Chapter 11: Biological Dispositions in Learning

Chapter Outline

- Preparedness & Conditioning
  - Pavlovian conditioning
  - Operant conditioning
- Operant-Pavlovian interactions
  - Instinctive drift
  - Sign tracking
- Adjunctive behavior
  - Procedure and defining characteristics
  - Adjunctive behavior in humans
  - Adjunctive behavior as displacement activity
- Activity anorexia
  - Procedure and defining characteristics
  - Comparison with anorexia nervosa
  - Underlying mechanisms & clinical implications
- behavior systems theory

Preparedness & Conditioning

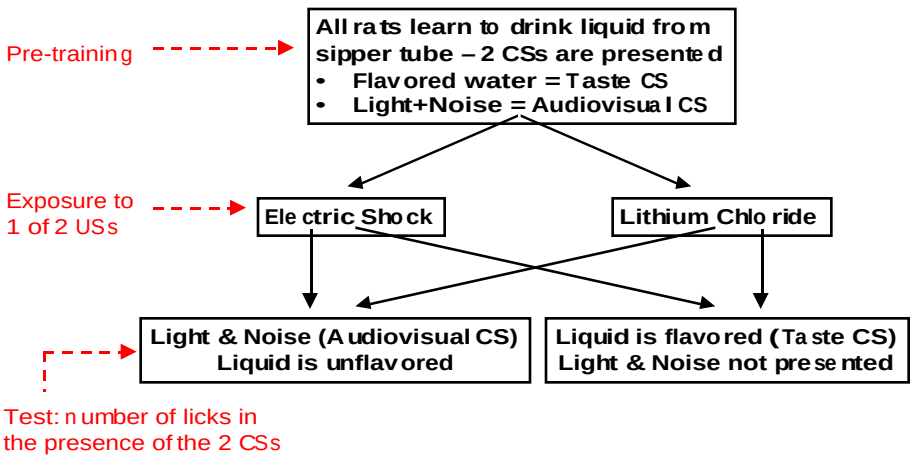
- Pavlovian conditioning
- Operant conditioning

Preparedness & Pavlovian Conditioning

- Equipotentiality hypothesis
  "Any natural phenomenon chosen at will may be converted into a conditional stimulus…any visual stimulus, any desired sound, any sound, and the stimulation of any part of the skin" (Pavlov, 1928, p. 86)

- Garcia & Koelling (naturalistic observation of behavior)
  - Investigated taste aversion learning in rats
  - Bait shyness –
  - As expected – Bait (CS) : Nausea (US) → Illness (UR)
  - BUT…
  - AND…
  - Shouldn't rats associate visual (location) cues with illness???

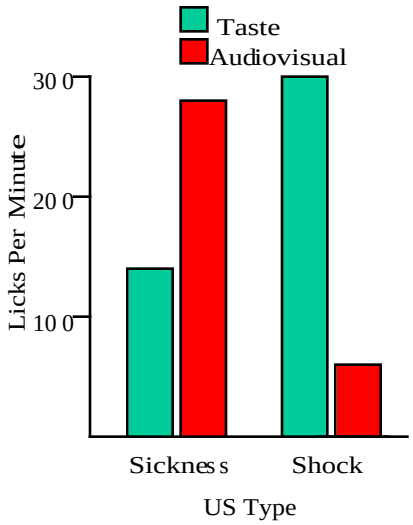
- Garcia & Koelling (1966)
  - Rats trained to drink water from tube
  - During drinking exposed to two types of CSs
    1.
    2.
  - Taste + Audio-Visual compound are CSs
  - Following conditioning
    - Half rats given dose lithium chloride →
    - Half rats given electric foot-shock →
  - Test
    - Half rats from each group rats allowed to drink flavored water
    - Half rats from each group allowed to drink plain water paired with audio-visual compound



