

Incidental learning with "omitted" context cues¹

ISABEL M. BIRNBAUM

UNIVERSITY OF CALIFORNIA, IRVINE

In a paired-associate learning task, context stimuli were present on study trials and absent on test trials. The context stimuli were then used as stimuli on a transfer task in one of three paradigms: A-B, A-B; A-B, A-Br; A-B, C-D. Performance on the transfer task indicated that associations had been formed between context stimuli and the appropriate responses on the original list.

Several recent studies have investigated the effect of context stimuli on paired-associate learning (e.g. Hill & Wickens, 1962; Saltz, 1963). Saltz (1963) found that colors which surround verbal stimuli on study trials facilitated learning, even when the colors were absent on test trials (C-NC condition). It was suggested that facilitation under this condition is a result of acquired distinctiveness of the verbal stimuli, since the colors are not present to serve as additional cues on the test trials. It is also possible that color facilitates learning in the C-NC condition via mediation, i.e., on the test trials the verbal stimulus leads to covert elicitation of the appropriate color name, providing an additional cue for the response.

Birnbaum (in press) found that during C-NC learning, associations develop between (1) the verbal stimulus and the context stimulus, and, (2) the context stimulus and the appropriate response. These results may be described as instances of incidental learning, since the instructions for original learning (OL) do not prepare S for any subsequent test of information about the context cues (Postman, 1964). Furthermore, the instructions as well as the omission of the context cues on test trials make it clear that S's task is to learn to respond to the verbal stimulus alone. Incidental learning which involves context cues might contribute to the facilitation which was observed in the C-NC condition (via the mediational chain described above).

Results of the prior studies might be restricted to the situation in which color, a salient feature of the compound stimulus, is used as the context cue. The present study investigated the generality of the findings on incidental learning, especially with respect to a different class of context stimuli. New materials were used on both the stimulus and response sides, and the context cues were single letters instead of colors.

Method

Ss learned a list of eight paired-associates to a criterion of one perfect recitation, and were then given 10 trials on a transfer list (described below). The pairs in OL consisted of eight numbers (2 through 9) as stimuli, and eight different states of the U.S. as responses. When context stimuli (single letters) were used in OL, they were shown with the numbers

on study trials, and were absent on test trials. The letters appeared half of the time above and half of the time below the numbers. Ss were fully instructed about the nature of the study and test trials, and were told their task was to call out the name of the appropriate state when each number was shown alone on test trials.

For convenience in discussion, two sets of first-list associations will be defined: (1) primary associations (the pairs which S is instructed to learn, number-state), and (2) contextual associations (letter-state). At the end of OL, Ss were given a transfer task which consisted of eight letter-state pairs. The relationship between the contextual associations in List 1 and the letter-state pairs in List 2 will define the four conditions. Group I was an A-B, A-B group: the letters from List 1 became the primary stimuli in List 2, and each letter was paired with the response with which it had appeared on study trials in OL. Group II was an A-B, A-Br group: the letters from List 1 became primary stimuli in List 2, but each letter was paired with a state from List 1 *other than* the state with which it had appeared on study trials in OL. Group III was an A-B, C-D group: The letters which were used as context stimuli in List 1 were replaced with different letters for primary stimuli in List 2, and the states from List 1 were replaced with different states in List 2. For Group IV, there were no letters present in OL on either the study or test trials, but the first-list task was otherwise the same as for the other groups. Group IV was run in order to investigate the effect of letters as context stimuli on speed of OL. Group IV was also given the transfer task, and the paradigm is most similar to Group III, A-B, C-D, with the exception that the A-terms, a set of different letters, had not appeared at all during first-list learning.

There were four different transfer lists and each list was used equally often in each group. Four corresponding lists for OL were constructed for each group to form the required transfer paradigm. Lists were presented on a Stowe memory drum at a 2-sec. rate with a 4-sec. intertrial interval. Alternate study and test trials were used. Four different orders of presenting the pairs were used equally often as starting orders. Ss were undergraduates at the University of California, Berkeley. They were assigned to groups in blocks of 4, with each group represented one time in each block. The assignment to groups, lists, and starting orders was determined by a table of random numbers. There was a total of 16 Ss in each of the four groups.

Results and Discussion

Original learning. The mean numbers of trials to criterion in OL ranged from 8.3 to 10.5, and there were no significant differences among groups ($F < 1.00$, $df = 3/60$). Thus, there is no evidence that the learning of number-state pairs was facilitated by the addition of a context cue on study trials. It may be that the colors used as context cues by Saltz (1963) were effective because they provided more salient cues than did the letters used in the present study. However, other important differences between the two studies should be noted: (1) Materials—word-nonsense syllable pairs vs. number-state pairs to be learned, and (2) Measure of learning—number correct on a constant number of trials in OL vs. number of trials to criterion.

Transfer. Although the context cues made no difference in speed of acquisition, performance on the transfer list shows that there was incidental learning with respect to the context cues and appropriate responses. There was a significant difference between groups in mean number of correct responses on the first trial of transfer ($F = 3.31$, $df = 3/60$, $p < .05$). Table 1 shows the mean number of correct responses on trial 1 and trials 1-5 on the transfer list. Group I (A-B, A-B) gave significantly more correct responses than did Group II (A-B, A-Br) on the first trial ($p < .05$, Duncan Multiple Range Test). Thus, when contextual associations from the first task become the primary associations in transfer, Ss show better performance than when the context cues and response terms are re-paired on the transfer task. Group III (A-B, C-D) was intermediate between Groups I and II, but did not differ significantly from either group ($p > .05$). It is interesting to note that Group IV, which had no con-

text stimuli (i.e. no letters) during OL, did as poorly as did Group II (A-B, A-Br) on the first trial of transfer. It had been expected that Group IV would be closest (in transfer) to Group III, since the transfer paradigm in Group IV is closest to the A-B, C-D paradigm. The superior performance of Group III suggests that there is some beneficial effect of either (1) having a compound stimulus on study trials in OL, or (2) having some exposure to letters during OL.

For mean number correct on trials 1 through 5, there was also a significant difference between groups ($F = 4.08$, $df = 3/60$, $p < .05$), and the comparison between Groups I and II falls short of significance ($.05 < p < .10$, Duncan Test). The acquisition curves showed convergence during transfer, and when total correct over all 10 trials is considered, there are no significant differences between groups ($F < 1.00$).

Early performance on the transfer task shows that associative connections were formed between context stimuli and appropriate responses during OL when context stimuli were not present on test trials. It should be noted that the associations may be direct (letter-state), or may be mediated (letter-number-state). These results indicate that the possible role of associative factors in the "Context-No Context" condition must be further investigated before differences in learning with context cues can be attributed to the acquired distinctiveness of stimuli.

References

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Note

1. This study was carried out at the Institute of Human Learning, University of California, Berkeley. The research was supported by a USPHS Postdoctoral Fellowship (MH13, 474).

Table 1. Mean number of correct responses on the transfer list

Group	Trial 1	Trials 1-5
I	3.8	29.4
II	2.4	25.0
III	3.2	28.0
IV	2.4	26.6