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It was predicted that two variables would influence recognition memory for complex visual stimuli: association values, and the realistic-abstract dimension, or "objectivity". The stimuli were 12 reproductions of realistic paintings (clearly representing real world objects), six of high association value and six of low; and 12 abstract pictures, also evenly divided into high and low association groups. After .5 sec. exposures of each of the 12 realistic (abstract) pictures, subjects attempted to identify the 12 among an array of 60 similar pictures. The overall effects of both objectivity and association value were significant. In addition, a significant difference was found between high and low association abstract, but not between high and low association realistic pictures. The results are discussed in terms of a two-channel encoding model using both imaginal and verbal mediators, with the former being both more basic and more independent. (Author)

VERBAL AND NONVERBAL MEDIATORS IN RECOGNITION[1] MEMORY FOR COMPLEX VISUAL STIMULI

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It was predicted that 2 variables would influence recognition memory for complex visual stimuli: association values, and the realistic-abstract dimension, or "objectivity." The stimuli were 12 reproductions of realistic paintings (clearly representing real world objects), 6 of high association value and 6 of low; and 12 abstract pictures, also evenly divided into high and low association groups. After .5 sec. exposures of each of the 12 realistic (abstract) pictures, S attempted to identify the 12 among an array of 60 similar pictures. The overall effects of both objectivity and association value were significant. In addition, a significant difference was found between high and low association abstract, but not between high and low association realistic pictures. The results are discussed in terms of a 2-channel encoding model using both imaginal and verbal mediators, with the former being both more basic and more independent.

Previous studies (Clark, 1965, 1968; Ellis, Muller, & Tosti, 1966) have found a positive relation between "association value" and delayed recognition of nonsense shapes. In each case, the association value of a stimulus was defined in terms of the proportion of Ss who reported the availability of a verbal label, regardless of whether the label was actually given. Ellis, et al. (1966) further reported that the number of associations given to such stimuli was unrelated to recognition performance. Apparently, then, meaningfulness was a significant variable only to the extent that the stimulus evoked at least one verbal association. However, all meaningfulness values in their experiment were, understandably, very low and the original difference that did exist could easily have been further reduced by the necessity for learning particular (meaningful) labels in predifferentiation trials before the recognition task. Hence, the relation between the associative frequency, or meaningfulness, of complex visual stimuli and later recognition without interpolated experimental manipulations remains to be explored.

It may be assumed that the greater the number of internal mediators available to S, the more effective and accurate his encoding, storage and retrieval of experienced events. This is the essence of Paivio's "conceptual peg" hypothesis (1968). In addition, the number of associations evoked by a stimulus would appear to be a useful index of the size of the verbal pool available for describing or labeling operations. But it appears from the recent literature that not all mediators are verbal in nature. For example, Shepard (1967), using as stimuli colored pictures of real-world objects, found the delayed recognition of pictures better than that for words or sentences, and suggested the operation of an efficient imaginal representation system concurrent with the assumed verbal encoding of the same stimuli. Paivio and Csapo (1968), using simple line drawings of familiar objects, obtained results supporting the hypothesis that free recall and recognition of such stimuli are functionally related to both visual imagery and the verbal symbolic system. They suggested that for such memory tasks interference with either encoding channel results in reduced overall performance. Kaplan, Kaplan, and Sampson (1968), with quite similar stimuli but using reproduction as a recall measure, came to a similar conclusion. It would seem that nonverbal mediators must be considered in accounting for the results of these three studies.

It is assumed that any perceived visual display evokes an image of itself at some point in the perceptual system of the viewer. What properties of such images might be expected to influence recognition memory? Verbal learning studies using nouns as stimulus items consistently indicate that recall is a function of such variables as familiarity, concreteness, and meaningfulness (e.g., Frincke, 1968; Kusyszyn & Paivio, 1966; Paivio, 1965; Smith & Harleston, 1966; Winnick & Kressel, 1965). It is expected that the same qualities can exist for images and that they can be significant factors in recognition memory for nonverbal visual stimuli. Images aroused by highly familiar real-world events might be said to be more concrete, in the sense that they are more stable, have more "thing-like" qualities, and can be more easily summoned up and internally rehearsed, than are the internal representations of novel, ambiguous and "abstract" stimuli. It is to be noted that the specific event need not be familiar--only that it belong to a familiar category.

An appropriate way to test the above speculations is through the use of reproductions of paintings, some clearly representing easily identified objects ("realistic" pictures) and others completely non-objective ("abstract" pictures). We would expect, in general, better recognition memory for realistic than for abstract pictures, and for those pictures that elicit a greater number of word associations.

Method

Stimuli. Sixty postcard-size reproductions of paintings judged by E to be "realistic" and 60 judged "abstract" were the original set from which the experimental stimuli were selected. Half of the realistic (R) pictures and half of the abstract (A) pictures were photographed on 35mm slides. They were projected on a screen for 30 sec. each, while a group of 11 Ss wrote down "as many words as you can that the picture makes you think of." There was a 30-sec. interval between pictures. Different groups of Ss associated to R and to A pictures. The six R pictures which elicited the greatest number of associations were chosen for the HR group of experimental stimuli; the six with the fewest associations were designated LR. Six HA and six LA stimuli were chosen in the same way. The average association value of HR pictures was 5.3; of LR, 4.0; of HA, 4.2; and of LA, 3.0. The list of the 24 experimental stimuli is contained in Table 1.

Insert Table 1 about here

Subjects. Ss for both the stimulus-selection procedure and the main experiment were paid undergraduate students at the University of Michigan. Twenty-two students participated in the association phase, and 20 in the recognition task. The only restriction placed on their selection was that they had no art courses, and that they engaged in no artistic activities on their own. Ss in the recognition task were run individually.

Apparatus. A Kodak Carousel 800 projector was used for projecting the pictures. Exposure timing was controlled by a programmed tape run on an Ampex 351 tape unit. The pictures were projected on a screen 5.5 ft. from the S.

Procedure. All Ss responded to all stimuli. Ten Ss first responded to all the R pictures, followed by the A pictures (order R-A); 10 saw the stimuli in reverse order (order A-R). Stimuli were presented in a different random order for each S. Instructions stated that after he had seen all the R (or A) pictures, he would be asked to identify them in a large group of similar pictures. He was then shown four practice slides (which were different from any of the other pictures he was to see) under instructions that they need not be remembered, in order to facilitate adaptation to the length of exposure. The 12 R (A) stimuli were then exposed under the control of the programmed tape; each picture was seen for .50 sec. and the inter-item interval was .86 sec. S was then taken into an adjoining room, where 60 postcard reproductions of realistic (abstract) pictures were randomly arranged on a large table, and asked to pick out the pictures he had just seen. The interval between original presentation and the recognition task averaged about 30 sec. He was not told how many pictures he had seen, nor was he given any feedback on his recognition accuracy.

S then returned to the experimental room and saw the 12 A (R) stimuli. The conditions for the recognition task were as before, except that the 60 pictures were abstract (realistic).

Results

Table 2 presents the means and standard deviations of the number of correct recognitions for each of the four groups of stimuli. An objectivity x

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Insert Table 2 about here

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association-value x order-of-presentation repeated-measures analysis of variance was performed. The only significant effects were those for objectivity (F [1,54] = 38.19, $p < .01$) and for association value (F [1,54] = 7.88, $p <$ .02). A posteriori tests of the differences between means, using the Newman-Keuls procedure, revealed that all differences were significant at or beyond the .05 level, with the single exception of HR-LR.

Discussion

The results confirm the operation of both variables--association value and objectivity--and support the suggestions of Kaplan et al. (1968), Paivio and Csapo (1968), and Shepard (1967) in providing further evidence of the independent operation of a nonverbal mode of encoding complex visual stimuli. The evidence lies in the fact that the main effect of objectivity was additional to any facilitation of performance that can be identified solely with differences in association values. The point is made most clearly in comparing recognition accuracy for LR and HA pictures: performance in the former case was significantly better despite virtually identical average m values (4.0 and 4.2 respectively).

This inference is consonant with Shepard's (1967) estimation that the lower bound of our storage capacity for visual stimuli ranges from 384 to 669 bits while that for sentences, for example, extends from about 170 to 292 bits. If it were possible to reduce internal representations of complex visual events entirely to verbal terms, differences of this magnitude should not occur. In addition, the obtained results extend those of Paivio and Csapo (1968): just as they found that recognition memory was better for realistic line drawings than for the drawing-labels and for abstract words, so was recognition memory in the present experiment a great deal better for realistic than for abstract pictures. In a sense, the present results are even more striking than theirs because while they found only marginally significant differences in recognition of abstract versus concrete words, the realistic-abstract picture differences are clear.