- **Diagrammatic representation of Garcia & Koelling (1966)**

Results

- Shocked rats
  - Drank very little when drinking
  - Drank more when
- Poisoned rats
  - Drank very little when drinking
  - Drank more when



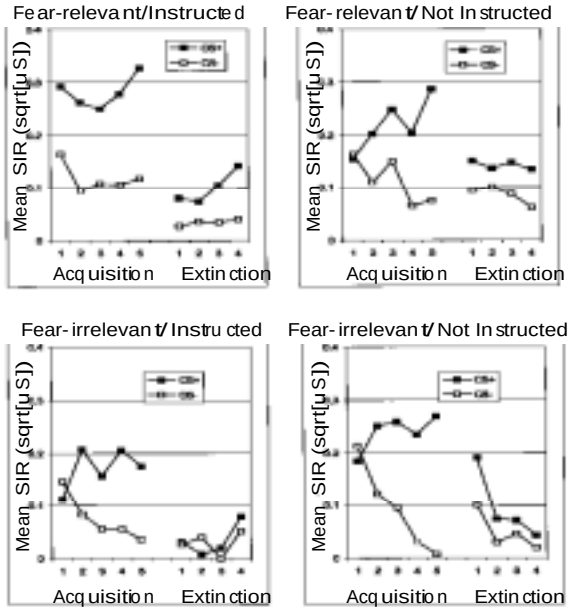
Preparedness & Pavlovian Conditioning

- Results in opposition to equipotentiality hypothesis
  - Taste aversion
  - Fear more
- Preparedness (Seligman, 1970)
  - Biologically determined tendency to more readily associate certain types of stimuli
  - Evolutionary relevance of prepared associations
    - Nausea more likely from ingested material
    - Pain more likely with stimulus that can be seen or heard
  - Prepared associations vs. non-prepared associations in taste aversion learning
    1.
    2.
    3.

Preparedness & fear conditioning

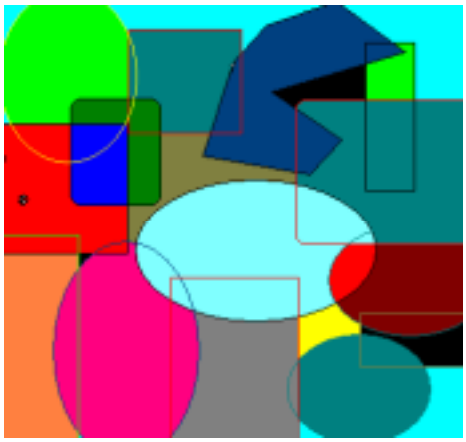
- Fear-relevant CSs and aversive US are thought to be prepared associations
  1. Selective (Hugdahl & Öhman, 1977)
  2. One trial learning (Öhman, Erikson, Olofson, 1975)
  3. Resistant to extinction (Öhman, Erixon, Löftberg, 1976)
  4. Unaffected by cognitive influence???
  - Lipp & Edwards (2002)
    - Differential fear conditioning paradigm
    - Half Ps trained with pictures of
    - Half Ps trained with pictures of
    - Following acquisition, half Ps in each group instructed no more shocks delivered; other half no instructions
    - DV = second interval GSR

- Resistance to extinction
  - Fear-relevant not instructed group vs. fear-irrelevant not instructed group
- Cognitive influence
  - Fear-relevant instructed group vs. fear-relevant not instructed group



Preparedness & Pavlovian Conditioning

- Fear-relevant CSs and aversive US are:
  1. Selective (Hugdahl & Öhman, 1977)
  2. Single trial learning (Öhman, Erikson, Olofson, 1975)
  3. Resistant to extinction (Öhman, Erixon, Löftberg, 1976)
  4. Unaffected by cognitive factors (Lipp & Edwards, 2002)
  5. Occur outside of awareness???
- Öhman & Soares (1998)
  - Differential conditioning paradigm
  - Ps shown pictures of snakes & spiders OR flowers & mushrooms
  - CS+ always followed by shock; CS- never with shock
  - Pictures presented backward masked to prevent awareness



- Example of backward masking

Öhman & Soares (1998) cont.

