Traditional Learning Theories

Chapter 2
An Ongoing Debate

- First, researchers conduct experiments to observe behavior and formulate laws to characterize their data.
- Next, researchers develop theories to explain the observations and try to generalize about how we learn.
  - They run more experiments to test their theories to see how close their ideas fit observed behavior.
Three Sources of Knowledge

1. The *findings* – how people behave.
2. The *theories* – explanations for the findings.
3. *Applications* – putting the knowledge to use to help people.

Our textbook includes all three but emphasizes findings and applications not theory.
Traditional Approaches

- S-R theorists:
  - Hull
  - Spence
  - Guthrie

- Cognitive theorist:
  - Tolman
Hull’s Drive Theory

- Drive – an intense internal force that motivates behavior.

- Learning is the result of several factors that determine the likelihood of a specific behavior:
  - Drive, D
  - Incentive motivation (reward), K
  - Habit strength (prior experience), H
  - Inhibition (due to absence of reward), I
Hull's Model

**FIGURE 2.1** Diagram of Hull's theory. The terms in the circles show the major variables influencing the likelihood of behavior. Drive (D), habit strength (H), and incentive (K) increase the excitatory potential ($E_R$), enhancing the likelihood that the stimulus will elicit a particular response. By contrast, inhibition (I) decreases excitatory potential. The terms in the rectangle represent the secondary processes that influence each major process.
Unconditioned Sources of Drive

- Events that threaten survival activate internal drive states.
  - Hunger, thirst, sex

- Behavior is designed to restore biological systems to normal.
  - Adjustments can be internal or external (burning stored fat or eating).

- Hull said drives can exist without deprivation.
Non-Survival Drives also Exist

- Electric shock is aversive but does not threaten survival, yet is strongly motivating.
- Saccharin provides no nutrition or calories and does not satisfy hunger but is highly motivating.
- Animals and people will work for stimulation, which is not drive-reducing.
Acquired (Conditioned) Drives

- An acquired drive is a conditioned (learned) drive.
- Classical conditioning results in drives that arise because the CS elicits them.
  - NOT because of an internal deprivation state (hunger, thirst).
  - Example: craving for beer or hotdogs at the ballpark.
Drive Reduction is Reinforcing

- Specific behaviors occur in specific contexts because of habit strength.
- Habits are formed when a behavior is reinforced by drive reduction.
  - Hunger is reduced by eating a hot dog at the ballpark.
  - The association between hot dog stand and eating a hot dog is strengthened by hunger reduction.
Unsuccessful Behavior

- When a behavior does not cause drive reduction, it will be temporarily inhibited.
- If it continues to be unsuccessful, conditioned inhibition occurs.
- This reduces the strength of a habit.
- The behavior that is performed is the one with the greatest habit strength in a hierarchy.
Incentive Motivation

- The size of a reward matters.
- Crespi found that changing the reward size greatly affects behavior.
- Environmental stimuli associated with a reward acquire the ability to motivate behavior (CS again).
Expectations Affect Behavior

**FIGURE 2.2** Speed in the runway as a function of the magnitude of reinforcement. The rats received 1, 16, and 256 pellets of food. (The acquisition data for the 1-pellet group are not represented.) Sixteen pellets were given to each rat after trial 20. A shift from 1 to 16 pellets produced a rapid increase in performance, while a rapid decline in speed occurred when reward magnitude was lowered from 256 to 16 pellets.
Hull’s Correct Ideas

- Intense arousal can motivate behavior.
- Environmental stimuli can acquire the ability to motivate behavior.
- The size (value) of a reward influences the intensity of the behavior.
Hull’s Mistakes

- Inaccurate concepts of reward and drive:
  - Olds & Milner showed that direct stimulation of the brain is reinforcing, so drive reduction isn’t necessary.
  - Sheffield argued that rewards produce excitement which is motivating.

- Hull suggested no mechanism for how environmental stimuli acquire the ability to motivate.
Spence’s Anticipatory Goal Response

- How does previous experience with reward become an incentive?
- Spence proposed that environmental cues become associated with rewards.
  - $R_G$ changes the stimulus to $S_G$
- Seeing the rewarding stimulus results in arousal, $r_g$ and $s_g$, motivating approach behavior.
Amsel’s Anticipatory Frustration Response

- Amsel used Spence’s idea of anticipatory states to explain inhibition.
- Frustration motivates avoidance and suppression of approach behavior.
- Nonreward produces $R_F$ and $S_F$ and motivates escape.
- Anticipation, $r_F$ and $s_F$, motivate avoidance.
Problems with Anticipatory Response

- Spence hypothesized a peripheral nervous system response ($r_G$).
- Rescorla & Solomon found no reliable physiological change with instrumental behavior.
- They suggest that the response may be CNS not ANS.
  - The change is in activation of some brain region, not autonomic response.
Guthrie’s Contiguity Theory

- Guthrie disagreed with Hull, Spence, Amsel, and most other learning theorists.

- Guthrie suggested that **contiguity** alone, **without reward**, was sufficient for learning.
  - Hanging up the hat and coat must be associated with coming in the door (contiguous in time and space).
Guthrie’s View of Reward

- Reward didn’t strengthen the association but it was important.

- In Guthrie’s view, reward changes the stimulus context.
  - A context can be internal or external.
  - When the stimulus is changed, further conditioning to another response is prevented.

- Reward must be immediate.
Guthrie’s View of Punishment

- Punishment only works when the response it elicits is different than the response being punished.

- Can you punish a child by spanking him for hitting others?
  - Punishment elicits aggression which is compatible with hitting – so hitting will not be eliminated that way.
  - It depends on the response to the pain.
Importance of Practice

- Guthrie’s theory predicts that learning occurs in a single trial.

- But performance improves over time because:
  - Stimuli vary or are attended to differently from time to time.
  - Many stimuli can be conditioned to produce the same response.
  - Each response element must become conditioned to the stimulus.
Problems with Guthrie’s Theory

- Guthrie was right about punishment but very strong punishment will suppress even compatible behavior.
- Guthrie was right about contiguity and that only some parts of a stimulus are attended at a time.
- Guthrie was wrong about reward.
Guthrie’s Single Trial Learning

**FIGURE 2.3** The performance of six subjects on a conditioned eye blink study. The rapid change in performance of each subject from one trial to the next supports one-trial learning. Note the mean performance of all subjects slowly increases across trials, which could erroneously suggest an incremental increase in learning over trials.
How Fast is Learning?

- Some studies support single-trial learning but others do not.
- Spence explained single-trial learning as a gradual process that is only revealed after a threshold is reached.
  - This lets an incremental theory explain an all-or-nothing phenomenon.
- Some aspects of learning are fast.
Tolman’s Purposive Behaviorism

- Behavior is not an automatic response to the environment but has direction and purpose.
  - Goal oriented.
  - Expectations are what will happen.
- The environment conveys goal-relevant information.
  - Signs point to reward or punishment.
- Behavior is not always conscious.
Motivations

- Deprivation causes motives to transfer to stimuli in the environment.
  - Cathexis – transference process.
  - Can be positive or negative.

- **Equivalence belief principle** – people treat secondary reinforcers as if they were primary.
Is Reward Necessary?

- According to Tolman, understanding can develop without reward.

- Reward motivates performance (display of understanding in a situation).
  - Presence of reward motivates a child to display previous learning.
Problems with Tolman’s View

- Experiments supporting Tolman’s ideas had inconsistent results.
- Tolman’s findings changed Hull’s theories.
  - Anticipatory goal responses are similar to Tolman’s concept of expectation.
- Only when Hull’s view of drive became problematic did people accept Tolman’s cognitive approach.