Chapter 6 (Cont.)
Factors Affecting Appetitive Learning
Timing of Reward

- Delay of reward weakens learning.
  - Grice’s gradient
  - Secondary reward cues can lessen the influence of a delay.

- Delay interferes with human learning too.
  - Children’s problem-solving time is lengthened with a delay of reward.
  - 7 trials immediate reward, 17 delayed
Grice’s Gradient

Figure 6.8  The level of learning decreases with an increased delay between the instrumental response and reward. The measure of learning is the reciprocal \( \times 1,000 \) of the number of trials to reach 75% correct choices: Thus, the higher the value, the greater the level of learning.

Faster learning with less delay
Size of Reward

- Crespi – the larger the reward the faster rats run down an alley.

- Likelihood and intensity of a response depends on size of reward.
  - Must be sufficient for response to occur
  - Intensity of response varies with size of reward.
Crespi – Reward Size Matters!

**Figure 6.9** A rat’s rate of responding, or the number of bar-press responses per minute, increases with the magnitude of reinforcement—in this case, higher concentrations of sucrose in the water.

More bar presses with bigger reward
Motivation vs Conditioning

- Performance differences occur because of changes in motivation not necessarily changes in learning.
- Crespi showed that responding differs depending upon past experience and expectations.
  - Depression effect
  - Elation effect
Contrast Effects

Figure 6.10 A higher level of performance occurs with a larger reward magnitude during the preshift phase. Not only does the level of response decline following a shift from high to low reward magnitude, but it is even lower than it would be if the level of reward had always been low (a depression or negative contrast effect). By contrast, a shift from low to high reward magnitude not only leads to a higher level of response, but it also produces a response level that is greater than it would be if the level of reward had always been high (an elation or positive contrast effect). The contrast effects last for only a few trials; then responding returns to the level appropriate for that reward magnitude.

256 to 16 on trial 20

1 to 16 on trial 20
Contrast Effects

- Zeaman – the specific context in which a stimulus is experienced can exaggerate or reduce effects.
  - **Positive contrast** – going from low to a higher reward.
  - **Negative contrast** – going from high to a lower reward.

- Positive contrast effects difficult to produce due to ceiling effect.
Explanation of Contrast Effects

- Negative -- occurs because of frustration.
- Prior experience establishes an expected level of reward.
  - Frustration at not obtaining that reward interferes with instrumental activity.
  - Drugs that reduce anxiety eliminate negative contrast effects.
Reward Size in Humans

- Reward size also affects human learning.
  - Children age 4 & 5 learn faster when given small prizes instead of buttons.
  - Adults show higher achievement when paid more money.
Extinction of Operant Responding

- When reward is discontinued, responding gradually decreases and eventually stops.
  - Unreinforced behavior gets worse before it gets better.
  - When reinforcement stops, behavior may temporarily increase.

- Spontaneous recovery also occurs with operant extinction.
Extinction Curve

Responding may increase before it decreases and stops.
Explanations for Extinction

- Hull – conditioned inhibition.
  - Environmental cues signal absence of reward which suppresses behavior.

- Amsel – nonreward elicits frustration, an aversive state.
  - Environmental cues become associated with frustration and motivate escape.
  - Unrewarded animals jump out of box faster than animals rewarded for jumping.
A Problem for Theorists

- If you alternate rewarded and nonrewarded trials, rats take longer to respond again on the next trial after they have been rewarded than when not rewarded.
- Why should reward produce a delay in doing the behavior again?
Capaldi’s Explanation

- If rewarded and unrewarded trials alternate, memory affects responding.
  - Memory of nonreward ($S^N$) becomes associated with appetitive response.
  - Memory of reward ($S^R$) becomes associated with nonresponse.

- Result is avoidance behavior and decreased response after rewarded trials because nonresponse is being reinforced.
Resistance to Extinction

- Three factors affect how quickly extinction occurs:
  - **Reward magnitude** (in relation to length of training)
  - **Delay of reward** experienced during acquisition training.
  - **Consistency of reinforcement** during acquisition training.
Resistance to Extinction

**Figure 6.12** Hypothesized resistance to extinction of an instrumental response as a function of level of acquisition training and magnitude of reward.
Reward Size

- Effect on extinction depends on number of learning trials:
  - With a few trials, higher reward leads to slower extinction.
  - With extended training, high reward leads to faster extinction.

- With large reward, anticipation leads to greater frustration and faster extinction (less resistance).
Effects of Delay and Consistency

- Only variable delay (not constant delay), when substantial (20-30 sec), makes extinction slower.
- Intermittent reinforcement – if the response is not reinforced every time it occurs, extinction is slower.
- Partial Reinforcement Effect
Effect of Intermittent Reinforcement

Figure 6.13 The mean cumulative number of bar-press responses during extinction is higher in rats who received intermittent reinforcement than in those who received continuous reinforcement.
Partial Reinforcement Effect (PRE)

- As the likelihood of reward during acquisition decreases, resistance to extinction increases.
- With humans, the lower the slot machine payoff, the longer people play (resistance to extinction).
- Very low levels of reinforcement lead to faster extinction (U-shaped curve).
Partial Reinforcement Effect

Figure 6.14  This figure presents the latency of running (1/response time $\times$ 100) during extinction as a function of the percentage of reward (46% or 100%) and the magnitude of reward (0.08 or 1.0 gram). The reference point contains the latency from the last training trial and the first extinction trial.
Amsel’s Explanation

- Conditioned persistence – rats who have been rewarded in the face of frustration learn to persist.
- An anticipatory frustration response is conditioned to the operant behavior.
  - The anticipation of nonreward (with frustration) elicits responding.
  - More frustration leads to less extinction.
Capaldi’s Explanation

- With intermittent reinforcement, the memory of a non-rewarded trial becomes associated with reward.
  - Continuously rewarded animals do not have this experience.
- There is no generalization decrement (nonrewarded trials are occasionally rewarded).