Learning

Learning

- Adaptive change in behavior that results from past experiences
- Nonassociative Learning
  - Habituation
  - Sensitization
- Classical Conditioning
- Instrumental Learning/Operant Conditioning

Habituation

- Ability to discontinue response to highly repetitive stimuli
- Sokolov (1963)
  - Delayed Train

Sensitization

- Increase in responsiveness as result of
  - repeated application of stimulus
  - aversive stimulus

Habituation and Sensitization

Characteristics of Habituation and Sensitization

Time course

Sensitization is usually temporary

-sensitization can last for up to a week but not generally a long-term effect.

-with a stronger stimulus, the effects last longer.

Habituation can be short-term or long-term, depending on presentation and interval between stimuli.

Short-term habituation:

-rapid presentations of a stimulus with a short interval between presentations

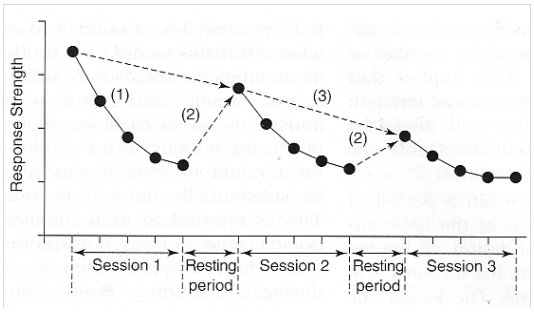
-results in habituation quickly but see **spontaneous recovery**

-the degree of spontaneous recovery depends on length of rest interval.

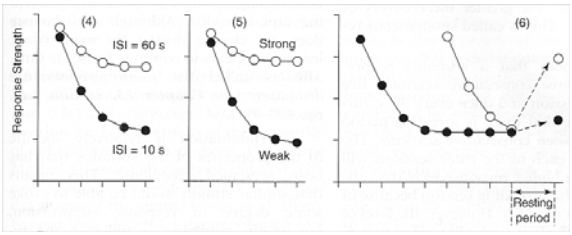
Long-term habituation:

-one stimulus presentation a day
-see more long-term effects
-see less spontaneous recovery

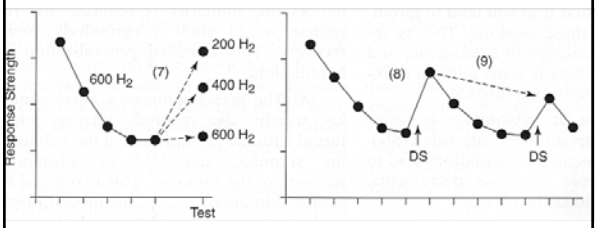
1. Short-term habituation
2. Spontaneous recovery
3. Long-term habituation



4. Rate of habituation faster for short ISI
5. Rate of habituation faster for weaker stimuli
6. Below-zero habituation

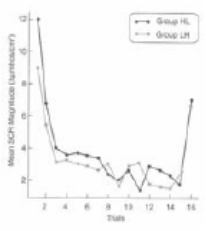


7. Habituation is specific – generalization gradient
8. Dishabituation
9. Habituation of dishabituation



Habituation/Dishabituation

- GSR measured at onset of either high or low tone
  - Tone gradually elicits less anxiety
- 15th trial is the opposite tone
  - high for low group & low for high group



Stimulus specificity

Habituation is stimulus-specific

-if you change the stimulus, see recovery of the response

Sensitization is not highly stimulus-specific

-if an animal is aroused, it is usually aroused to a variety of cues

Effects of strong extraneous stimuli

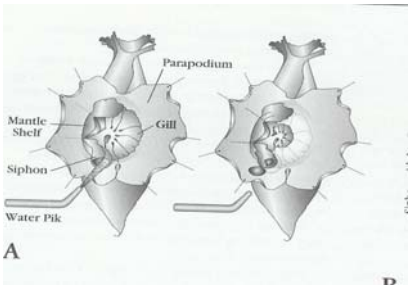
If you change the nature of the eliciting stimulus you see recovery of the habituated response.

Can also see recovery of the response if the animal is given a rest period = spontaneous recovery.

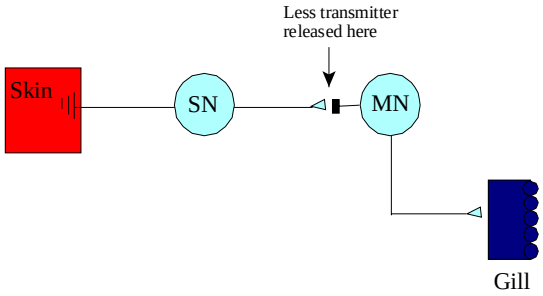
The response can also be restored by presenting a strong stimulus— this is called sensitization

Dishabituation refers to recovery of the response to the habituated stimulus following presentation of a different, novel stimulus.

