Excerpt from

LABORATORY MANUAL

PRINCIPLES OF PSYCHOLOGY: EXPERIMENTAL FOUNDATIONS

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Experiment 8

Animal Learning

James Dickson

begins on the next page and constitutes pp. 96-102 of the full manual

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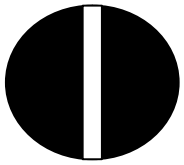
Animal Learning

James Dickson

Introduction

Any psychological theory that aspires to comprehensiveness must be able to account for stimulus control. It is nearly impossible to think of an example of behavior that is reinforced all the time, under all circumstances. The law of effect may tell us how organisms learn *what* to do, what behavior is effective. However, it is equally important that we know *when* to engage in a particular behavior. As described in lecture, a discriminative stimulus is used as a cue in operant conditioning. The cue is present when a particular behavior will be reinforced, and is absent when it will not be reinforced.

In the present experiment, we will examine the behavioral effects of reinforcing a pigeon to peck a response key illuminated by a particular discriminative stimulus (in this study, a 90^0 line angle). We would expect the pigeon would respond vigorously to stimuli that are similar to the 90^0 training stimulus (S^D), and less and less to stimuli as they become less and less similar to the 90^0.



A "90^0 line angle"

Objectives

- to explore how animals differentiate between different visual cues
- to introduce the concepts of stimulus generalization and discrimination (the "two faces" of stimulus control)
- to introduce the use of animals as research subjects
- to investigate a procedure that has been used for measuring animal behavior
- to examine the extent to which findings obtained in the laboratory with infrahuman subjects can be generalized to humans and other species

Terms

absolute generalization slope

ad-libitum weight

continuous reinforcement (CRF)

extinction

generalization gradient

law of effect

operant conditioning

orthogonal dimension

randomized blocks

relative generalization slope

replicate

response strength

response-reinforcer association

S^D

serial position

stimulus control

stimulus-response association

VI (variable interval) schedule of reinforcement

VR (variable ratio) schedule of reinforcement

Methods

Subject

The subject for this experiment will be a laboratory pigeon from the St. Olaf pigeon colony. The subject will be maintained at 80% of its "ad libitum" weight.

Apparatus

We will use a standard pigeon chamber with associated automatic programming and recording equipment. The chamber is equipped with a display cell that presents the stimuli on a translucent pecking key. The stimulus is a white line 3.2 mm wide by 22.2 mm high that can be projected with a dark background in orientations ranging from 0^0 (horizontal) to 90^0 (vertical) in 15^0 increments. The response key will provide the only source of light in the chamber, with the exception of illumination of the food magazine during reinforcement periods.

Procedure

The procedure will be replicated seven (7) times, reestablishing pecking to the 90^0 line angle and then presenting each line angle in a different specified order for a 30 second extinction period. Over the seven replications, each stimulus will be presented once in each serial position (e.g., the 75^0 angle will be first in one

extinction period, second once, third once, etc.). Each row in the data sheet identifies one "replication".

SPECIFIC PROCEDURE

Weigh your bird, check all apparatus, and set the 90^0 line angle on the response key.

First Conditioning Trial: To recondition the pecking, give 5 continuous reinforcements (CRFs) and then give six (6) reinforcements on the following variable ratio (VR) schedule: 1, 5, 10, 20, 9, 15. (This means that the following responses will be reinforced: 1, 6, 16, 36, 45, 60.)

First Extinction Trial: Present each of the line angles in turn for 30 seconds, reading across the table for the order of presentation. Count the number of responses emitted to each line angle, and record the number in the appropriate box in the table. Specifically, at the end of each 30-second trial, the total number of responses through that trial will be called out. You are to enter this number in the appropriate cell in your data sheet.

After each line angle has been presented for 30 seconds, return the 90^0 line angle to the key for the next reconditioning trial.

Subsequent Reconditioning Trials: Again, extinguish pecking in the presence of each intensity for 30 seconds, presenting the line angles in the order given in the next row of the table.

Repeat this procedure 7 times, once for each row of the table. If you started in the middle of the table proceed to the end of the table, then go to the beginning and continue until you reach the row where you started. You will then have presented each line angle 8 times in extinction, once in each serial position.

After completing all 7 extinction trials, remove your bird from the experimental box, weigh it, and feed it up to 80 percent ad libitum weight if it is below that weight.