Instead of assuming, as was done by Kaplan, et al. (1968) and Paivio and Csapo (1968) that the normal mode of cognitive operation calls for encoding nonverbal events both imaginally and verbally in more or less automatic sequential fashion, an alternative interpretation of the results of this and previous studies (Cohen & Granström, 1968; Kaplan, et al., 1968; Paivio & Csapo, 1968; Shepard, 1967) is offered: we encode and store real-world nonverbal events nonverbally, and we are then able to "translate" some of this information into verbal terms. In other words, the retrieval alone is verbal--and maybe then only when the situation specifically calls for a verbal response. This position is quite distinct from Glanzer and Clark's (1964) verbal-loop hypothesis, in that it does not require the verbal encoding of visual events, while accepting that capacity as a supplementary encoding channel.

This suggestion might be seen as an extension of Oldfield's (1966) postulation of a two-stage perceptual process, in which the "familiarity domain" of a new stimulus is first responded to in nonverbal terms followed by naming and labeling operations. What is being added here is the notion that the second stage need not occur for all stimuli, but that storage in the original nonverbal form can take place. It follows that retrieval and rehearsal of these nonverbally represented items is possible. In sum, it is suggested that the internal representation of real-world nonverbal events has a strong--possibly a primary--nonverbal component; verbal input, of course, is represented directly in verbal terms. Such a differentiation would be adaptively efficient and the notion fits our intuition that we do not even covertly name each item in the kaleidoscope of events we encounter in daily life.

It is reasonable to conclude that complex stimuli such as these provide "conceptual pegs" (Paivio, 1968) to which can be hooked a multitude of relations with other components of our cognitive structure and that the number of these relations--insofar as they are verbal--is effectively indexed by the m measure. In addition, congruent with the same model of cognition, there seem to be components which are nonverbal in character. In response to an open-ended question in post-experimental interviews, 60% of the Ss reported that the "thing-like" qualities of the R pictures facilitated later recognition. It cannot be said that the high and low m realistic pictures differed in these qualities. In addition, there was no greater concentration on a relatively few different associations for R than for A items--the type-token ratios were .87 and .91 respectively.

It is worthy of note that the only non-significant difference between recognition means was that between HR and LR pictures. When viewed in the context of a significant HA-LA difference, and almost no overlap in the distribution of recognition scores for R and A stimuli, this suggests the possibility that m (verbal encoding) is a less important variable for realistic, highly familiar events than for novel, ambiguous ones. Using much simpler, but meaningless stimuli, Cohen and Granström (1968) obtained results which they interpreted in much the same way. Their measure of verbal encoding was the inter-personal communication accuracy of Ss' descriptions of the stimuli. This variable, however, correlated .95 with length of description in words--closely comparable to the meaningfulness measure used here.

The knotty problem that remains for future exploration is how we gain access to the contents of a nonverbal storage mechanism and express them in verbal terms. The matter is pertinent--perhaps crucial--to the linguistic relativity question. It is probable that the quite modest correlations customarily found between language and nonverbal cognitive activities are related to the hypothesized operations of a functional nonverbal system of internal representation. Such a system would, by definition, be little affected by language structures--unless a verbal response is called for. Two other factors must also be borne in mind. This nonverbal encoding system might be most salient when Ss are dealing with familiar stimuli, and most experimental studies of linguistic relativity have used just such materials.

Footnote

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Table 1

List of Experimental Stimuli

Realistic pictures	Abstract pictures
Breughel, "The return of the herd"	Baumeister, "Animated landscape"
Breughel, "Winter"	Kandinsky, "Pink composition"
Canaletto, "Eton College"	Marca-Relli, "Summer noon"
Chardin, "The attributes of the arts"	Matta, "Listen to living"
Corot, "Le beffroi de Douai"	Mondrian, "Composition, 1913"
Courbet, "The trellis"	Poliakoff, "Huile"
Dali, "Protrait of Gala"	Pollock, "Number one"
De Hooch, "Boy with pomegranates"	Schneider, "Peinture 65B"
Dufy, "Bunch of anemones"	Singier, "L'été"
Goya, "El bebedor"	Stamos, "Avignon II"
Manet, "The balcony"	Sugai, "Sugata"
Van Ruisdael, "The mill at Wijk"	Van Welde, "Composition 1957"

Table 2

Mean Number of Correct Recognitions as a Function of Objectivity and Association Value

	Objectivity	
Association value	Realistic	Abstract
High		
Mean	4.05	2.85
S.D.	.88	1.27
Low		
Mean	3.60	2.05
S.D.	1.64	1.27