Bulletin of the Psychonomic Society
1990, 28 (1), 1-3

Extension of the picture-superiority effect over multiple lists

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In general, pictures are freely recalled better than words, but results of a pilot experiment indicated that this picture-superiority effect diminished with successive lists. We report here an experiment in which we investigated how the diminution over lists would respond to manipulation of rate of presentation and list length. Although the diminution over lists did not replicate, the experiment serves to extend the generality of the picture-superiority effect.

Are pictures remembered better than words? The results of the many studies contrasting recall performances for these two types of stimuli seem to suggest that they are (e.g., Nelson, Reed, & Walling, 1976; Pavio & Csapo, 1969, 1973). However, the research reported here pursued a finding that suggested that this conclusion may not be as generalizable as it may first appear. Specifically, the results of a pilot experiment suggested that the superiority for recall of pictures over words disappears after the first trial in a series. As we will see, this pilot result did not stand up under further examination, but our examination did help to fill a large gap in the picture-superiority literature.

Many studies have examined the difference in memory performance for pictoral stimuli and written verbal stimuli. Although there have been variations on the fundamental experimental theme, the central findings have been remarkably robust: In a free recall paradigm, pictures are consistently remembered better than words, whereas in serial recall this relationship is either absent or even reversed (Pavio & Csapo, 1969; Pavio, Philipchalk, & Rowe, 1975).

Nonetheless, the results of a pilot study led us to question the generality of this conclusion regarding free recall. In the pilot study, each subject freely recalled 18 lists: 6 lists of auditory words, 6 lists of written words, and 6 lists of pictures. Surprisingly, we found that only the first list in each group of six produced a significant difference in recall between pictures and written words. Given the large body of literature supporting the picture-superiority effect, this seemed to be a striking finding. However, a subsequent review of experiments comparing free recall for pictures with free recall for written words (Fischler & Puff, 1971; Kaplan, Kaplan, & Sampson, 1968; Lieberman & Culpepper, 1965; Nelson, Reed, & McEvoy, 1977; Nelson et al., 1976; Pavio & Csapo, 1969, 1973; Pavio et al., 1975; Sampson, 1970; Scott, 1967; Shepard, 1973; Weldon & Roediger, 1987) revealed that only one (Pavio et al., 1975) had included more than one list per subject. Importantly, Pavio, Philipchalk, and Rowe report an "uninterpretable triple interaction" involving the trials factor, but, unfortunately, they dismiss this as theoretically uninteresting and fail to elaborate further on the other factors involved. Thus, the possibility existed that the picture-superiority effect was not generalizable across a series of lists and that previous research had ignored this possibility.

One aim in the present experiment was to attempt to replicate the finding from the pilot experiment that recall of pictures is superior to recall of written words for only the first list of a series. A second aim in this experiment was to explore the generality of this result across the manipulation of two independent variables that have been demonstrated to have a large effect of memory—namely, list length and rate of presentation.

METHOD

Subjects

One hundred forty-four University of Wisconsin-Madison undergraduates enrolled in introductory psychology courses participated in the study to fulfill a course requirement.

Materials

One hundred forty-four concepts with high name-agreement ratings were selected from the norms developed by Snodgrass and Vanderwart (1980). The pictorial stimuli were slides of line drawings of these concepts. The word stimuli were slides of the words printed in lowercase typeface. The concepts were randomly assigned to six lists of 24 items each, with the provision that homophones and semantically similar words be separated as much as possible.

Design

The within-subjects factor was list modality; each subject saw six lists, three composed of pictures and three composed of written words. The three lists in each modality were blocked. The three levels of the between-subjects factor, length/rate, were : short list/fast rate, short list/slow rate, and long list/slow rate. The long-list condition contained lists of 24 items, and the short-list conditions included only the first 12 items from the long lists. The fast presentation rate was 1.5 sec per item, and the slow rate was 3.0 sec per item. In addition, a number of counter-

This work was supported by National Science Foundation Grant BNS 8416300 to Arthur Glenberg. We wish to thank Tim Courtney and Teena Wilson for their help in collecting and scoring the data. Requests for reprints should be sent to Arthur Glenberg, Psychology Department, University of Wisconsin-Madison, 1202 West Johnson Street, Madison, WI 53706.

