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Mimeticism and the spatial context of a map

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College students studied a labeled map for either 2.4 or 4.8 min, either with or without the presence of mimetic drawings of the features. Availability of drawings made no difference in either the amount or categorization of free recall. On map-cued recall, subjects in the shorter exposure group who saw drawings remembered significantly more correctly located features and produced more feature representations than subjects in the longer exposure condition. The data support a mediator discovery explanation that treats time as the primary determiner of effective locational mediation.

Research concerning how maps are learned and remembered has dealt mostly with the perceptual characteristics of the map stimuli (Halpren, Fishbein, & Warm, 1979; Maki, Maki, & Marsh, 1977). Generally, little attention has been paid to how people represent cartographic map structures or to what types of information are retained when maps are viewed as simultaneous units for longer exposure times.

In the present study, our interest was in how the spatial context of a map influences feature memory for both verbal recall and spatially cued recall. In the typical case, in which feature labels are accompanied by a mimetic drawing of the feature, we agree with Paivio (1971) and his associates and predict superior performance relative to a label-only condition, at least for a verbal free recall task. We were also concerned with the interaction between stimulus exposure time and degree of mimeticism. Work with verbal mediators indicates that mimetic drawings should have their greatest effect with shorter exposures (e.g., Schultz & Lovelace, 1964). When time is short, the presence of a descriptive image should allow subjects to directly encode the verbal-pictorial unit, simply because they have too little time to create an appropriate storage device of their own. We also included a map-cued recall in order to determine whether or not similar relationships exist when the original spatial context is available as a retrieval cue.

Finally, our map features were selected for their ease of categorization. In the case in which only verbal labels are available, subjects should show a stronger preference for semantic-based tactics such as clustering, rather than attempt to develop an individual encoding strategy for each feature. This position is similar to that of Kulhavy and Heinen (1974), who argue that order-based strategies such as clustering are more likely to occur when unit-based strategies (e.g., imagery) are not directly available.

METHOD

Design and Subjects

The design was a 2 by 2 factorial, containing two levels of presentation format (labels and pictures vs. labels alone) and two levels of exposure time per map feature (3.4 vs. 6.8 sec).

The subjects were 59 undergraduate volunteers attending Arizona State University. Subjects were randomly assigned, 14 to each factorial cell, in order of their appearance for the experiment. Three subjects were dropped from the study for failure to follow procedural instructions.

Materials and Procedure

The map structure used in the experiment was designed to portray a set of six city blocks and consisted of a 3 by 2 rectangular grid containing six equal-sized squares. Each grid line was drawn as a two-lane road, with column roads labeled alphabetically as streets (A Street, B Street, etc.) and row roads labeled numerically as avenues (1st Avenue, 2nd Avenue, etc.). The original grid was drawn in black India ink on 24 x 18 in. white cardboard. Thirty-six highly concrete verbal labels were selected from various frequencies of the Battig & Montague (1969) category norms, with six labels chosen from each category grouping: buildings for religious services, types of human dwellings, occupations/professions, natural earth formations, sports, and the three plant categories. The only restriction applied in choosing the labels was that they be amenable to graphic representation. A professional artist produced an 8 x 10 in. line-detail drawing of each label referent, and a panel of three judges evaluated each drawing to assure that it represented a common conception of the item named and that it was clearly differentiated from the other items in the same category. After several rounds of redrawing and modification, all items were judged to meet the two criteria, and the 36 final drawings were photoreduced proportionately until all were about 1/18 the size of an individual square in the master grid. One drawing from each category was randomly assigned to each of the six grid squares, and the items were distributed evenly over the surfaces, with no obvious replication of pattern across squares. The completed map structure was photoreduced, either with or without drawings, to 8 x 10 in. size for use in the experiment. In both reductions, the labels were identical in form and placement; the only difference was that one set contained a mimetic drawing for each label and the other set did not. A third reduction was used in the cued recall task and consisted only of the grid boundaries without labels or drawings.

From 5 to 20 subjects participated in each experimental session, with individuals from both presentation conditions present in every group. As they arrived for the study, each subject received a packet from a random stack that contained a labeled map, either with or without drawings, and a direction sheet that was identical for all groups. When subjects were seated, they both read and heard the standard instructions telling them that they would see a map, have several minutes to study it carefully, and be tested over its content after learning. At the starting signal, each subject turned to the map and had either 2.4 or 4.8 min in which to complete his study. At the end

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of the specified time, the maps were removed and replaced with a sheet instructing the learners to count backward by fours from 100 and to write their responses on the paper. The interpolated task lasted exactly 1 min to preclude recall from STM, and subjects then received a free recall test consisting of a sheet of lined paper on which they were given 10 min to write as many of the map features as they could remember. Following free recall, subjects were given a copy of the blank grid and were allowed a second 10 min to write in as many of the map features as possible. The cued recall instructions stressed that subjects should try their best to place the features in the same locations as on the original map.

RESULTS AND DISCUSSION

All test statistics reported here were evaluated at $\alpha = .05$. The free recall sheets were scored for words correctly recalled, excluding intrusions and repetitions. A 2 (presentation) by 2 (time) ANOVA on words free-recalled yielded significance only for the time main effect [$F(1,52) = 15.67$, MSe = 50.23]. The means and standard deviations for this analysis are shown in the top half of Table 1. Contrary to previous data, the word-picture combinations were recalled no better than were words alone. Since most studies showing word-picture superiority have used essentially a paired associate methodology, it is possible that presenting the individual stimuli within a diffuse spatial context works in some fashion to equalize the effect of the associated drawings.

