Learning Part I

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 20\textsuperscript{th} century)**
  – studied simple learning mechanisms
  – focus on animal studies
  – introduction of stimulus-response theories

• **Cognitivism (1950s-present)**
  – introduction of complex mental processes ("inside the mind")
  – 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**: Presentation of a novel stimulus leads to an increase in responsiveness.
Using habituation to study infant cognition

2-month old infant

Looking time

Repeated observations of Object 1

Present Object 2

4-month old infant

Looking time

Repeated observations of Object 1

Present Object 2

habituation
dishabituation
Video: habituation (40 secs)

(for original video, see: http://www.youtube.com/watch?v=UiB2ZX1phmc&feature=related)
Classical Conditioning

- In *classical conditioning*, animals learn about the association between one stimulus and another.

One of Pavlov’s dogs

Ivan Pavlov
1849-1936
Nobel Laureate
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

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

Important Question: 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
Video: Little Albert (~3 min.)
Conditioned Emotional Responses

http://www.youtube.com/watch?v=0FKZAYt77ZM
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
• Temporal ordering
• Contingency
• Blocking
Second-order conditioning

(1) US (food) paired with $CS_1$ (metronome)

(2) $CS_2$ (light) is followed by $CS_1$ (metronome) followed by no food

(3) $CS_2$ (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
Temporal Ordering

- **Green** – CS
- **Red** - US

**Temporal Ordering**

**Temporal Pairing**

- **Backward Pairing**
- **Simultaneous Pairing**
- **Forward Pairing**

**Graph**

- **Relative frequency of conditioning (percent)**
- **Stimulus interval (seconds)**
Contingency

• The primary causal factor for establishing an association between the US and CS is *contingency*

• The CS should be *informative* about the arrival of the US
Contingency: an example

Out of 200 trials:

<table>
<thead>
<tr>
<th></th>
<th>US</th>
<th>no US</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS</td>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>no CS</td>
<td>60</td>
<td>40</td>
</tr>
</tbody>
</table>

Lack of Contingency: The CS is not informative and no conditioning occurs.

Out of 200 trials:

<table>
<thead>
<tr>
<th></th>
<th>US</th>
<th>no US</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS</td>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>no CS</td>
<td>40</td>
<td>60</td>
</tr>
</tbody>
</table>

Positive Contingency: the US is more likely when the CS occurs and less likely when the CS does not occur. Conditioning occurs.
Contingency: another example

<table>
<thead>
<tr>
<th></th>
<th>US</th>
<th>no US</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>no CS</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Out of 200 trials:

- e.g., CS = light that is always on

**Lack of Contingency:** The CS is not informative and no conditioning occurs.
CS should provide **new information** about US: the blocking effect

**BLOCKING:**

- **Training Phase 1**
  - Pair CS\(_1\) with US (establish association)
  - Tone with shock

- **Training Phase 2**
  - Pair CS\(_1\) and CS\(_2\) with US
  - Tone and light with shock

- **Test Phase**
  - Test CS\(_2\) alone
  - Test light alone; no response (CR)

There is no new or independent information provided by CS\(_2\). No conditioning occurs to CS\(_2\) because it provides no new information about the arrival of the US.
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”
Compensatory conditioning

• Sometimes the preparation takes the form of a compensatory response

• Examples:
  • drug addiction
  • rats in ice boxes
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
For exam, bring Form F-288-PAR-L and pencil