- Results
  - Ps presented with
  - Ps presented with

Preparedness & Pavlovian Conditioning

- Preparedness can explain why phobias are so easily acquired
  - It makes sense that some CS-US associations are readily learned
  - Selectivity – no sense in learning all CS-US associations e.g.,
  - Rapid learning
  - Rapid detection
  - Genes find their way next into next generation
- Preparedness can explain why phobias are so difficult to treat
  - Fear to snakes & spider extinguishes more slowly
  - Despite safety instructions Ps still fearful

Preparedness & Operant Conditioning

- Evidence for biological constraints in operant conditioning

Preparedness & Operant Conditioning

- Bolles (1970)
  - Animals cannot be trained to give any behavior for any reward
    - Rats can easily be trained to lever-press to receive food rewards
    - Rats cannot easily be trained to lever-press to escape shock
  - Training difficulties can be explained by animal's evolutionary history

Preparedness & Operant Conditioning

- Biological dispositions in pigeon avoidance responses
  - Pigeons can be easily trained to
  - Pigeons cannot easily be trained to
  - Pigeons can be easily trained to
  - Pigeons cannot easily be trained to
- It seems that some behaviors are naturally associated with certain types of need

Preparedness & Operant Conditioning

- Bolles (1979)
  - Preparedness plays an important role in avoidance behavior
  - Avoidance responses not operants (controlled by consequences) – seem to be elicited behaviors (controlled by stimuli that precede them)
  - Aversive stimuli elicit SSDRs (species-specific defense reaction)

Example

A rat's natural reaction to fear is to freeze or to run and these behaviors are naturally elicited. In a Skinner box a rat will sometimes freeze when a shock is signalled (adaptive…ensures the rats receives the shock?). If a rat experiences fear in a confined space it cannot escape so its best defence is to freeze.

Operant-Pavlovian Interactions

- Instinctive drift
- Sign tracking

Instinctive drift

- A classically conditioned
- Breland & Breland (1961)
  - Attempted to train a pig to drop a coin in a piggybank
  - Early conditioning was effective (eager pigs!!!)
  - BUT…pigs began to drop coin and
  - Perhaps pig wasn't hungry enough…food deprivation was increased → misbehavior worsened
- Pigs had associated
- Learned behavior

Operant-Pavlovian Interactions

Demonstration

- Coin (S^D) : Deposit Coin (R) → Food (S^R)

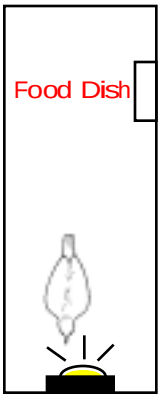
- Coin (CS) : Food (US) → Rooting (UR)
- Coin (CS) → Rooting (CR)

– Pigs had associated the coin with food and began treating it as though it was food

– Learned behavior drifts towards instinctive behavior

Operant-Pavlovian Interactions

- Sign tracking
  - The organism



Key Light Signalling Food

- Light signals delivery of food
- Pigeon should go to food dish & wait
- Instead…
- Autoshaping (Brown & Jenkins, 1968)
  - Pigeons - light key (8s) + *non-contingent* food delivery
  - No need to peck at key but do anyway
    - Key Light : Food → Peck
    - Key Light → Peck
  - Associate key with food
    - Key Light : Peck → Food

Adjunctive Behavior

- Procedure and defining characteristics
- Adjunctive behavior in humans
- Adjunctive behavior as displacement activity

Adjunctive Behavior

- Procedure and defining characteristics
  - Excessive pattern of behavior that emerges
- Falk (1961)
  - Rats trained to lever press for food on intermittent schedule drank excessive amount of water
  - During 3-hr session they drank
  - Rats were food deprived…NOT water deprived
- Studies typically employ FI schedule
  - Adjunctive behavior develops in period
  - When probability of reinforcement is low,