We next assessed the degree of free recall organization by calculating adjusted ratio of clustering (ARC) values for both conceptual and spatial groupings (Roecker, Thompson, & Brown, 1971). For conceptual ARCs, we measured clustering, using the six original norm groupings from Battig and Montague (1969). A 2 (presentation) by 2 (time) ANOVA on conceptual ARCs showed only that clustering increased with longer exposure times [$F(1,52) = 4.40$, MSe = .10]. The conceptual ARC means and standard deviations are displayed in the bottom half of Table 1. Spatial ARCs were next calculated to assess the possibility that subjects used the map grid itself as a vehicle for organization. Here, we computed the ARC values based on item membership in a particular grid square; all features in (say) Square 11 were considered to belong to the same spatial category. The results of this analysis were disappointing, since the spatial ARC means were near zero for all conditions. Obviously, whatever spatial cues subjects used to encode the map information, they were not keyed to the organization provided by the grid structure. The presence of the mimetic drawings made little apparent difference in either the amount or the type of organization used in free recall.

Table 1
Means and Standard Deviations for Free Recall and Conceptual ARCs

Variable		Seconds per Feature: Pictures and Labels 3.4	6.8	Labels Only 3.4	6.8
Free Recall	Mean	16.71	23.00	14.42	23.14
	SD	5.51	6.89	6.90	8.68
Conceptual ARCs	Mean	.27	.49	.23	.53
	SD	.10	.08	.13	.11

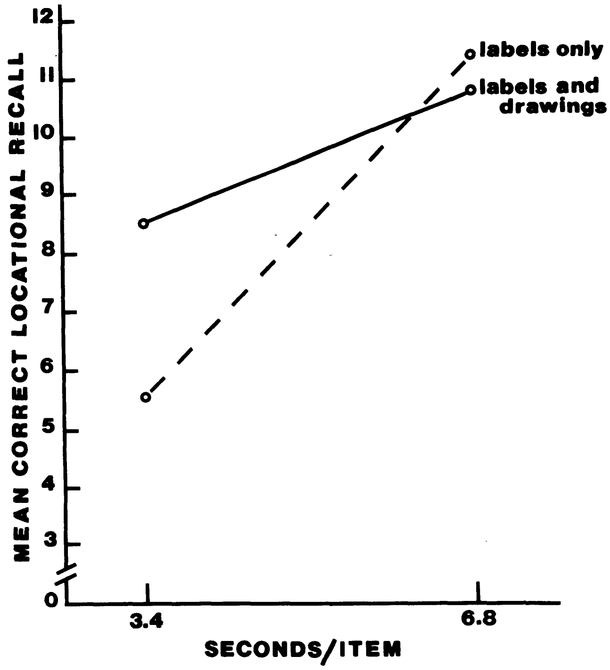

Figure 1. Presentation Condition by Exposure Time interaction.

Our analysis of the cued recalls was concerned only with those responses produced in the correct spatial location on the test grid. Scoring of cued recall was accomplished by placing a transparent overlay of the original map over the test grid for each subject. A recalled feature was counted as correct if it overlapped more than 50% with the same feature on the scoring template. A 2 (presentation) by 2 (time) ANOVA on correctly placed features was significant for the time main effect [$F(1,52) = 6.44$] and for the Presentation by Time interaction [$F(1,52) = 8.01$, MSe = 33.55], which is plotted in Figure 1. A test of simple effects on the means contributing to the interaction showed significantly better memory for the label-picture condition at 3.4 sec, but no difference between groups at the 6.8-sec interval.

Our results indicate that increases in locational recall for the group seeing mimetic drawings is limited to more rapid exposure times, at least with the restricted intervals used in this study. One explanation for the higher performance at shorter times lies close to our initial contention that whether or not subjects use provided mediators at encoding depends on the time allotted during learning. We reasoned that subjects in the 3.4-sec condition lacked the time needed to produce appropriate mediational devices for spatially based storage and were thus more likely to encode the feature-location compounds as intact units within the map context. Conversely, when only labels were available at the shorter time, subjects were at a disadvantage, since they could neither appropriate nor produce a useful mediator for marking the feature location in memory. At the longer exposure interval, people in both presentation conditions were able to generate mediational devices consonant with their own requirements, and the initial advantage of the mimetic representation was lost. As one test of this interpretation, we returned to the cued protocols from the groups who saw drawings and counted the number of times subjects produced drawings in addition to the labels correctly placed on the map. Although subjects were not instructed to include drawings as a part of their response, the mean number of recognizable efforts was 5.31 for the 3.4-sec group and only 1.48 for the 6.8-sec condition: an unquestionably significant difference in favor of the shorter time interval [$t(26) = 27.10$]. No subject produced a drawing on the free recall task.

The cued recall data support the argument that map features are first encoded as intact label-picture units in order to preserve the locational context of the original presentation. As the exposure interval increases, subjects probably have time to produce idiosyncratic devices to replace the mimetic feature supplied in the drawing. This hypothesis explains why the two time groups are virtually equivalent at longer study intervals. Substantially more labels were remembered in free than in cued recall, but the advantage for the mimetic drawings lay only in memory for spatial locations. This data suggests that verbal and spatial encoding may involve different processes, or at least different priorities, during the learning of a map structure. Both the results and our explanation do emphasize that figural characteristics work to maintain relational context, at least in the case in which a recall task demands performance that is spatially isomorphic with the original stimuli.

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