9.65 March 15, 2004 LEARNING: Handout

Assigned: One chapter (2) and part of Chapter 3 from J. R. Anderson (2000). *Learning and memory: 2nd Edition*. New York: Wiley. Note: you may omit pp. 45-48; read pp. 49-57 to pick up the general ideas about conditioning; and study the rest of the chapter (including the beginning sections, 39-44).

Outline:

Elementary principles of learning:
- A. Contiguity
- B. Frequency
- C. Contingencies and blocking

Introduction: Learning vs. memory

Pavlov's dogs now link up with computational modelling and even with Bayesian reasoning.

A. CONTIGUITY

The principle of **association by contiguity in time [and space]**:

E.g., flashbulb memories

Basics of classical conditioning:

US: Unconditioned stimulus

UR: Unconditioned response

CS: Conditioned stimulus

CR: Conditioned response

[Also: CER: Conditioned emotional response]

Standard procedure in classical conditioning:

Why form an association **only** when objects or events are in close temporal [and spatial] proximity?

Constraints on learning:

Is simple contiguity **sufficient** for learning?

Preparedness: Seligman (1970) (also called **associative bias**)

For example, a rat can readily associate a sound or light with a shock (and learn what to do to avoid it), or can learn to avoid a food or liquid with a certain taste to avoid becoming nauseated, but has great difficulty associating the taste with shock or the sound or light with nausea (Garcia, Hawkins, & Rusiniak, 1974)

Continguity: Necessary for an association?

In rats and other animals, the association between a foodstuff and getting sick may be made **even though the sickness does not begin until hours after the food has been eaten** (the Garcia effect).

This "long-distance" association is more readily made if the food the animal has eaten is different from the animal's usual diet.

Humans: (in one study, root-beer Lifesavers), that food becomes a scapegoat: the patient is *less* likely to develop aversions to ordinary foods eaten at the same pre-treatment meal. (Bernstein, Webster, & Bernstein, 1982)

B. Second fundamental principle of learning is FREQUENCY

This supplementary principle increases the likelihood that valid associations (such as causal relationships) will be strengthened at the expense of chance associations that do not reflect regularities in the world.

Other principles of learning and memory are also relevant: attention, elaborative processing

E.g., chein-dog

C. CONTINGENCY LEARNING AND BLOCKING

Contiguity and frequency are not sufficient for learning: you need **contingency** between the two events you are associating:

Learning reflects not only positive pairing, but also failures of pairing: that is, if you are exposed to A+B, the likelihood that you will learn A-->B depends not only on the frequency of A+B, but also the frequency of 0+Band A+0. In effect, A has to predict B more often than not-A does.

Partial reinforcement

Blocking: If you already "know" that it is a light that predicts shock, adding in a tone that is also correlated with the shock will not lead to learningthat tone-->shock.

The **Rescorla-Wagner Rule**

delta V = alpha (lambda - V)

Compound stimuli and **competitive learning**

Application to **blocking**

Conditioned inhibition

Modifications of Rescorla-Wagner

Delta Rule in neural-net learning

Relation to **Bayes' Theorem**

Summing up: