Chapter 8: Stimulus Control

Stimulus Control

- Generalization & discrimination
- Peak shift effect
- Multiple schedules & behavioral contrast
- Fading & errorless discrimination learning
- Stimulus control: Applications for the study of memory

Stimulus Control

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- Stimulus control
  - Presence of the
  - Does not

  Examples
  - *2000 Hz Tone* : Lever Press → Food
  - *Hotel* : Smoking Urge → Smoking

Generalization & Discrimination

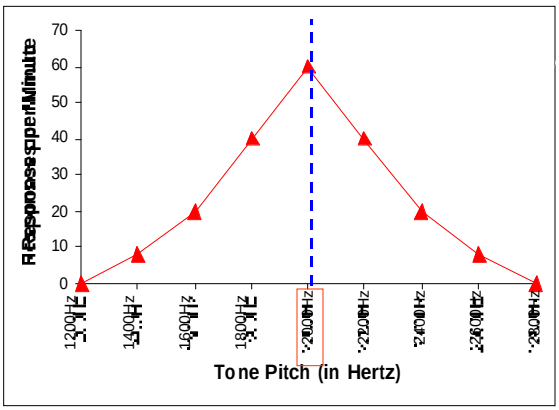
- **Stimulus Generalization** is the tendency for an operant response
  - **Example:** If you have learned to beg for candy in a grocery store, you might also do it in a convenience store
  - More similar the stimulus to the S^D
    - Rat is rewarded with food for lever pressing in the presence of a 2000Hz tone. More likely press the lever in presence of 1800 Hz tone than 1000 Hz tone

Generalization & Discrimination

- **Stimulus Discrimination** is the
  - Opposite of generalization

Stimulus Generalization

- Generalization gradient
  - Depiction of strength of responding in the presence of stimuli similar to the S^D



- Steeper gradients =
- Shallow gradients =

Discrimination Training

- While the discriminitive stimulus signals that reinforcement is available, other stimuli become signals that reinforcement will NOT be available.
- These other stimuli are called *"discriminitive stimuli for extinction"*

Discrimination Training

- Discrimination training (operant procedures)
  –
  – When responding is NOT reinforced in the presence of certain stimuli those stimuli become *discriminative stimuli for extinction* (symbol = S^{Δ})

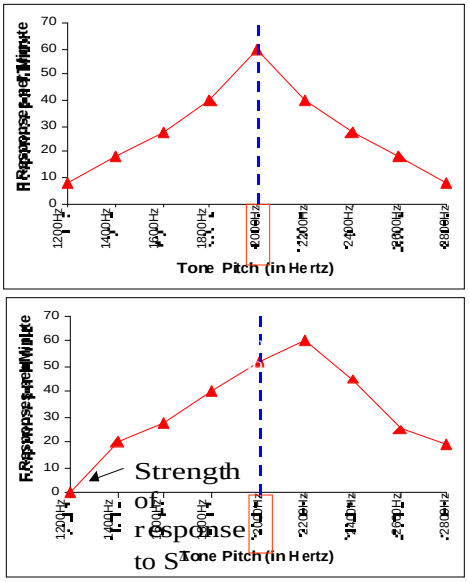
Example

2000 Hz Tone (S^{D}) : Lever Press (R) $\rightarrow$ Food (S^{R})

1200 Hz Tone (S^{Δ}) : Lever Press (R) $\rightarrow$ No Food (-)

Peak Shift Effect

- Peak Shift Effect -Following discrimination training,
  - Originally trained to press for 2000 Hz tone.
  - See generalization gradient.
  - Then train for 2000 Hz tone and NOT for 1200 Hz tone.
  - See new generalization gradient.
  - Peak responding to 2200 Hz, which has never been trained.



Peak Shift cont.

- Explanations
  - Responding occurs to relative (rather than absolute) values of stimuli (e.g., higher pitched tones indicate food; lower pitched tones indicate no food)
  - S^D is more similar to S^Δ than 2200Hz tone and has acquired its inhibitory properties

Multiple Schedules

- Multiple schedules & behavioral contrast
  - *Multiple schedules* -
  - Differ from chained schedules (reinforcer is delivered after each component)

FI 30-sec VI 30-sec

Red Key: *Key Peck* → Food / Green Key: *Key Peck* → Food

S^D R S^R S^D R S^R

Multiple Schedules

- Multiple schedules & behavioral contrast continued

FI 30-sec VI 30-sec

Red Key: *Key Peck* → Food / Green Key: *Key Peck* → Food

S^D R S^R S^D R S^R

  - Can demonstrate stimulus control if responding varies with S^D reinforcement schedule
  -

Behavioral Contrast-negative

- *Behavioral contrast* –

- *Negative contrast* – increase in rate of *reinforcement* on one component produces

  VI 60-sec VI 60-sec

  Red Key: *Key Peck* → Food / Green Key: *Key Peck* → Food

  – Same schedule so equal responding on both parts

  – Change reinforcement associated with red key (twice as much)

  VI 30-sec VI 60-sec

  Red Key: *Key Peck* → Food / Green Key: *Key Peck* → Food

  – Despite the Green condition remaining the same,

Behavioral Contrast-positive

- *Positive contrast* - decrease in rate of *reinforcement* on one component produces

  VI 60-sec VI 60-sec

  Red Key: *Key Peck* → Food / Green Key: *Key Peck* → Food

  – Change reinforcement associated with red key (half as much)

  VI 120-sec VI 60-sec

  Red Key: *Key Peck* → Food / Green Key: *Key Peck* → Food

  – Despite the Green Key remaining the same,

- Similar effects are observed when the magnitude of the reinforcer is changed

Limitations

- Limitations of discrimination training
  - When discriminating S^D from S^Δ P will make mistakes
  - Can result in frustration, emotional behavior etc.
- Fading & errorless discrimination learning
  - Can reduced number of errors to S^Δ if:
    1.
    2.

