VISUAL IMAGERY ABILITY AND MULTITRIAL PICTURE RECOGNITION WITH VARIANT VERSUS IDENTITY CUES

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ABSTRACT

Subjects who scored high or low on a measure of visual imagery ability completed three recognition tests for a set of pictures viewed 48 hr earlier. The tests assessed recognition of previously depicted objects, queried either by identity cues (same picture) or variant cues (different picture of the same object). The discrimination index, d', was significantly greater for High Imagery subjects and increased modestly across tests for variant cues, but not for identity cues. High Imagery subjects also employed different decision criteria (B) with the two sets of cues, while Low Imagery subjects did not. These strategic response biases may reflect imagery-related differences in the quality or utility of the memory trace in recognition.

PROBLEM

There is considerable evidence that imagery benefits the registration, storage, and retrieval of information in episodic memory (Paivio, 1972). Furthermore, the improvement in memory generated by repeated testing (hypermnesia) occurs most reliably with pictorial stimuli and verbal stimuli that are intentionally imaged during study, but rarely with low-imagery words (Erdelyi & Becker, 1974; Erdelyi, Finkelstein, Herrell, Miller, & Thomas, 1976; Popkin & Small, 1979; Roediger & Payne, 1985).

Previous studies have assessed the hypermnesia phenomenon by using variations of the free recall procedure, or in one study (Erdelyi & Stein, 1981), by a hybrid recall/recognition task. Our interest was to determine whether hypermnesia could be demonstrated in a picture recognition task, in which the quality of retrieval cues was varied so as to invoke different amounts of retrieval effort. In view of the seeming importance of imagery processes in hypermnesia, it was hypothesized that recognition hypermnesia would be observed in response to variant retrieval cues, but not to identity cues, and only among individuals with adequate visual imagery ability.

METHOD

Subjects. Twelve female undergraduate volunteers, between the ages of 19-45, participated for course credit.

Materials and Procedure. Subjects completed the Vividness of Visual Imagery Questionnaire (VVIQ of Marks, 1973) and were assigned by median split to High and Low Imagery groups [$t(10) = 4.83$, $p < .001$].

Two weeks later, all subjects participated in an experiment in which they first provided imagery ratings for 40 nouns differing in concreteness, followed by exposure to 34 black and white line drawings of common objects (Snodgrass & Vanderwart, 1980), presented for 2 sec each by slide projector. Following this they were given a surprise test for recall of the 40 nouns. A subsequent debriefing explained that the purpose of the picture phase was to interfere with rehearsal of the images evoked by the words during the interval between study and test.

Forty-eight hours later, another surprise memory test was announced, this time for recognition of the pictures. Each subject received a test booklet containing the 34 target pictures and 34 lures. Half of the target items were the identical Snodgrass & Vanderwart (1980) pictures (Identity Cues) shown previously, and half were different drawings (Variant Cues) of the objects depicted in the remainder of the earlier slides. The lures were also derived from these two stylistically different picture sets. The specific versions (cue type) of all target and lure items were counterbalanced across subjects.

Subjects were instructed to indicate using a 1-4 recognition confidence scale [(1 = absolutely certain, 2 = I think) that item is "new"; (3 = I think, 4 = absolutely certain) that item is "old"] whether the objects were the same as those shown two days previously, even though the specific pictures might be different. Eight minutes were allotted to complete the test booklets. Following this, subjects were asked to sit quietly for two minutes and "think" about the slides they were shown. A second recognition booklet was then distributed and the identical procedures were followed. This was followed by a second "think" opportunity and a third and final recognition test.

RESULTS

Figure 1 shows the proportion of correct recognitions (hits) for the High and Low Imagery groups across the three tests as a function of cue quality. It is evident that Identity cues were more effective than Variant cues in eliciting correct recognitions [$F(1,20) = 22.6$, $p < .001$]. The effects of imagery ability and repeated testing were not significant.

Insert Figure 1 here

Figure 2 shows the proportion of incorrect recognitions (false alarms) across tests as a function of imagery ability and cue quality. A significant Imagery x Cue x Test interaction emerged [$F(2,20) = 5.3$, $p < .025$]. Thus, Identity cues were again more likely than Variant cues to elicit recognition responses, and High Imagery subjects [$F(2,20) = 5.27$, $p < .025$], as well as Low Imagery subjects [$F(2,20) = 3.5$, $p < .05$], became progressively more vulnerable to this effect with testing. On all tests, however, High Imagery subjects made fewer false alarms than Low Imagery subjects.

Insert Figure 2 here

To assess the presence of hypermnesia, the signal detection parameters, d' and B, were computed for each subject's test performances. Figure 3 shows the effects of the experimental treatments on the discrimination index (d'). Overall, the recognition accuracy of High Imagery subjects was superior to that of Low Imagery subjects [$F(1,10) = 7.6$, $p < .025$]. Moreover, as predicted, only the High Imagery group showed an increase in d' across tests,

and only in the case of the Variant cues, while all other conditions resulted in a decrease in d' with repeated testing. This effect was modest, however, and the interaction fell short of statistical reliability [$F(2,20) = 3.0$, $p = .084$].