Analysis of the Data: Compute the following for the experimental subject:

1. Absolute generalization gradient
   a. First two test blocks
   b. Last two test blocks
   c. Entire test

      To calculate the <u>absolute generalization gradient,</u> you will need to determine the number of responses made to each stimulus during the generalization test. Do this by subtracting the total number of responses made to each stimulus through the previous trial from the total number of responses made to each stimulus through the trial in question. The "first two test blocks" calculation is made from the row in the data sheet where you started the test and the row that follows. The rows that enter into the "last two test blocks" calculation will be

the last two rows of your test. The "entire test" calculation involves the entire data sheet. For this test, add together all of the responses for a particular stimulus.

For the "entire test" gradient you will plot number of responses on the y-axis (ordinate) against line angle on the x-axis (abscissa).

2. Relative generalization gradient
   a. First two test blocks
   b. Last two test blocks
   c. Entire test

To calculate the relative generalization gradient, you will need to determine the total number of responses made in the data set in question (i.e., first two test blocks, last two test blocks, entire test), and then figure the percent of that total made to each of the test stimuli. For example, if 245 responses were made during the entire test and 44 of these were made to 45^0, the percent figure to 45^0 would be 18%.

Enter the results of your "entire test" absolute and relative generalization gradient calculations on the graph sheets at the end of this exercise. Be sure to label and scale the axes as needed. You should also put a title on your figures.

CT	**How can we determine if a particular stimulus is controlling behavior?**

CT	**What conclusions can we reach about stimulus control if the generalization gradient is "flat"? if it is "peaked" around the S^D?**

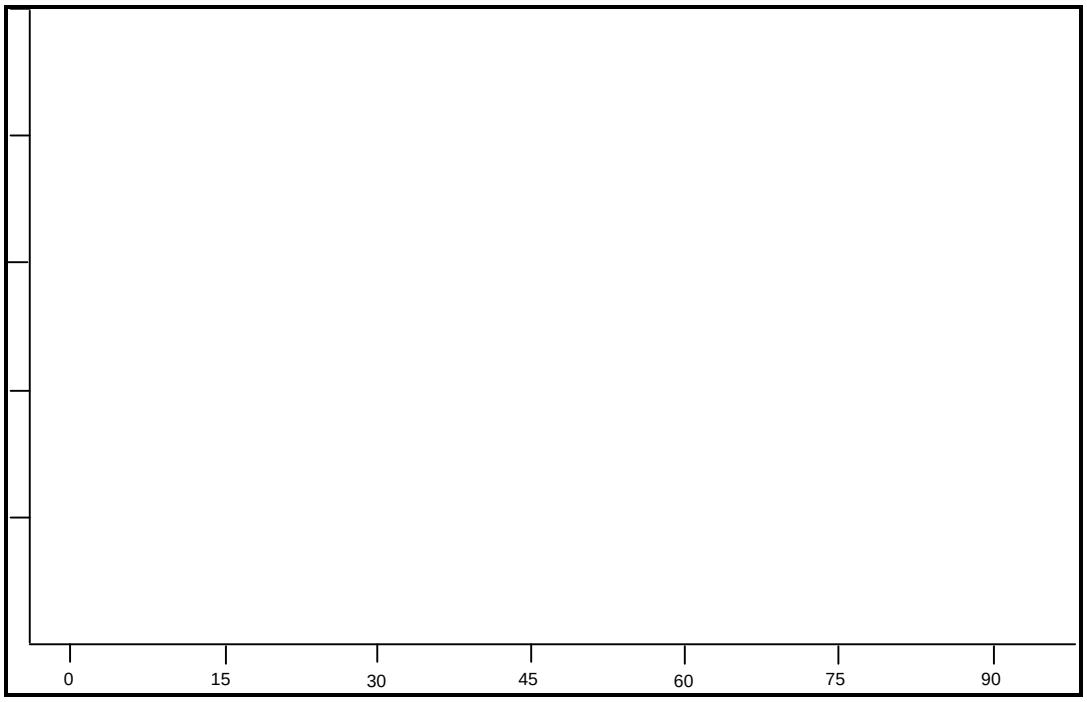
CT	**Why did you calculate both absolute and relative generalization gradients? As you think about the answer to this question consider which analysis might be appropriate if we were to work with a group of subjects, not just one pigeon.**

