Learning Part I

Nonassociative Learning
Assocative Learning: Classical Conditioning
Study of learning

• Learning:
  – process by which long-lasting changes occur in knowledge/behavior as a result of experience
Two approaches to study learning

• Behaviorism (early 20th century)
  – studied simple learning mechanisms
  – Did not rely on introspective reports
  – Focused on the ENVIRONMENTAL STIMULUS and the animal’s BEHAVIORAL RESPONSE
  – Not concerned about what happened in between--what the person or animal thought or felt

• Cognitivism (1950s-present)
  – introduction of complex mental processes ("inside the mind"): cognitive learning
  – focus on human learning
Nonassociative forms of Learning

• **Habituation**
  – An organism’s response to a stimulus will decline following repeated presentations of a stimulus.

• **Dishabituation**
  – Change in the environment (absence of a recurring stimulus or presence of novel stimulus) leads to an increase in responsiveness
Video: habituation (40 secs)

(for original video, see: http://www.youtube.com/watch?v=UiB2ZX1phmc&feature=related)
Using habituation to study infant cognition

4-month old infant

Looking time

Repeated observations of Object A

Present Object B

→ A and C can be discriminated but A and B cannot

4-month old infant

Looking time

Repeated observations of Object A

Present Object C

habituation
dishabituation
Classical Conditioning

- In *classical conditioning* (also known as Pavlovian conditioning), animals learn about the association between one stimulus and another.
Video (~3 min.)
Salivation is a physiological reflex to food.

Unconditioned response

A tone is presented at the same time as the food.

An association between the tone and food is established.

After training, the tone presented alone will elicit salivation.

The UR and CR are similar, but not necessarily identical.
Acquisition and extinction of a conditioned response

Important Question
At some point, even spontaneous recovery will be completely extinguished. Has the association been erased?

No. If the dog is reconditioned following complete extinction, fewer pairings of food (US) and tone (CS) will be required to reestablish the salivation response to tone alone.

Consequences for exposure therapy
Examples of US-UR pairings

Stimulus (US) / Response (UR):

- Food / Salivation
- Electric shock / Pain reaction
- Food / Nausea
- Puff of air / Eye blink
Video: conditioned eyeblink response (~2 min.)

Original video: http://www.youtube.com/watch?v=Xg3WuvCrlZg
Major Phenomena of Classical Conditioning

- Second-order conditioning
- Generalization
- Discrimination
- Contiguity
- Blocking
Second-order conditioning

(1) US (food) paired with CS₁ (metronome)

(2) CS₂ (light) is followed by CS₁ (metronome) followed by no food

(3) CS₂ (light) alone elicits CR (salivation), although at a reduced level

Learning is based on establishing associations

Complex behaviors are assembled from simple ones
Generalization

**Training**
Pair a 1200 Hz tone with the US

**Testing**
Measure the CR when tones with different frequencies are presented
Contiguity (Temporal Ordering)

- Backward Pairing
- Simultaneous Pairing
- Forward Pairing
BLOCKING:  

Training Phase 1  
Pair CS₁ with US  
(establish association)  
tone with shock

Training Phase 2  
Pair CS₁ and CS₂  
with US  
tone and light  
with shock

Test Phase  
Test CS₂ alone  
test light alone; no  
response (CR)

There is no new or independent information provided by CS₂. No  
conditioning occurs to CS₂ because it provides no new information  
about the arrival of the US.
Rescorla Wagner Model

• Mathematical model of classical Conditioning

• Classical conditioning occurs only if the US (UCS) is surprising to the organism.
  – If the UCS is already predicted by a CS, then it is not surprising – it is expected.
  – When the CS predicts the UCS perfectly, no further learning occurs.

• Rescorla Wagner Model predicts the blocking effect
Biological Preparedness

• Do the laws of learning of classical and operant conditioning really apply *equally well to all types of animals and all types of stimuli*?

• Species specific learning:
  – Birds easily associate illness with visual cues (e.g., color of food), but not with taste
  – Rats easily associate illness with taste, but not with visual cues
Specificity of Taste Aversion
(Garcia & Koelling, 1966)

Rats that had been shocked associated the shock with the lights and sounds (but not the taste) that had accompanied the painful experience. Rats that had become ill associated the illness with a taste (but not with the lights and sounds).
What is the conditioned response (CR)?

- The CR may be a version of the UR
  - e.g. salivating to food might be the same as salivating to a bell

- The CR may also be quite different from the UR
  - it might be a preparatory response to the US
  - organism might prepare a response that is adaptive for the US
  - Example preparatory response:
    - rats anticipating shocks
    - anticipatory responses to caffeine
    - “pre-game jitters”
    - Drug tolerance
A young man who had been treated several times for heroin addiction died of an overdose. The dose that caused his death did not differ from the dose he had taken the previous day taken in his usual circumstances. The concentration of morphine in his blood did not exceed the level measured during earlier treatment. So why did he die?
Drug Tolerance

• Decreased sensitivity to a drug as a result of repeated exposure

• Larger amounts of the drug must be administered to produce an effect

• Tolerance to a drug can be classically conditioned to the environment in which the drug is normally consumed
Classical Conditioning and Overdose Deaths

Experiment with rats (Siegel et al. 1982)

Rats were given heroin and gradually developed a tolerance. They were injected with an overdose – an amount twice as much as what they had been receiving.

This might explain why some heroin addicts die after injecting their usual amount of heroin in an unfamiliar environment.
Video: Little Albert (~3 min.)
Conditioned Emotional Responses

John B. Watson
1878-1958
Treatment of Phobias

• Counterconditioning

• Pair the stimulus (CS) that elicits fear with a stimulus (US) that elicits positive emotion (UR)
Application: Bedwetting Alarms

- Designed for habitual bed wetters: alarm sounds when the pad’s sensor strips detect moisture
- Child learns to wake up when bladder is full
Application: Advertising

• Pair products with stimuli that elicit positive emotions (e.g., a form of second-order conditioning)

• Stuart et al. (1987) showed a series of slides to college students that contained neutral scenes, pleasant scenes, and various products
  – Experimental group = Brand L toothpaste was presented several times and always followed by pleasant scenes
  – Control group = Brand L toothpaste was always followed by neutral scenes

• Afterwards she found that Experimental students rated Brand L significantly more positively than the Control group did