Representational storage in picture memory*

STEPHEN MADIGAN

University of Southern California, Los Angeles, California 90007

Just as subjects can be highly accurate in identifying the original sense modality of presentation of words, they are also easily able to remember whether items were originally presented in verbal or pictorial form. This finding suggests some representational storage in terms of symbolic as well as in terms of sensory modality.

This note reports the results of a study of the preservation of information about the format of items from mixed lists of words and pictures. The experiment was basically an extension of the techniques that have been used in a number of studies of the retention of modality information in immediate memory tests (Kirsner, 1974; Madigan & Doherty, 1972). In the Madigan and Doherty study, for example, mixed-modality (auditory-visual) lists were presented, and subjects were required to recall both words and the presentation format of recalled words. Like the results of Kirsner's experiments, using a recognition procedure, the results strongly indicated the storage of information about sense modality of input over time periods generally regarded as exceeding the limits of short-term sensory storage. The present results show that memory for the *symbolic* modality (word or picture) is at least as good as that for sensory modality; in this sense, there seem to be some clear representational aspects of picture memory.

METHOD

Design and Procedure

The basic method was very similar to one used by Madigan and Doherty (1972). Subjects were presented with a number of lists that contained six different kinds of events: items presented twice in either picture (PP) or word (WW) form; items presented once in each form, in one order or the other (PW, WP); and items presented as words (W) or as pictures (P) once only. An immediate free recall test followed list presentation, with subjects required to recall names of items, and also to identify all recalled items by specifying one of the six categories described above.

In each list, there were four replications of each of the repeated events (PP, PW, WP, WW), and four of the nonrepeated (P, W) making 24 types (different items) and 40 tokens (total item presentations) per list. The lists actually consisted of two blocks of presentations. In the first block, there were 10 pictures and 10 words. Four of the pictures were presented in the second block as pictures again, and four as words; the other two did not occur again in the list. There were two new once presented pictures in the second block of the list. The same was true of words in the first block; they were either repeated in the second block, repeated in the new format, or did not occur again in the list. There were no buffer items; instead, subjects performed a brief (auditory) digit-span test following list presentation. Each

subject was tested with three such lists; there were four random sets of lists, with random assignment of items to picture or word formats in each.

The lists were presented at a rate of one item every 3 sec. Slides showed either a colored line drawing of a common object, or a word. There were actually two variants of this basic proceudre. In one, subjects were required to generate and recall their own labels for pictures. In a second version of the procedure, auditory labeling of pictures and words was used, with a stereophonic tape recorder and sound synchronizer controlling presentations. (The purpose of this labeling was to reduce the variability in naming across subjects with picture material. The labeling per se appeared to have no effect at all on performance, and subsequent presentation and discussion of results is based on data combined over the two methods). The recall tests were written; subjects had 3 min to recall as many items as possible. As they recalled each item, they circled one of six alternatives listed on the recall sheets (PP, PW, WP, P, W). Both kinds of tests were precued; prior to list presentation, subjects were informed that they had to remember items and their format. They were also fully instructed as to the nature of the events in the list.

Subjects

A total of 70 subjects were tested, 30 with the unlabeled slides procedure, and 40 with the auditory labeling procedure. Testing sessions were conducted with small groups of not more than five subjects each.

RESULTS AND DISCUSSION

Recall Effects

There are a number of features of interest in the effects of presentation format on recall frequency. The rightmost column of Table 1 shows total recall frequency for the six kinds of items; the maximum total possible was 840 (70 subjects x 12 items.) These results clearly show the usual superiority of pictures over words

Table 1
Distribution of Item Identifications (Percentage)

Type	Identification						Recall Totals
	PP	PW	WP	WW	P	W	
PP	92.7	1.6	1.8	0.3	3.5	0.0	548
PW	8.1	65.4	14.8	1.1	9.8	0.7	540
WP	3.0	9.5	70.3	2.4	12.3	2.4	496
WW	0.2	3.2	3.5	74.4	1.7	16.9	402
W	4.1	4.5	4.1	0.0	84.2	3.0	266
P	0.0	0.6	1.8	3.7	3.1	90.7	161

(e.g., PP vs WW, and P vs W). They also indicate that presentation order of mixed item types (PW, WP) had some effect, with recall scores greater for PW than for WP. A single-factor analysis of variance with repeated measures on the four kinds of twice-presented items indicated significant variation among the means [$F(3,207)$ = 21.65, $p < .001$]; the only paired comparison of means that was not significant by the Newman-Keuls test was the comparison of PP and PW ($p > .20$). This result may be similar to the finding that picture facilitation of paired-associate recall occurs when the pictorial version of a paired-associate stimulus is presented before, but not after, presentation of the pair in word form (Wollen & Lowrey, 1974).

Format Identification

The entries in the body of Table 1 are percentages of each type (rows) that were assigned the various identifications (columns). There was a small number of missing observations due to failures to identify recalled items (a total of 13 over all subjects and lists); these have not been included in the recall totals. The entries on the negative diagonal are the proportions of correct identifications. These data strongly indicate that the discrimination among recalled items was an easy one; the largest entry by far from each row is for the correct classification. While it involves a comparison of two different experiments, these data also suggest that discrimination on the basis of symbolic modality was easier than a discrimination on the basis of sensory modality of presentation (cf. Madigan & Doherty, 1972). For example, virtually all (99.7%) of the identifications for recalled pictures contained a judgment that the item had been presented at least once as a picture (i.e., collapsing over PP, PW, WP, and P identifications for repeated pictures). Wells (1973) has reported a similarly high level of accuracy for picture-word discriminations following a series of Brown-Peterson trials.

Plainly, in an immediate recall task, subjects have very little difficulty in remembering if the verbal labels they recall correspond to items originally presented in a verbal or pictorial form. To the extent that these results can be regarded or evaluated in the same way as studies of retention of modality of information (cf. Kirsner, 1974), they suggest a kind of representational storage in terms of symbolic modality. The results are also consistent with those of studies that show preservation of information about structural features of pictures in memory (e.g., Madigan & Rouse, in press). One of the consequences of the storage of information about symbolic format may be some improvement in the efficiency of the recall editing process. Wells (1973) found many fewer extra-experimental instrusions in recall following presentation of picture triads as compared to word triads; and in comparison of free recall of word lists and picture lists, Madigan, McCabe, and Itatani (1972) found more than twice as many intrusions for the word lists.

Finally, it may be of interest to compare the present results to what happens when subjects are directed to encode verbal material using imaginal or verbal (sentence) codes and are subsequently tested for retention of information about the coding procedure. Anderson and Bower (1973), noting that subjects are relatively poor at remembering the original encoding format, conclude that the basic or more permanent mode of internal representation is abstract or propositional. The present results may not be so easily interpreted in these terms.

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