DATA SHEET, GENERALIZATION GRADIENT

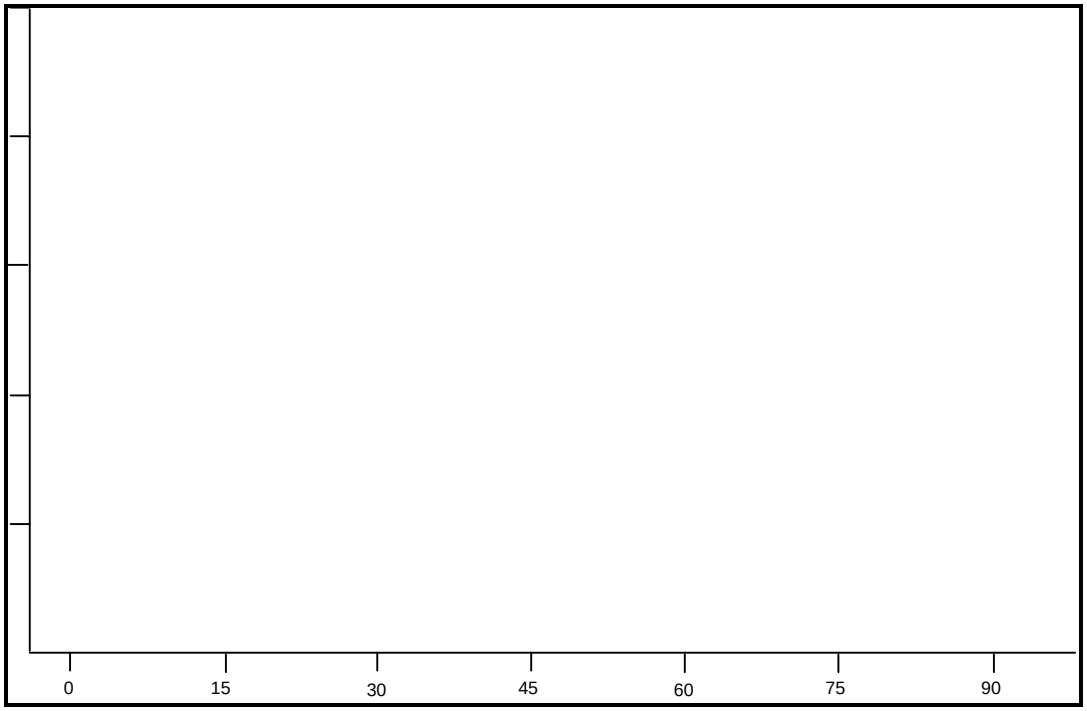
Order of Presentation of line angles during extinction trials.

LEARNING ($S^D=90^{0)}$	GENERALIZATION TEST (EXTINCTION)						
Block 1 VR 1, 5, 10, 20, 9, 15	0^0	30^0	90^0	45^0	75^0	15^0	60^0
Block 2 VR 1, 5, 10, 20, 9, 15	30^0	0^0	60^0	90^0	45^0	75^0	15^0
Block 3 VR 1, 5, 10, 20, 9, 15	90^0	45^0	0^0	15^0	60^0	30^0	75^0
Block 4 VR 1, 5, 10, 20, 9, 15	45^0	60^0	75^0	0^0	15^0	90^0	30^0
Block 5 VR 1, 5, 10, 20, 9, 15	75^0	15^0	30^0	60^0	90^0	0^0	45^0
Block 6 VR 1, 5, 10, 20, 9, 15	15^0	75^0	45^0	30^0	0^0	60^0	90^0
Block 7 VR 1, 5, 10, 20, 9, 15	60^0	90^0	15^0	75^0	30^0	45^0	0^0

Absolute Generalization Gradient



Relative Generalization Gradient



Discussion Questions

1. What explanations can you develop for the failure of a stimulus to control operant responding?
2. Can you design an experiment to study stimulus control in humans? What differences in procedure would you employ? Why?
3. What would happen to the generalization gradient if a subject were trained to associate extinction (non-reinforcement) with a particular line angle?
4. How would you go about demonstrating that stimulus control is an important property of behavior, not simply an idiosyncratic aspect of behavior in the pigeon?
5. Consider the ethical implications of this research.

References

Required Lab Reading

Guttman, N. & Kalish, H.I. (1966). Experiments in discrimination. In T. Verhave (Ed.), *The Experimental Analysis of Behavior* (pp. 209-216). New York, Appleton-Century-Crofts.

Suggested Readings

Honig, W. K., & K. Urcuioli, P. J. (1981). The legacy of Guttman and Kalish (1956): 25 years of research on stimulus generalization. *Journal of the Experimental Analysis of Behavior, 36*, 405-445.

Schadler, M. & Thomas, D.R. (1972). On the acquisition of dimensional stimulus control by the pigeon. *Journal of Comparative and Physiological Psychology, 79,* 82-89.

Thomas, D. R. (1993). A model for adaptation-level effects on stimulus generalization. *Psychological Review, 100*, 658-673.

Web links

Division for Behavior Analysis, American Psychological Association
http://www.apa.org/divisions/div25/