Bulletin of the Psychonomic Society
1974, Vol. 2 (4B), 426-428

Compounding of discriminative stimuli from the same and different sensory modalities which maintain responding on separate levers

LAURENCE MILLER
Western Washington State College, Bellingham, Washington 98225

Rats barpressed for food during light or tone or two separate lights. Each stimulus maintained responding on a separate lever. In Phase 1, one lever and its correlated stimulus appeared during a session. In Phase 2, both levers were concurrently exposed and each stimulus appeared. When light and tone were combined in Phase 1, responding increased with either lever exposed. Responding also increased during compounding in Phase 2, but nearly all responses occurred on the light-correlated lever. When the two lights were combined in Phase 1, no change in responding occurred with either lever present, regardless of the intensity of each light. No change in responding also occurred during compounding in Phase 2 with lights of different intensity. However, responding increased significantly with lights of equal intensity. There was no significant difference in the number of responses emitted on each lever with either set of intensities.

If separate discriminative stimuli (S^Ds) maintain similar rates of responding for food on the same single response lever, their compound will produce a rate of responding greater than that maintained by either S^D alone. This additive summation has occurred with S^Ds from the same or different sensory modalities (Miller, 1971; Weiss, 1964, 1972). Miller (1973) used light and tone S^Ds which each maintained responding on a separate lever. Either only one lever was exposed at a time or both levers were always present (also see Meltzer & Masaki, 1973). The results obtained in each of these situations when the S^Ds were combined were interpreted as showing dominance of and preference for light and its lever. Additive summation occurred only in the presence of the light-correlated lever when only one lever was present; and, when both levers were present, most responses occurred on the light-correlated lever.

In the present experiments, separate levers and stimuli from the same (two lights) as well as different sensory modalities were used. Of concern was (1) whether the same preference for light and its lever would occur with both levers exposed if increased responding occurred in the presence of *both* the light- and tone-correlated levers when only one of these levers was present, and (2) whether similar patterns of dominance and preference for a light S^D and its lever would also occur when the S^Ds came from the same modality.

METHOD

Subjects and Apparatus

Twenty-nine experimentally naive male Holtzman albino rats, 150 days of age, were maintained at 85% of free-feeding weight. Grason-Stadler operant chambers equipped with two retractable levers were used. The light and tone sources were located 6.7 cm above the translucent roof, 10.5 cm from the right side wall and equidistant from each lever. The frequency and amplitude of the tone were, respectively, 1500 Hz (0.0002 dynes/cm²) and 8 dB above the 74-dB ambient noise level. The intensity of the light was 61.2 cd/m² (18.0 fc). When both S^Ds were lights, each light was located on the outside of the roof, directly above its correlated lever. The lights were either of equal or different intensity. Within each of these conditions, two different sets of intensities were used. Both lights were either 61.2 cd/m² or 41.5 cd/m² (12.2 fc), one light was 41.5 cd/m² and the other light was 102.0 cd/m² (30.0 fc), or one light was 61.2 cd/m² and the other light was 225.1 cd/m² (66.2 fc). When the light and tone were used, a houselight of 46.6 cd/m² (13.6 fc) intensity remained on throughout the session to prevent the light from overshadowing the tone during compounding (Miller, 1973). The houselight was located at the front upper left-hand corner of the box. No houselight was used when both stimuli were lights.

Procedure

After pressing was shaped on each lever, the first response emitted after 30 sec in the presence of an S^D was reinforced with a single Noyes 45-mg pellet (a fixed-interval or FI 30-sec schedule). Responses emitted in the absence of an S^D were not reinforced (S^Δ). A period of S^Δ occurred after each S^D-FI presentation. The average duration of S^Δ was 35 sec, and responses emitted during S^Δ prolonged it for 10 sec. Daily sessions lasted 1.5 h. Each S^D was correlated equally often with the left and right levers across Ss.

In Phase 1, only one S^D and its lever appeared during a session. Each lever and its S^D appeared on alternate days. In Phase 2, both levers were concurrently present and each S^D was presented in random order. A response on the lever correlated with the S^D that was present was required to obtain food after the FI timed out. Training in each phase lasted 30 days. By this time, responding was confined to presentations of the S^Ds, and in Phase 2 nearly all responding occurred on the appropriate lever during presentation of each S^D.

The S^Ds were then combined six times during a test session upon termination of S^Δ. The single S^Ds occurred on noncompound presentations. During compounding in Phase 1, the S^D correlated with the lever that was not present was superimposed upon the S^D which maintained responding on its correlated lever. The left lever was extended during one test session and the right lever during the second. Responding was reinforced during compounding, and during compounding in Phase 2 food could be obtained by responding on either lever.