Insert Figure 3 here

Figure 4 displays the corresponding values of B, the decision criterion, across tests as a function of retrieval cue and imagery ability. The interesting finding in these data is that High Imagery subjects established different criteria for responding to Identity cues and Variant cues, which were both more relaxed and more stringent, respectively, than the nondifferential criteria set by Low Imagery subjects [$F(1,10) = 5.54$, $p < .05$]. In addition, there was a reliable tendency across tests for High Imagery subjects to increase their decision criterion with Variant cues, while Low Imagery subjects increased their criterion with Identity cues [$F(2,20) = 3.5$, $p < .05$].

Insert Figure 4 here

CONCLUSIONS

These results suggest that individual differences in visual imagery ability play an important role in determining the accuracy of long-term recognition of pictorial stimuli. Regardless of whether recognition was

occasioned by identity cues or variant pictorial cues, High Imagery subjects were significantly more accurate than Low Imagery subjects. In addition, there was very clear evidence of differences in the decision processes of High and Low Imagery subjects. For High Imagery subjects, the stylistic properties of the retrieval cues appear to have been discriminated and thus served to facilitate their recognition judgments. Although this did not result in a greater hit rate, it did produce a significantly lower false alarm rate.

Why should imagery ability influence the utilization of style cues as discriminanda for recognition in the present task? We wish to suggest that the basis for such selective utilization resides in differences in the quality of the memory trace available to High and Low Imagery subjects, since even for the latter subjects, the stylistic differences between the two sets of recognition cues should have been discriminable. In the case of Low Imagery subjects, however, the stored information about the original stimuli may have been inadequate to inform them that cue style was a relevant dimension on which to base their decision criteria. This view could then account for the observation that, by the final recognition test, High Imagery subjects made significantly more false alarms to lures that resembled the identity cues than to lures that were stylistically similar to the variant cues, while Low Imagery subjects responded nondifferentially, at even higher rates, to both sets of lures.

The question of whether hypermnesia is demonstrable in a multitrial recognition paradigm is not yet resolved. The modest intertest increase in $\underline{d}'$ that was observed for the High Imagery group under the Variant cue condition is encouraging, but a larger sample size will be necessary to properly assess the reliability of this result. Also at issue is whether $\underline{d}'$ is an appropriate index for studying hypermnesia in recognition memory, since in the present

study, d′ increments were obtained not by an increase in the hit rate, but by a decrease in the false alarm rate. While this clearly conveys an improvement in the accuracy of memory, it is not strictly comparable to the net memory increase referred to as hypermnesia in the multitrial recall paradigm.

REFERENCES

Erdelyi, M.H., & Becker, J. (1974). Hypermnesia for pictures: Incremental memory for pictures but not words in multiple recall trials. *Cognitive Psychology*, *6*, 159-171.

Erdelyi, M.H., Finkelstein, S., Herrell, N., Miller, B., & Thomas, J. (1976). Coding modality vs. input modality in hypermnesia: Is a rose a rose a rose? *Cognition*, *4*, 311-319.

Erdelyi, M.H., & Stein, J. (1981). Recognition hypermnesia: The growth of recognition memory (d′) over time with repeated testing. *Cognition*, *9*, 23-33.

Marks, D.F. (1973). Visual imagery differences in the recall of pictures. *British Journal of Psychology*, *64*, 17-24.

Paivio, A. (1972). A theoretical analysis of the role of imagery in learning and memory. In P.W. Sheehan (Ed.), *The function and nature of imagery* (pp. 253-279). London: Academic Press.

Popkin, S.J., & Small, M.Y. (1979). Hypermnesia and the role of imagery. *Bulletin of the Psychonomic Society*, *13*, 378-380.

Roediger, H.L., III, & Payne, D.G. (1985). Recall criterion does not affect recall level or hypermnesia: A puzzle for generate/recognize theories. *Memory & Cognition*, *13*, 1-7.

Snodgrass, J.G., & Vanderwart, M. (1980). A standardized set of 260 pictures: Norms for name agreement, image agreement, familiarity, and visual complexity. *Journal of Experimental Psychology: Human Learning and Memory*, *6*, 174-215.