Adjunctive Behavior - Characteristics

1. Occurs immediately
   - E.g., rat quickly eats food pellet then moves to drinking tube. As time for next food pellet nears rats returns to lever pressing
2. Affected by deprivation
   - E.g., the greater the food deprivation the more water

Adjunctive Behavior - Characteristics

3. Adjunctive behaviors
   - E.g., during the inter-reinforcement interval rats will lever press to gain access to water
4. Optimal interval between
   - E.g., pellet delivered every 5 s – little water drinking
   - Pellet delivered 180 s – lots of water drinking
   - Pellet delivered 300 s – lots of water drinking

Adjunctive behaviors in humans

- Doyle & Samson (1988)
  - FI schedule of money reinforcement for game playing drank more *water* immediately following reinforcement
  - FI schedule of money reinforcement for game playing drank more *beer* immediately following reinforcement
  -
- Cherek (1982)
  - FI schedule of monetary rewards for button pressing
  - Schedule varied (30, 60, 120, 240 s)
  - Highest rate of
- May explain substance abuse development in low SES groups where external stimulation/reward is low

- Adjunctive behaviors = displacement activity
  - Displacement activity =
  - Falk (1977)
    - Adaptive purpose of displacement activities

    1.
      - E.g., adjunctive behavior might produce new food source

    2.
      - E.g., displacement activity reduces boredom while waiting for reinforcer

Activity Anorexia

- Procedure and defining characteristics
- Comparison with anorexia nervosa
- Underlying mechanisms
- Clinical implications

Activity Anorexia

- Procedure and defining characteristics
  - Low level of
- Epling & Pierce (1991)
  - Group 1 –
  - Group 2 –
  - Group 3 –
  - Results
    - Group 1 –
    - Group 2 & 3
  - Food restriction + exercise opportunity = fatal!!!

Comparison with anorexia nervosa

- Anorexia nervosa =

- 10 % of sufferers die (electrolyte imbalance)
- Similarities

  1. Both precipitated by
  2. Both accompanied with
  3. Anorexia more common among

- Differences

  1. Rat's food restriction is

  2. Human anorexia sometimes

Activity Anorexia

- Underlying mechanisms
  - Endorphin theory
    - Endorphins = morphine-like substance linked to pain reduction
    - Accompanied with pleasure feelings
    - Boer, Epling, Pierce & Russel (1990)
      - Activity anorexic rats injected with endorphin blocking substance
- Clinical implications
  - Focus on establishing normal eating patterns
  - Focus on establishing normal activity patterns
  - Rats do not develop activity anorexia

Behavior Systems Theory

- Behavior is organised into
- Each system functions to

- Each system is
- Each system incorporates a number of discrete response sets (CRs; fixed action patterns)

Example – Feeding system of the rat (3 systems)

1. General-search for food (travelling, sniffing etc.)
2. Focussed-search (chasing, pouncing, grabbing etc.)
3. Handle/Consumption (chewing, swallowing etc.)