Ss 1 through 13 were run first in Phase 1 and then in Phase 2. Ss 14 through 21 were run only in Phase 1 and Ss 22 through 29 were run only in Phase 2. For Ss 1 through 5, the light and tone were the S^Ds and for Ss 6 through 29, the lights were the S^Ds. The lights were of equal intensity for Ss 6 through 9 (41.5 cd/m^2), 14 through 17 (61.2 cd/m^2), and 22 through 25 (61.2 cd/m^2). The lights were of different intensity for Ss 10 through 13 (41.5 and 102.0 cd/m^2), 18 through 21 (61.2 and 225.1 cd/m^2), and 26 through 29 (61.2 and 225.1 cd/m^2). These procedures were followed to see if there was any effect of Phase 1 on Phase 2 and to see if the particular intensity of the lights had any effect.

RESULTS

The data are presented in Figs. 1, 2, and 3. Each mean is based on the total number of responses emitted by each S for all presentations of each S^D during testing. With only one lever exposed, significantly more responses occurred to the compound than to the single S^D in the presence of either the light- or tone-correlated lever [$F(1,4) = 19.0$, $p < .02$; Panels A and B,

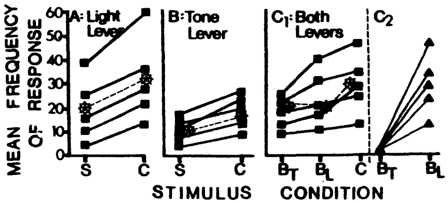

Fig. 1. Mean number of barpresses to the single (S) and compound (C) S^Ds when only the light- (Panel A) or tone-correlated (Panel B) lever was present. Mean number of presses on the bar correlated with tone (B_T) or light (B_L) and to the compound (C) when both levers were present, and the distribution of responses on each lever during compounding are shown in Panels C_1 and C_2, respectively. Individual data are represented by squares and the mean for each group by the starred circles.

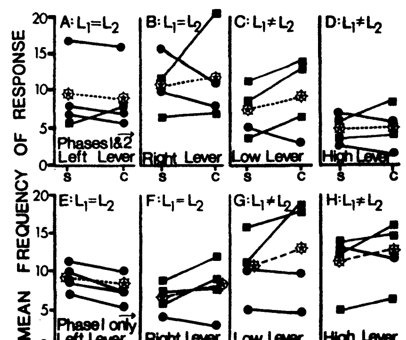

Fig. 2. Mean number of barpresses to the single and compound S^Ds when both S^Ds were lights and only one lever was present. Compounding occurred in the presence of the right and left bars when the lights were of equal intensity (L1 = L2, Panels A, B, E, and F), or the lower (Panels C and G) and higher (Panels D and H) intensity bars when the lights were of different intensity (L1 ≠ L2). Ss were either run in both phases under one set of intensities (Panels A through D), or in Phase 1 only under a different set of intensities (Panels E-H). Points at which the compound maintained a higher or lower frequency than the single S^D are represented, respectively, by squares and circles.

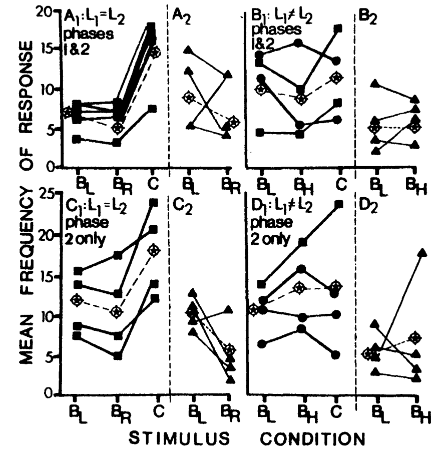

Fig. 3. Mean number of barpresses to the single and compound S^Ds when both S^Ds were lights and both levers were exposed. Compounding occurred in the presence of the left (B_L) and right (B_R) bars when both S^Ds were of equal intensity (Panels A_1 and C_1), or the lower (B_L) or higher (B_H) intensity bars when the lights were of different intensity. Panels A_2, B_2, C_2, and D_2 show the distribution of responses on each lever during compounding.

respectively, of Fig. 1]. When both levers were exposed, more responses occurred to the compound than to the light ($p = .07$) or tone ($p < .01$) (Panel C_1 of Fig. 1). Significantly more responses occurred on the light-correlated lever [$F(1,4) = 27.2$, $p < .01$; Panel C_2].

When both S^Ds were lights and only one lever was present, there was no significant effect due to (1) whether the single or compound S^D was presented; (2) whether the lights were of equal or different intensity; (3) the particular sets of intensities that were used; or (4) whether Light 1 was superimposed upon Light 2 or vice versa [all differences $F(1,6) < 1.0$, $p > .25$; Panels A through H of Fig. 2].

