which merits some discussion concerns the comparitive performances of imagery groups during the transfer phase of the experiment. The direction of the data imply that irrespective of the mode of context received during learning, high-imagers were more successful than low-imagers at transfering to unrelated instances and especially to related instances. This should not appear surprising if it is again emphasized that high-imagers should not be considered as low in verbal ability. In fact, there is recent evidence to suggest high-imagers can effectively employ both imagery and verbal strategies to their advantage in associative learning tasks (e.g., Di Vesta & Ross, 1971). Relating this to the present experiment, imagery strategies could be applied to strengthen stimulus-response associations and to preserve the perceptual experiences, whereas verbal strategies could be used to transfer this learning to related instances. Although these comments are conjectural, if correct, they imply that high-imagers ordinarily will surpass low-imagers in tasks requiring the effective use of both imaginal and symbolic modes of thought.

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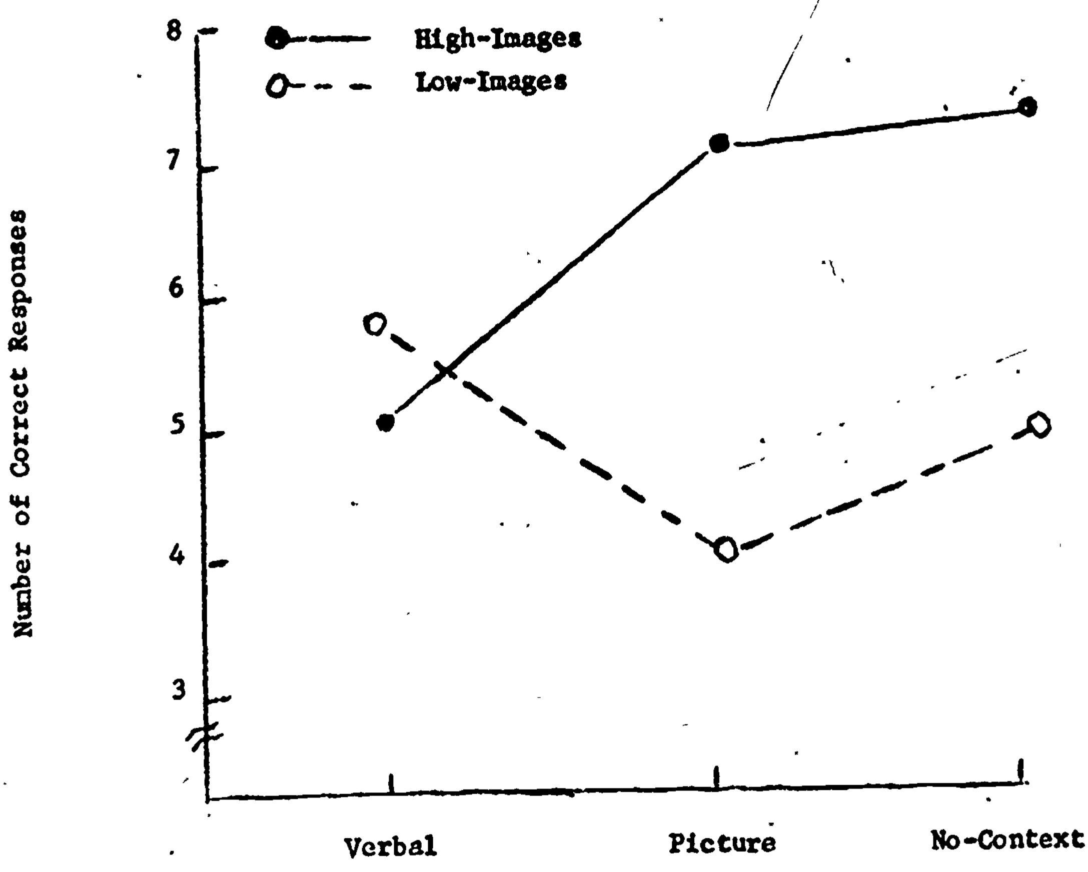

Figure 1. Mean number of correct responses on first-trial of learning phase for high-imagers and low-imagers across each of the context conditions.

