A Cognitive View of Learning

Lecture 10
Cognition and Conditioning

- Conditioning Occurs When the US Surprises the Organism
- Conditioning Accrues to CSs that Provide Information About the US
- In Classical Conditioning, the Organism Learns to Predict Environmental Events
- What about *Instrumental* Conditioning?
Two-Factor Theory of Avoidance Learning
Mowrer (1947)

• Tone CS ==> Shock US
  – Respond During Shock ==> Escape
  – Respond Prior to Shock ==> Avoidance
• Classical Conditioning
  – Fear Conditioned to Tone
• Instrumental Conditioning
  – Escape Reinforced by Offset of Shock
    • Reduction in Pain
  – Avoidance Reinforced by Offset of Tone
    • Reduction in Fear
Learned Helplessness
  e.g., Seligman & Maier (1967); Seligman, Maier, & Solomon (1971)

• Prior Fear Conditioning Should Facilitate Avoidance Learning
  – Organism Already Fears CS
  – Only Has to Learn Avoidance Response

• Phase 1: Condition Fear to Tone

• Phase 2: Avoidance Learning

• But Prior Fear Conditioning *Retards* Acquisition of Avoidance Response
Escapable vs. Inescapable Shock
Seligman & Maier (1967)

- Avoidance Learning in Shuttlebox
- Pretreatment: 64 Signalled Shocks
  - Escape Shock by Pressing Paddle with Snout
  - Yoked Controls
    - Receive Same Amount of Shock as Escape Group
    - No Experience of Control Over Shock
  - Standard Controls
    - Receive No Shocks
Learned Helplessness
Seligman & Maier (1967)

Response Latency (secs)

Pretreatment

Controls 26.3%
Escape 22.5%
Yoked 72.5%

Escape Failures
Controllability and Instrumental Conditioning

- **Learned Helplessness**
  - Shock is Inescapable, Unavoidable
  - Negative Expectations of *Control*
    - Generalize to New Learning Environment

- **Instrumental Conditioning**
  - Organism Learning to Control Environment

- **Develops Expectations Concerning Control**
Prediction, Control, and Conditioning

• Classical Conditioning
  – Learning to Predict Environmental Events
  – Conditional Probability: $p(\text{Event} \mid \text{Signal})$

• Instrumental Conditioning
  – Learning to Control Environmental Events
  – Conditional Probability: $p(\text{Event} \mid \text{Behavior})$
Role of Reinforcement in Learning

• Corollary to S-R Learning Theory
  – Conditioned Response
  – Reinforced in Presence of Conditioned Stimulus

• Classical Conditioning
  – CS Reinforced by Experience of US

• Instrumental Conditioning
  – CR to CS Reinforced by Reward
    • Yields Thorndike’s Law of Effect
    • Skinner: Reinforcement is Any Stimulus that Increases the Probability of the Conditioned Response to the CS
Classical Conditioning in the Absence of Reinforcement

• Sensory Preconditioning
  – CS1 ⇒ CS2
  – CS1 Predicts US by Transitivity

• Higher-Order Conditioning
  – CS2 ⇒ CS1
  – CS2 Predicts US by Transitivity
Maze Learning in Rats
Tolman & Honzik (1930); Tolman (1932)
Latent Learning
Tolman & Honzik (1930)

Figure 5.3. Evidence for latent learning in the maze. With no food reward there is some reduction in errors, but not as great a reduction as with regular food reward. Despite the higher error scores prior to the introduction of food, the group rewarded only from the eleventh trial immediately begins to do as well as the group that had been regularly rewarded. The interpretation is that some learning went on within the first ten trials which did not show in performance until the food incentive activated it. (From Tolman & Honzik, 1930b. Originally published by the University of California Press; reprinted by permission of The Regents of the University of California.)
Curiosity in Rhesus Monkeys
Harlow (1953); Harlow et al. (1956)

• “Puzzle Lock”
• Food Reward
• Hunger
• Intrinsic vs. Extrinsic Motivation
What is Learned in Learning?

• *Not* Associations between Stimuli, Responses
• Expectations
  – Outcomes of Events
  – Outcomes of Behaviors
• Classical Conditioning
  – Predictability of Environmental Events
• Instrumental Conditioning
  – Controllability of Environmental Events
Cognitive Reinterpretation of Learning

• Relatively Permanent...