When both S^Ds were lights and both levers were concurrently present, a significant interaction was found in each instance between the level of responding to the compound vs single S^D and whether the lights were of equal or different intensity [$F(2,12) = 7.4$, $p < .01$ for Panels A_1 and B_1, and $F(2,12) = 3.94$, $p < .05$ for Panels C_1 and D_1]. The level of responding to the compound was significantly greater than that to either single light when the lights were of equal intensity ($p < .01$ for Panel A_1 and $p < .05$ for Panel C_1), but this difference was not significant when the lights were of different intensity ($p > .05$ for Panels B_1 and D_1). No effects of the prior experience with Phase 1 on Phase 2 or the sets of light intensities were apparent. Also, there were no significant differences in the number of responses emitted on each lever during compounding for any of the groups [$F(1,3) = 3.8$, $p < .25$ for Panel C_2; $F(1,3) < 1.0$, $p > .25$ for Panels A_2, B_2, and D_2].

DISCUSSION

When light and tone were the S^Ds and only one lever was present, summation occurred in the presence of each lever.

However, when both levers were present, nearly all responses occurred on the light-correlated lever during compounding. This indicates that light and its lever were salient and preferred stimuli, even though there was no suggestion of this dominance from the pattern of responding when only one lever was exposed. This result cannot be explained in terms of a higher frequency of responding being maintained by the light during single S^D presentations. This occurred with three of the five Ss but nearly equal frequencies occurred with the other two Ss. And, both Meltzer and Masaki (1973) and Miller (1973) reported a number of instances in which the tone maintained the higher frequency, but most responding still occurred on the light-correlated lever at compounding.

Combining two lights of different intensity did not significantly affect responding when either one or both levers was present. This also occurred with lights of each intensity with one lever present, but when the lights were of equal intensity and both levers were present, responding significantly increased. It is not clear why responding did not also increase when the lights of different intensity were combined and both levers were present. Five of the eight Ss emitted most of their responses on the lever correlated with the lower intensity light, indicating that the higher intensity light did not overshadow or obscure the lower intensity light. Also, Miller (1971) reported summation when he used lights of similar low and high intensity but which were correlated with the same single lever.

When both levers were exposed, no significant preference for a particular lever was found during compounding, regardless of light intensity. This outcome was quite different from what occurred when light and tone were the S^Ds. The lever correlated with the higher frequency of responding during single S^D presentations was the lever on which most responses were emitted during compounding in only 9 of 16 instances.

These results suggest that the effects of combing S^Ds is sensitive to whether the following variables were same or different: the response manipulanda, the modalities of the S^Ds, and the values of the S^Ds. The effects obtained with one combination of variables were not necessarily predictive of what was obtained when a different combination was used.

REFERENCES

Meltzer, D., & Masaki, M. A. Measures of stimulus control and stimulus dominance. Bulletin of the Psychonomic Society, 1973, 1, 28-30.

Miller, L. Compounding of discriminative stimuli from the same and different sensory modalities. Journal of the Experimental Analysis of Behavior, 1971, 16, 337-342.

Miller, L. Compounding of discriminative stimuli that maintain responding on separate response levers. Journal of the Experimental Analysis of Behavior, 1973, 20, 57-69.

Weiss, S. J. Summation of response strengths instrumentally conditioned to stimuli in different sensory modalities. Journal of Experimental Psychology, 1964, 68, 151-155.

Weiss, S. J. Stimulus compounding in free-operant and classical conditioning: A review and analysis. Psychological Bulletin, 1972, 78, 189-208.

(Received for publication June 24, 1974.)

Bulletin of the Psychonomic Society
1974, Vol. 2 (4B), 428-430

Dependence and thought as determinants of interpersonal hostility*

ABRAHAM TESSER and ROBERT JOHNSON
Institute for Behavioral Research and Department of Psychology
University of Georgia, Athens, Georgia 30602

It was assumed that thought tends to make attitudes more extreme (by making relevant cognitions more consistent) and that dependence on another tends to focus one's thoughts on that other. This lead to the predictions that attitudes toward an initially disliked other would become more negative as a function of opportunity for thought, dependence on other, and opportunity by dependence. Dissonance theory leads to an opposite prediction: Attitudes will become *less* negative as a function of opportunity, dependence, and opportunity by dependence. Although results were not completely consistent with either prediction, they were better accounted for by the first.

A recent series of studies has been concerned with attitude change as a function of simply thinking about the attitude object. The conceptualization guiding these studies is based on two assumptions: (1) thinking about some attitude object has an impact on the cognitions concerning that object so that they tend toward greater consistency with the initial attitude direction, and (2) there is a causal relationship between the cognitions and affect associated with some attitude object. These assumptions lead to the hypotheses that merely thinking about some object will produce more polarized attitudes and, since thought is a time dependent process, the longer one thinks about the attitude object the more polarized will his attitude become. Both of these hypotheses have received some support (Sadler & Tesser, 1973; Tesser & Conlee, in press).

The thought polarization hypothesis sometimes makes predictions that differ from those oi other theories. For example, it predicts that the more we think about someone we initially dislike the more we will come to dislike that person. Assuming dependence on that other heightens one's predisposition to concentrate his thoughts on that other; then, given the opportunity for

*The authors are indebted to Chris Leone for his assistance in running Ss. This paper is sponsored by Robert M. Pollack, who takes full editorial responsibility for its contents.