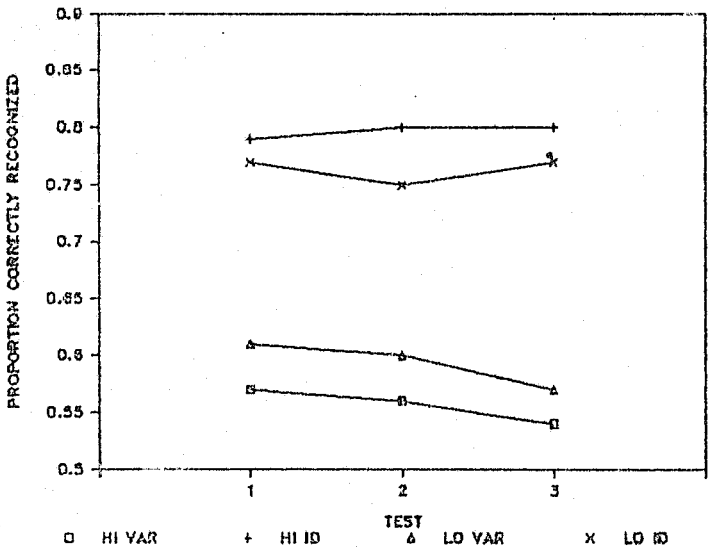
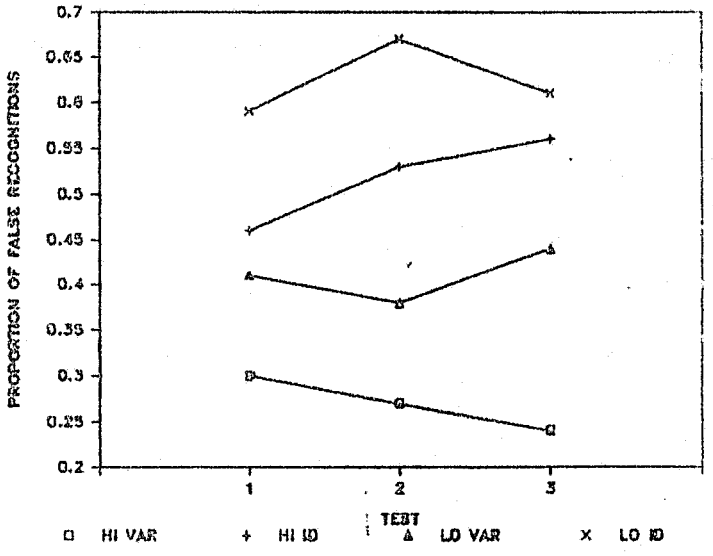


Figure 1



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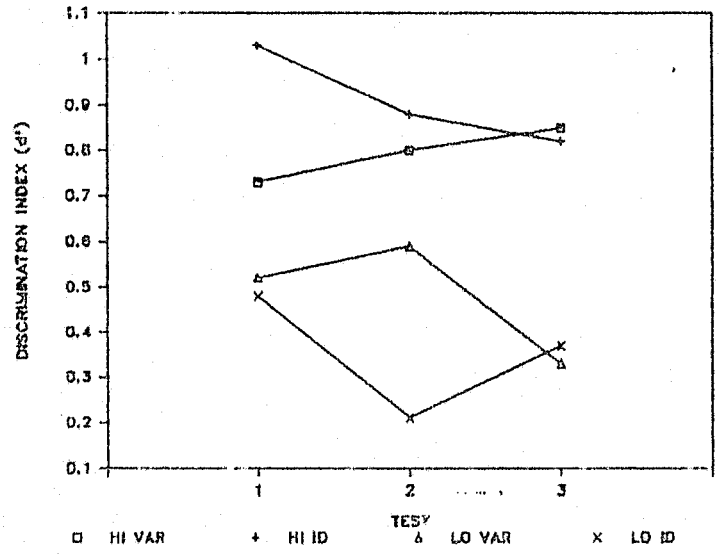

Figure 3

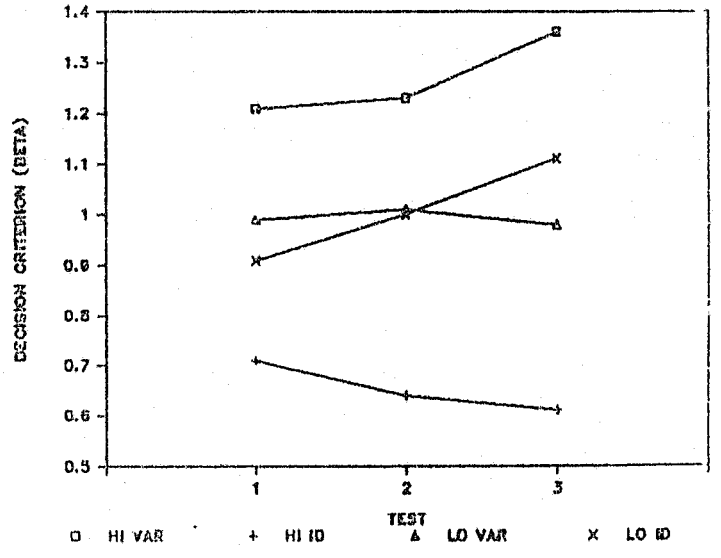

Figure 4