Table 1
Proportion of Concepts Freely Recalled from Each of Three Lists

	Proportion Recalled											
	List 1 Position*				List 2 Position				List 3 Position			
Length Rate†	1	2	3	*M*	1	2	3	*M*	1	2	3	*M*
Short/Fast												
Pictures	.734	.542	.651	.642	.541	.479	.672	.564	.588	.458	.660	.569
Words	.713	.453	.609	.592	.604	.380	.609	.531	.651	.385	.578	.538
Short/Slow												
Pictures	.781	.604	.765	.717	.791	.630	.719	.713	.687	.594	.744	.675
Words	.802	.489	.640	.644	.713	.522	.614	.616	.703	.510	.682	.632
Long/Slow												
Pictures	.534	.492	.591	.539	.458	.422	.604	.495	.482	.484	.604	.532
Words	.469	.409	.487	.455	.453	.357	.487	.432	.479	.375	.523	.459

*Position refers to serial position of thirds of the lists. †The short list length was 12 items, and the long list length was 24 items. The fast rate was 1.5 sec for each item, and the slow rate was 3.0 sec for each item.

balancing factors were introduced. The order of the two modalities was counterbalanced, as was the order of the three lists in each modality. Finally, the set of three lists assigned to each modality was counterbalanced—that is, the same concepts were presented equally often as pictures and as words. The resulting 36 between-subjects conditions (3 length/rates × 2 orders of modalities × 3 orders of lists × 2 sets of lists) were randomly assigned to 36 groups of subjects. Each group consisted of 2 to 5 subjects.

Procedure

The subjects were given standard free recall instructions and forewarned about the length/rate values as well as the two different modalities. Each trial was preceded by the experimenter's saying "ready," followed by the appearance of a row of asterisks on the screen and then the list items. The last item was followed by a row of question marks, which served as the recall signal. A total of 90 sec was allowed for written recall after each list.

RESULTS AND DISCUSSION

The results of the most interest are presented in Table 1. Note that unlike in our pilot data, there was a picture-superiority effect at each list for each length/rate condition. An ANOVA with the following factors was applied to the data: modality (picture vs. words), list number (1-3), length/rate condition (short/fast, short/slow, long/slow), and serial position (summary percent recalled scores were computed for the first ⅓, middle ⅓, and final ⅓ of the list). There was a main effect for modality [$F(1,141) = 43.72$, $MS_e = 0.0059$, $p < .0001$], indicating better overall performance for pictures over written words, list number [$F(2,282) = 11.44$, $MS_e = 0.0037$, $p < .0001$], indicating a decrease in performance across lists, length/rate condition [$F(2,141) = 45.57$, $MS_e = 0.0175$, $p < .0001$], indicating the predictable effects that shorter lists and slower presentation rates lead to better recall, and serial position [$F(2,282) = 94.18$, $MS_e = 0.6819$, $p < .0001$], indicating a standard serial position effect with poorest recall of items from the middle of the list. We were mainly interested in the interactions, particularly that involving modality and list number. However, this interaction and all other interactions pertinent to the experimental hypothesis were nonsignificant (all Fs < 1.47, all ps $> .23$), indicating that the differences between recall for pictures and written words did not vary as a function of list number and, thus, that the picture-superiority effect did not significantly diminish after the first list. Indeed, the modality × list-number interaction remains nonsignificant when analyzed separately for each length/rate condition.

Although we did not replicate our pilot results, these data do serve an important function. The picture-superiority effect has been used as a tool in the development of theories of mental representation (e.g., Pavio, 1971; Nelson et al., 1977). Therefore, it is important to explore any possible limitations this phenomenon may have. On the basis of the results of our pilot study and our review of the picture-word literature, the possibility existed that the picture-superiority effect might not be generalizable beyond the first list in a series. The results of this experiment demonstrate the generality of the picture-superiority effect beyond a single list, and thus serve to extend our confidence in this central principle.

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(Manuscript received June 19, 1989.)