• Change in Behavior **Knowledge**...
  – Predictability
  – Controllability

• Resulting from Experience.
  – Not Drugs
  – Not Injury
  – Not Maturation
Observational Learning

• Direct versus Vicarious Experience
  – Conditioned Stimuli
  – Unconditioned Stimuli
  – Reinforcements
Observational Fear Conditioning
Mineka et al. (1984)

- Snake Fear in Rhesus Monkeys
  - It’s Adaptive: But Is It Innate?
- Wild-Reared vs. Lab-Reared
  - Snake Fear Not Innate
- What Role for Direct Experience?
  - Snake Fear Not Acquired Directly
- Adaptive Value of Vicarious Learning
  - Vicarious Learning of Human Fears, Phobias
Test of Snake Fear

- Wisconsin General Test Apparatus
- Obstacle Between Animal and Food Reward
  - Must Reach Past Object to Obtain Food

- Measure of Fear
  - Latency to Reach Past Object
Pretest of Snake Fear in Rhesus Monkeys

Mineka et al. (1984)

Latency of Food-Reaching (secs)

Obstacle

Real
Toy
Model
Black
Yellow
Neutral

Snake
Cord

Wild
Lab
Vicarious Conditioning of Snake Fear
Mineka et al. (1984)

- Wild-Reared Adults
  - Already Afraid of Snakes
- Lab-Reared Adolescent Offspring
  - No Snake Fear
- Posttest After Observing Parent
Snake Fear in Rhesus Monkeys Prior to Vicarious Exposure

Mineka et al. (1984)

Time Spent With Object (secs)

Object

Real  Toy  Model  Neutral

Snake

Parents  Offspring
Snake Fear in Rhesus Monkeys
After Vicarious Exposure

Mineka et al. (1984)

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**Graph:**

- **X-axis:** Object
  - Real
  - Toy
  - Model
  - Neutral

- **Y-axis:** Time Spent With Object (secs)
  - Parents
  - Offspring

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**Legend:**

- Parents
- Offspring

**Snake Object:**
- Parents: 200 seconds
- Offspring: 150 seconds
Variants on Observational Learning

• Unrelated Adult as Model
• Immunization through Extensive Prior Exposure to Snakes
• Snake vs. Flower
  – Mirrors, Video to Control Exposure
  – Model Sees Snake
  – Observer Sees Snake or Flower
Examples of Observational Learning by Animals in the Wild

- Chickadees and Milk Bottles
- Red Squirrels and Hickory Nuts
- Israeli Roof Rats and Pine Cones
- Chimpanzees and Panda Nuts
The “Bobo Doll” Experiment
Bandura et al. (1961)

• Nursery-School Children
• Adult Model
  – Aggressive
  – Non-Aggressive
  – Control
• Aggression During Free Play
  – Imitative: Physical and Verbal
  – Punching, Hitting with Mallet
  – Nonimitative Aggression, Gun-Play
Observational Learning and Language Acquisition

• Native or Secondary Language
• Exposure to Language
  – Aural or Gestural
  – Critical Period before Puberty
• Detect Sounds of Language
  – Separate into Words
• Recognize Words
• Grammatical Rules
• Prosody, Nonverbal Communication
Statistical Learning by Infants
Saffran, Aslin, & Newport (1996)

- Stimulus Materials
  - Tupiro Golabu
  - Bidaku Padoti

- Test Items, Exp. 1
  - Tupiro Golabu
  - Dapiku Tilado

- Test Items, Exp. 2
  - Tupiro Golabu
  - Tibida Kupado

![Bar chart showing listening time (secs) for familiar and novel items across two experiments.](chart.png)
Social Learning Theory
Miller & Dollard (1941)

• Imitation as Acquired (Secondary) Drive
  – Necessary Component of Socialization
    • Conformity
    • Discipline

• Two Forms of Imitation
  – Matched-Dependent Behavior
    • No Awareness of Cues
  – Copying
    • Awareness of Cues
Cognitive Social Learning Theory
Bandura & Walters (1963); Bandura (1977)

• Expectations, not Behavior
• Learning by Response Consequences
  – Direct Experience
    • Trial and Error
    • Reward and Punishment
• Vicarious (Observational) Learning
  – Example
    • Modeling, Imitation (Informal)
  – Precept
    • Sponsored Teaching (Formal)
Social Learning and Culture

- **Culture**: Customary Beliefs, Social Forms, and Material Traits of a Racial, Ethnic, or Social group
  - Transmitted through Informal Learning and Formal Training from One Generation to the Next

- Observational Learning is the Cognitive Basis of Culture and Cultural Transmission

- *Thinking* is the Cognitive Basis of Cultural Evolution