More on masking of stimulus control during generalization testing*

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Twenty-four pigeons were given single-stimulus training with a white vertical line on a yellow (576 nm) background. For half of the Ss, the houselight was on during the entire experiment, while for the other half it was off. A generalization test along the angularity dimension was conducted, with the 576-nm surround present on only half of the stimulus presentations. In the houselight-off group, the relative generalization gradient was flatter with the yellow surround present, indicating masking of angularity by wavelength; however, there was no such difference in the houselight-on group.

Freeman & Thomas (1967) and Newman & Benfield (1968) have reported that pigeons trained with a white vertical line on a green field yield sharper angularity generalization gradients when the green surround is removed and with the line angles projected against a black surround than when the green surround is retained. This phenomenon, in which the presence of one dimension during generalization testing reduces the measure of control acquired in training by another dimension, has been called "masking" by Thomas, Svinicki, & Svinicki (1970). These authors replicated the masking effect within Ss by testing each pigeon (in alternate blocks of trials) under both background conditions.

Baron & Bresnahan (1969) have reported the failure to find a masking effect under conditions quite similar to those used in our laboratory. Two procedural differences seem potentially significant. One is their use of a yellower surround than we have used, 578 nm¹ vs 555. Another difference is their use of a houselight in the experimental chamber, whereas we have typically used none. In a dark chamber, the white line on the pecking key is the only visual stimulus available, and a chromatic surround may compete with the line for control over S's behavior during generalization testing. An illuminated chamber, however, presents a very complex visual array to the bird, such that one additional visual cue (the chromatic field) may make little difference. The present experiment was designed primarily to test the role of the houselight in obtaining a masking effect.

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SUBJECTS

Twenty-four experimentally naive domestic pigeons were individually housed with free access to food and water upon arrival at the laboratory. After 10 days, they were deprived of food and maintained at 75% of their free-feeding weights during the experiment. Water was always available in the home cages.

APPARATUS

Four Grason-Stadler pigeon test chambers were used. The stimuli were presented via Industrial Electronics Engineers in-line display cells and consisted of a 1/8-in.-wide by 7/8-in.-long white line in various angular orientations and a yellow field (Kodak Wratten Filter No. 73). The houselight was on in two of the boxes and off in the other two.

PROCEDURE

All Ss underwent single-stimulus training with a white vertical line on a yellow surround (576 nm). Reinforcement consisted of 3 sec of access to a tray of mixed grain. On Day 1, Ss were magazine trained, as well as trained to peck the key. On the following 2 days, a continuous reinforcement schedule was in effect for 30 reinforcements. Over the next two sessions, the reinforcement schedule was gradually changed to VI 1 min, with 30 reinforcements per session. This schedule was in effect on the following 10 days for 30-min sessions each day.

A generalization test to angularity was given in extinction on Day 16 after a 5-min reinforced warm-up period. The generalization test consisted of 20 blocks of five test stimuli (30, 60, 90, 120, and 150 deg) randomized within each block. Each stimulus appeared for 30 sec, with no blackouts intervening between successive stimulus presentations. The yellow surround was present on every other block of five stimuli, with half of the Ss starting the test with the yellow present and the other half beginning with it absent.

RESULTS AND DISCUSSION

A record was made of the total number of responses occurring in the presence of each generalization test stimulus for each S. Each S's relative generalization gradient for the yellow present and yellow absent conditions was computed by determining the proportion of the total responses under that background condition emitted to each of the five line angles. These relative generalization gradients constitute the basic data of the present experiment, although absolute gradients are also presented for comparison purposes.

Figure 1 presents the mean relative generalization gradients obtained under the four conditions of the experiment. As can be seen in the figure, the houselight-on group yielded essentially identical relative generalization gradients under the two background conditions. For this group, a *t* test between percentage of total responses to the peak of the gradient (usually the vertical line CS) under the two background conditions yielded a *t* < 1, and of the 12 Ss, 7 gave sharper gradients under the yellow background condition. The houselight-off group, however, showed the typical masking effect. Eleven of the 12 birds in this group gave a higher percentage of total responses to the peak stimulus with the yellow surround removed, and a comparison between these percentage values under the two background conditions yielded a *t*(11) = 5.31, *p* < .01.

Fig. 1. Mean relative generalization gradients of houselight-on and houselight-off groups tested with the yellow background present (designated "yellow" in the legend) and with the yellow background removed (designated "black").

As Fig. 2 indicates, for both groups the removal of the surround reduced the level of responding: for houselight off, $F(1,11) = 36.69$; for houselight on, $F(1,11) = 15.43$; both $p < .01$. For the houselight-off group there was a somewhat sharper absolute gradient under the black background condition; however, the interaction between stimuli and background was not significant. Thus, masking was significant only with the relative generalization measure.

The arguments favoring relative generalization gradients as a more valid index of stimulus control than absolute gradients have been made elsewhere and need not be repeated here (e.g., Thomas & King, 1959; Thomas, Freeman, Svinicki, Burr, & Lyons, 1970; Thomas, Burr, & Eck, 1970). Usually comparisons of absolute or of relative gradients are in essential agreement with regard to the effects of a particular independent variable, although statistical significance is far more often obtained with relative measures. The present experiment is thus no exception in this regard.

The results of this experiment indicate that the masking effect is not specific to the 555-nm background wavelength that Thomas, Svinicki, & Svinicki (1970) used. A surround of 576 nm works just as well. On the other hand, the use of a houselight is a critical factor, eliminating the masking effect entirely, thereby explaining why Baron & Bresnahan (1969) may have failed to find masking in their study. Even without a houselight, the magnitude of the masking effect observed here was such that only a powerful within-Ss procedure would have demonstrated it. The theoretical significance of masking for the assessment of stimulus control, however, is not as limited as the magnitude of the effect observed in this study would suggest. In a recent study by Thomas, Burr, & Eck (1970), rats were trained to discriminate between two tone-light compounds in which tone frequency differed but light intensity was held constant. In generalization testing with different light intensities, it was found that a decremental gradient could be obtained when the lights were presented *alone*, but not when they were paired with tones or even when tones were alternately presented during the same test session. Thus, in the Thomas, Burr, & Eck study, masking was *total*, and only when this was recognized could a valid assessment of stimulus control by light intensity be made. Although masking may be minimal in some experimental situations, it may be substantial in others, and therefore the possibility of

Fig. 2. Mean absolute generalization gradients of houselight-on and houselight-off groups tested under both yellow background and black background conditions.

masking must always be considered in testing for stimulus control.

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NOTE

1. Personal communication from Dr. Bresnahan revealed that the designation of their background stimulus as 578 nm was in error. The correct designation should have been 576 nm, as produced by Kodak Wratten Filter No. 73 with a tungsten light source. Thus, their background stimulus was the same as that used in the present experiment.

The red nucleus and visual performance in the white rat: A methodological artifact?*

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Albino rats, trained in a Thompson-Bryant apparatus without a choice chamber, were found to be deficient in visual discrimination performance after ventral midbrain damage. The results support previous work with rats and raise the possibility of a species difference in functional significance of the red nucleus between white rats and rhesus monkeys.

The ventral midbrain of the white rat has repeatedly been shown to be an important area for the successful retention of brightness and pattern discrimination problems (McNew, 1968; Thompson, 1969; Thompson, Lukaszewska, Schweigerdt, & McNew,

1967). Within this area, the red nucleus has been found to be of primary importance. However, a recent attempt (Thompson & Myers, 1971) to replicate the red nucleus work using the rhesus monkey met with unexpected results. For example, all eight monkeys with red nucleus damage displayed excellent retention of two out of three simple visual discrimination problems.

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