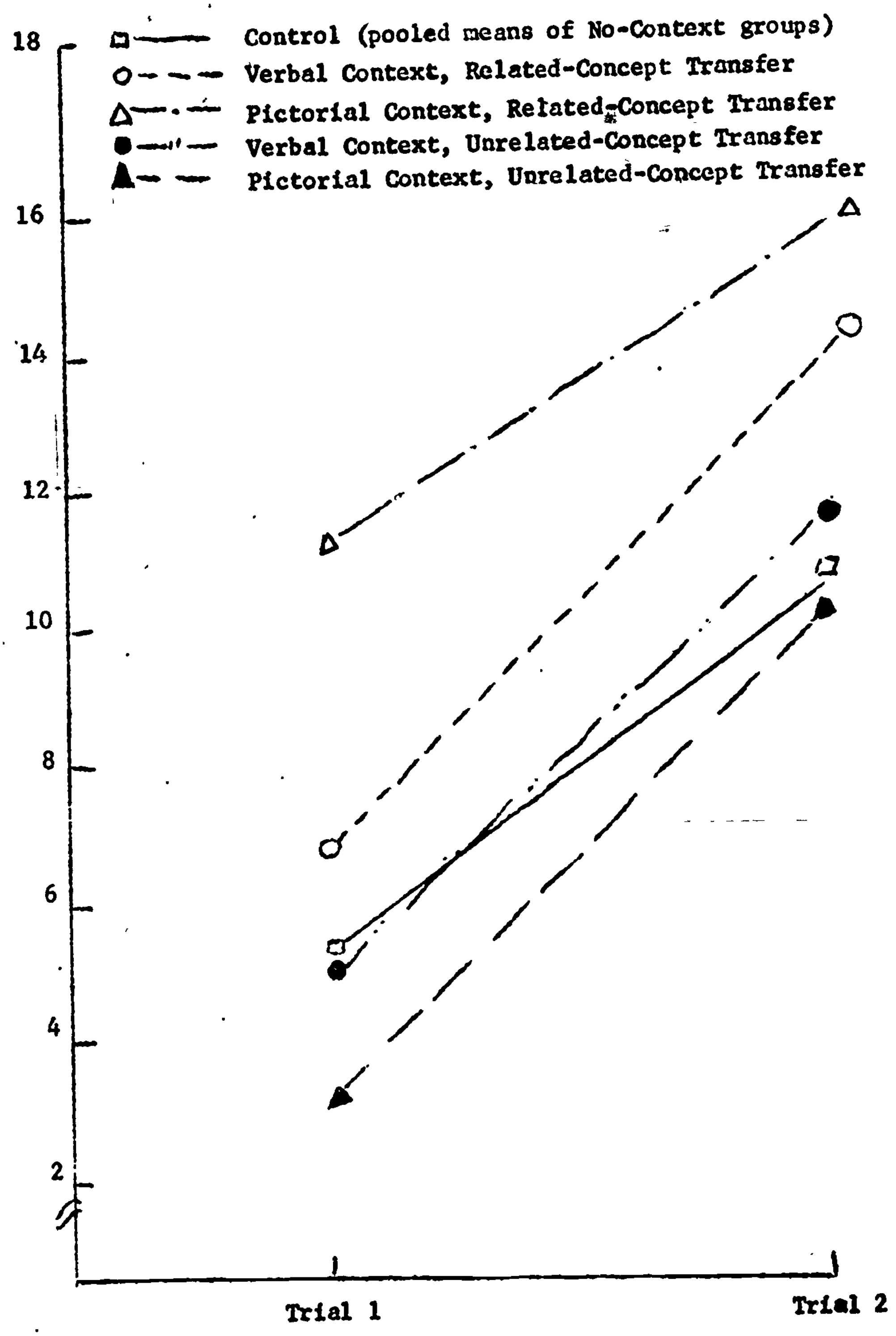

Figure 2. Mean number of correct responses during Trial 1 and Trial 2 of Transfer as a function of Learning Context and Transfer Concept.