Limitations Cont.

Example

Pigeons trained to peck at red key (VI 60-sec), once behavior established 5 sec extinction intervals implemented (light key switched off). Pigeons don't peck at dark keys so it's easy to establish as S^Δ. Reinforcement and extinction sessions gradually increased to 3-mins each. Dark key then gradually illuminated with green tinge. Almost no errors made to S^Δ relative to control group

Limitations of errorless discrimination training

- Marsh & Johnson (1968)
  - Pigeons trained to discriminate between red and blue keys using errorless discrimination procedure
  - Other pigeons trained to discriminate using standard discrimination procedures
  - Once discrimination learning had taken place the S^D and S^Δ were reversed
  - Pigeons that learned to discriminate using standard procedures had
  - Pigeons that learned to discriminate using errorless procedures had

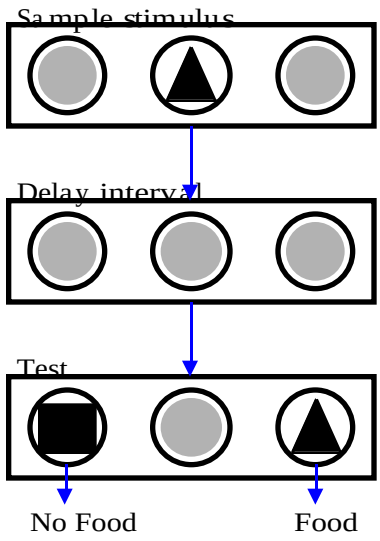
  – Standard task – adverse side effects in original learning but task produces greater flexibility if material requires subsequent modification

Memory

- Stimulus control: The study of memory
  – Can assess the effect of stimulus control on memory in humans by asking questions that require verbal response (e.g., multiple choice exams)
    - Correct response = S^D
    - Incorrect response = S^Δ
  – Animals do not have verbal ability so need alternative techniques to study memory
  – Delayed-matching-to-sample
    - Animal is shown sample stimulus and following a delay it is required to select it from a group of alternatives
    - If correct stimulus is selected the animal is thought to have remembered it

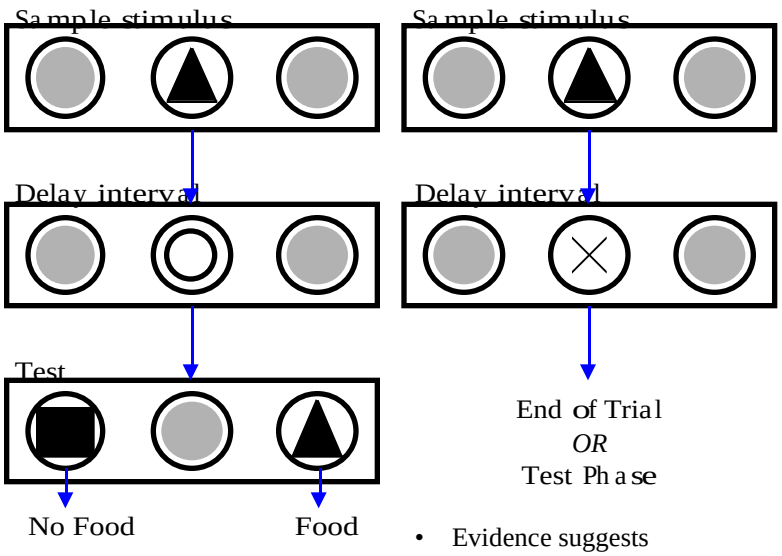
1. Sample stimulus is presented (pigeon must peck at it to ensure that it is noticed)
2. Delay interval administered
3. At test, pigeons must remember which key was previously illuminated to receive food reward

- Can be used to test memory processes by altering aspects of the procedure (e.g., length of sample presentation, length of delay period etc.)



Memory cont.

- Directed forgetting
  - Is memory poorer for material that you have been told to forget (relative to memory for material that you have not told to forget)?
  - Matching-to-sample procedure employed
  - During delay phase pigeon is shown either:
    - O = remember the sample stimulus
    - X = forget the sample stimulus (trial will start over)
    - Following occasional X-trials test display is presented
  - Question – will pigeon perform worse at test for material they have been instructed to forget (i.e., X-trials) as opposed to information they have been instructed to remember (i.e., O-trials)



- Evidence suggests

Lecture Summary

- Behavior is under stimulus control when the presence of a discriminative stimulus (S^D) affects the probability of the behavior
- Peak shift effect refers to the tendency for the peak of a generalization gradient to shift to one side of the S^D (away from the S^Δ) following discrimination training
- Multiple schedules consist of two or more schedules presented in sequence, each with its own S^D
- Errorless discrimination training reduces side effects associated with discrimination training, but behavior acquired through this procedure is difficult to modify later
- Delayed matching-to-sample procedures can be used to study memory in animals e.g., directed forgetting