References and Notes

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Discriminative Control of "Attention"

Heinemann *et al.* (*1*) suggest that discriminative control by an auditory frequency dimension over the key-pecking of pigeons may be under the discriminative control of another dimension. They concluded that the auditory dimension controlled the distribution of pecks between two keys when the keys were one color and not when the keys were another color. Their procedure was designed to provide two conditions for the pigeons—tone relevant and tone not relevant—with a different key-color associated with each condition. Because the pigeons behaved as though the tone were relevant when the keys were one color and not when the keys were the other color, one might assume that there was discriminative control by some visual dimension, presumably wavelength, throughout the generalization tests.

The experimental procedure was symmetrical with regard to color and tone frequency, except that color differences were introduced before tone differences and generalization functions were gained with respect to tone frequency alone. The same procedure could also have been formulated to provide two other conditions for the pigeons (color relevant and color irrelevant), and similar generalization functions (for wavelength) could have been obtained with equal facility. Had this been done, one might conclude that control by wavelength was conditional on tone frequency, and hence, that control by tone frequency was evident throughout the generalization tests.

Thus, although the auditory dimension may not have controlled the distribution of pecks when the keys were one color, the conclusion that the auditory dimension was completely without influence during some generalization test trials must be treated with reservation. Goldiamond (*2*) has made a useful distinction between dimensional stimulus control (control by a dimension over behavior) and instructional stimulus control (environmental control over which dimension controls behavior). To rephrase the conclusion of Heinemann *et al.*, in their experimental situation wavelength exerted instructional control over whether the tone frequency had dimensional control. Because of the symmetry of the procedure with respect to wavelength and tone frequency, one must presume that each dimension exerted instructional and dimensional control during the generalization tests, with the instructional control continuously available and the dimensional control evident only when appropriate.

Such an analysis of the gaining of control by two features of a compound stimulus may not be justified. Nevertheless, the possibility of two kinds of stimulus control remains intriguing and, as Heinemann *et al.* suggest, raises problems for current theories of stimulus generalization. It is probably difficult to provide a demonstration of exclusively instructional control by one dimension over a single other dimension. It might be possible, however, to place a pigeon's pecking under the control of either the intensity or the wavelength characteristics of a transilluminated key, depending on the value of an auditory dimension which has only instructional control.

R. M. GILBERT

Addiction Research Foundation, Toronto 4, Ontario, Canada

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In a more complete experiment that included the conditions discussed by Gilbert, we followed our procedure (*1*), except that the two stimulus continua were the radiance of white light and the intensity of white noise. Generalization curves for each dimension were obtained in the presence of each of a large number of stimuli from the other dimension. The results are as surmised by Gilbert; the steepness of the noise curves varies as a function of the radiance of the light, and the steepness of the light curves varies as a function of noise intensity. In particular, the generalization functions for noise and light that were obtained in the presence, respectively, of the radiance associated with condition "noise not relevant" and the noise intensity associated with condition "light not relevant" are horizontal lines.

Provided that control by a stimulus dimension is defined in terms of observed variations in behavior there appears to be no room for argument: in the presence of the stimulus quantity associated with the "not relevant" condition the "irrelevant" dimension has no control over behavior. This conception of control, however, leads to a paradox. When a pigeon is presented with the combination of stimuli consisting of the radiance associated with condition "noise not relevant" and the noise intensity associated with condition "light not relevant", neither dimension can be said to control the behavior; yet the pigeon responds to the disk that is appropriate when these dimensions do control his behavior. One way to avoid this paradox is not to assume that each dimension exercises instructional control over the other. It should be noted that although the symmetrical formulation proposed by Gilbert adequately describes the data, it involves a redundancy. All that is required for a full description of the data is an expression showing how the form of the generalization curves for one of the dimensions varies with stimulus values from the other dimension. This means that a theory which assumes instructional control by only one dimension is compatible with the data. To avoid the paradox it is necessary only to assume that on a given trial only one of the dimensions exerted instructional control. The dimension which exerts instructional control might change from trial to trial. Whether this is what happened or whether one dimension exerted instructional control throughout cannot be decided on the basis of our experiments.

ERIC G. HEINEMANN

SHEILA CHASE

CHARLOTTE MANDELL

Department of Psychology, Brooklyn College of the City University of New York, Brooklyn 11210

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