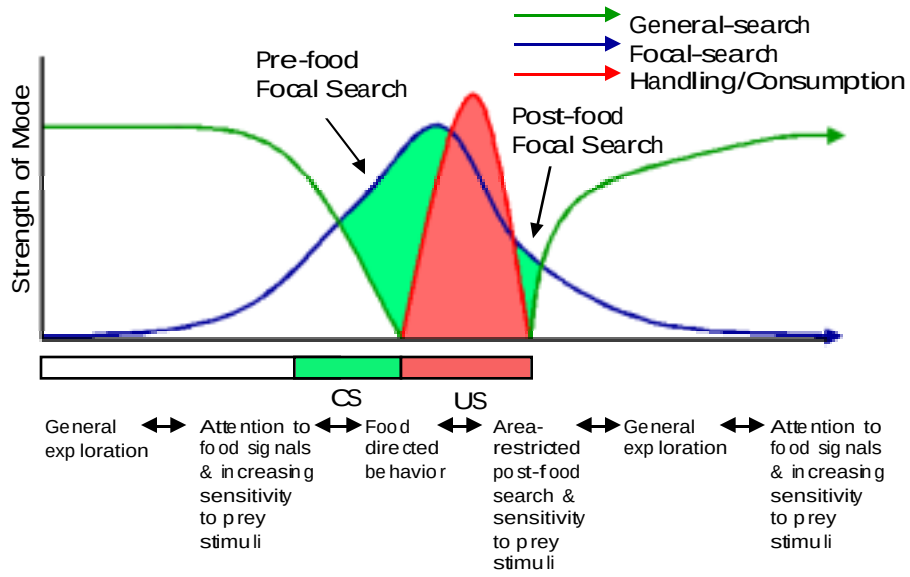
Behavior Systems Theory

- Can investigate using Pavlovian conditioning procedure
- Various behaviors (CRs) within the feeding system should be sensitive to:
  - *Temporal intervals*
    - Long CS-US intervals =
    - Short CS-US intervals =
  - *Distance*
    - Distant CSs engage
    - Close CSs engage
- Predictions - nature of the CR will depend on
  - The CS-US interval
  - The particular CS employed

Behavior Systems Theory cont.

- Timberlake, Wahl & King (1982)
  - Rats presented with a rolling ball (CS) followed by food (US)
  - CS-US interval varied (2.6 s vs. 7.6 s)
  - Results:
    - 2.6 s =
    - 7.6 s =
  - Interpretation:
    - Short CS-US interval =
    - Long CS-US interval =
  - Summary – the nature of the CR depends on CS-US interval

- Does the nature of the CR depend on the CS employed?
- Holland (1977)
  - Food conditioning paradigm
  - Half rats conditioned with a tone CS
  - Half rats conditioned with a light CS
  - Delay between CS-US same for both groups
  - Results:
    - Tone: CR =
    - Light: CR =
  - Summary:
    -



- Source: Silva, Timberlake & Gont, 1998

Behavior Systems Theory cont.

- Summary
  - Intended as general theory of
  - Theory is plausible
  - Theory does make several testable predictions (most have been supported)
  - Theory too new to draw firm conclusions (more research is needed)
- Limitations
  - After-the-fact conclusions
  - E.g., need to predict a-priori that a rat will rear on its hind legs in response to a light; and will head-jerk and increase in activity in response to a tone

Lecture Summary

- Organisms appear to be biologically wired to learn some CS-US associations more readily than others
- In taste-aversion learning CS-US associations can occur over long delays, in a single trial, and be specific to certain CS-US associations
- Preparedness might explain why phobias typically develop to certain stimuli and why they are so difficult to extinguish
- Prepared associations in fear conditioning paradigms have shown they are selective, occur in a single trial, are resistant to extinction, are unaffected by cognitive influence, and occur outside of awareness
- Examples of preparedness in operant procedures can be seen in the ease of training some responses over others
- Instinctive drift is a genetically based fixed action pattern that displaces an operant conditioned behavior

Lecture Summary

- Sign tracking is the tendency to approach a signal stimulus for an appetitive event
- Adjunctive behavior is an excessive behavior that emerges in response to an intermittent reinforcement schedule for another behavior
- Adjunctive behaviors typically develop in the period immediately following the reinforcer, and are strongest with a moderate duration post-reinforcement interval
- Activity anorexia is a pattern of excessive activity and low food intake resulting from limited food supply
- Activity anorexia in rats is somewhat similar to anorexia nervosa in humans
- Behavior systems theory suggests behavior is organised into a series of motivational systems
- Each system contains a series of species specific responses activated by situational cues (CSs)