A FLEXIBLE MODEL FOR GENERALIZATION GRADIENTS

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In much current research in Learning, the task of *E* has been cut drastically: He merely programs the experiment, and works up the results. It is true that he still has certain non-psychological duties, for he must make sure that the apparatus works, and he usually puts the *S* into the experimental situation and removes him at the close of the session. This isn't unduly onerous, for *S* is often reduced to an *N* of one. The present paper suggests that even this *N* is excessive—variability can be reduced by substituting a mechanical model for the *S*, at least in studying generalization. The model has the further advantage that it, unlike the rat or pigeon, can be made to behave in terms of certain preconceived principles of generalization.

The model is based on a sheet of graph paper, 10 lines to the inch, 9 inches long, and 4 inches high. The wooden frame of the graph has 10 screw-eyes on the top and bottom,

Figure 1. Vertical cross-section of Gradient Model, to show method of mounting one sliding ordinate. See text. This section does not show the sides of the frame; each side has a vertical row of brads, a half-inch beyond the edge of the graph. The brads are spaced a half-inch apart, and serve as the ends of the sensory continuum. The side support is cut away at the top, to show the counterweights. Reinforced stimulus values are shown by + , and unreinforced ones by -.

serving as guides for stiff wires (bicycle spokes) that serve as ordinates. Each ordinate has an eyelet in its center, which serves as a plotting point. A nylon fishing line, under tension, passes through these eyelets, representing the generalization gradient. The right and left margins of the graphs have brads every one-half inch, which serve as the point of attachment and end for the thread. By hooking the loop of the thread "generalization gradient" to one value on the left, and passing it over a brad at another value on the right, one can establish an "Operant Level" which takes account of any possible "Stimulus Dynamism."

Each spoke (ordinate) is counterbalanced by a thread which passes over a glass rod as a bearing,¹ and carries an appropriate weight, so that the ordinate is "free-floating." Any additional weight can be attached to one counterweight, to represent the number of reinforcements at the particular stimulus value of this ordinate (S^D). On the other hand, weights hung from the bottom of each ordinate represent the number of extinction trials (unreinforced S^A). The tension on the thread representing the generalization gradient (supplied by weights at its free end) has no clear analogue; like Drive, it increases the level of S^A , but it decreases the value for S^D .

The mode described above gives a reasonable description of the apparently conflicting results of Solomon and Schlosberg (1943) and Pierrel (1958). If reinforcement is continued

Figure 2a. Generalization gradients, plotted by the model. In all cases, the "Operant Level" runs from a response strength of 0.75 on the left, to 0.25 on the right, measured from the ends of the continuum. This would correspond to a stimulus continuum in which the low end produced the stronger response, as auditory intensity measured in decibels attenuation.

The gradient suggested by Schlosberg and Solomon, with reinforcement at stimulus value 4, and nonreinforcement at 9. Intermediate values determined by occasional test trials.

at one point (S^D) and nonreinforcement at the other end of the continuum (S^A), a few tests of intermediate stimuli yield a linear gradient. But if a number of unreinforced tests are made of the intermediate points, the gradient is depressed, resembling that reported by Pierrel under such conditions.

Professor Donald Blough pointed out that the model didn't behave like the pigeon, as reported by Hanson (1957), in which a nonreinforced S^A to the right of S^D would move the crest of the generalization gradient to the left of S^D . A simple change in the model makes it behave like the pigeon—substituting a flexible spring steel wire for the thread which con-

¹The model would be improved by substituting a row of 10 small pulleys for the glass bearing, to decrease friction.

stituted the generalization gradient. This makes the crest move in the expected direction, but it also smooths out the gradient, making it curvilinear rather than linear. It is clear that the stiffness of the thread or wire which represents the generalization gradient in this model will determine the detailed form of the gradient. This is just another example of the

Figure 2b. The gradient found under the conditions of Pierrel (1958) when a number of test trials have depressed the gradient at the intermediate points, yielding the appearance of a concave gradient.

fact that what one puts into a model determines what he gets out of it. However, a good model, with manipulable variables, will often suggest relationships that can be tested by experiment. The present model may have such value, and at least it furnishes a convenient demonstration for clarifying a set of relationships that is hard for the student to grasp.

Figure 2c. The effect of substituting stiff wire for the thread used as the gradient line in Fig. a and b. Reinforcement conditions same as 2a, but note that the gradient is curved, with a high point beyond the reinforced value (cf. Hanson).

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