Habituation and Sensitization in Aplysia



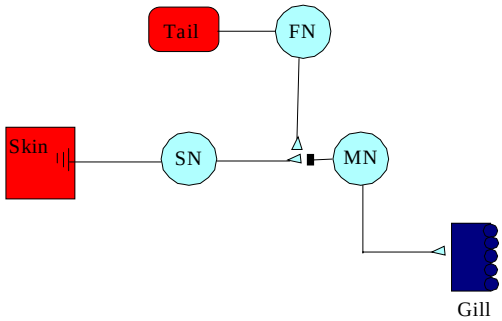
Habituation of the gill withdrawal reflex results from changes in the S-R pathway



Sensitization

After the gill withdrawal reflex has habituated, a shock to the tail sensitizes the gill withdrawal reflex elicited by touching either the mantle or siphon

Sensitization occurs because tailshock augments the release of neurotransmitter from the sensory neuron



Habituation vs. Sensitization

Habituation	*Sensitization*
• Decrease in strength of behavior	• Increase in strength of behavior
• Typically low-intensity stimuli	• Typically high-intensity stimuli
• Stimulus-specific generalization	• Nonspecific generalization
• < neurotransmitter	• > neurotransmitter

Pavlov

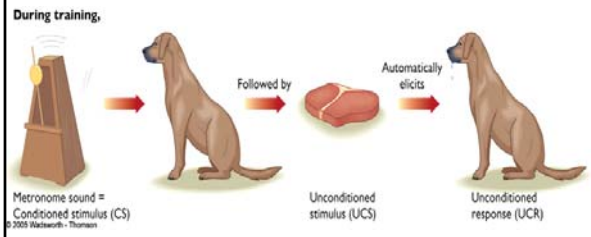
Classical Conditioning

- Process by which a neutral stimulus (CS) comes to be associated with another stimulus (UCS) that elicits a response (UCR)
- Results in elicitation of response by CS

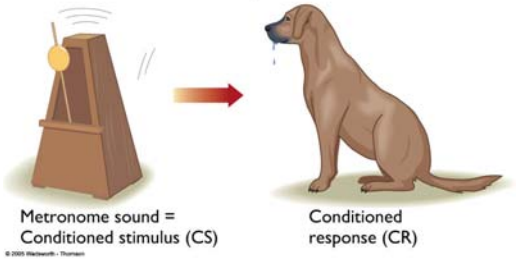
Pavlov paired the clicking of a metronome with food.

Clicker → Food (never used a bell)

Dogs normally salivate with food but not with the clicker



After some number of repetitions,



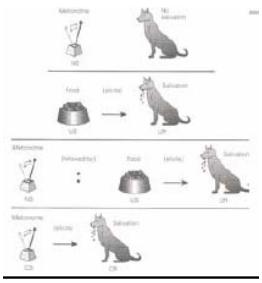
After a few of these pairings, dogs began to salivate when the metronome came on.

Four major terms apply to Pavlovian Conditioning experiments

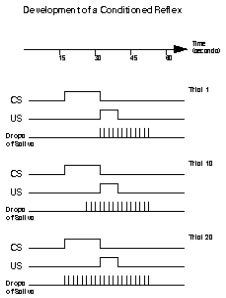
Stimuli	Responses
US **Unconditioned stimulus** Biologically potent stimulus that reliably evokes an unlearned or reflexive reaction (i.e., food)	**UR** **Unconditioned response** The unlearned response triggered by the US Powerful and reflexive (i.e., salivation to food)
CS **Conditioned stimulus** Biologically weak stimulus The CS may evoke an orienting response, but not the strong response evoked by the US (i.e., metronome)	**CR** **Conditioned response** It is elicited by the CS and represents the learned behavior (i.e., salivation to the Metronome)

Sequence in Conditioning

- Initially the neutral stimulus elicits no response
- UCS elicits reflexive response (UCR)
- Pair NS w/ UCS & elicit UCR
- CS elicits salivation
  - UCR=CR salivation



Timing



Appetitive & Aversive Conditioning

Appetitive

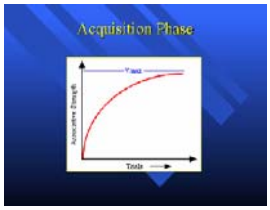
- US is an event the organism seeks out & considers pleasant
  - food
  - physical touch
  - warmth

Aversive

- US is an event the organism avoids & considers unpleasant
  - shock
  - painful stimulus
  - air puff in eye

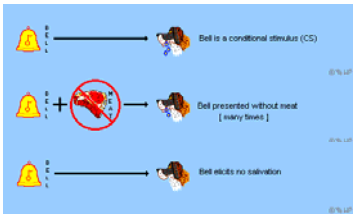
Phases of Learning

- Acquisition – phase w/strengthening of response through repeated reinforcements

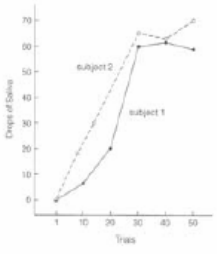


Extinction

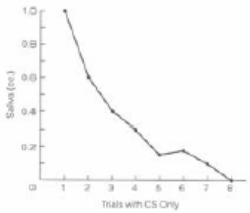
- Diminishment of response when reinforcement is discontinued



Acquisition & Extinction



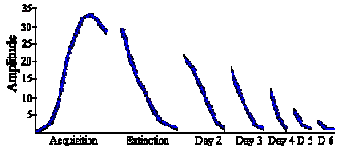
Data from Anrep, 1920



Data from Pavlov, 1927

Acquisition and Extinction

- Spontaneous Recovery

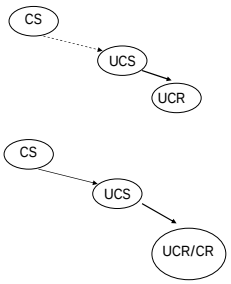


What is learned?

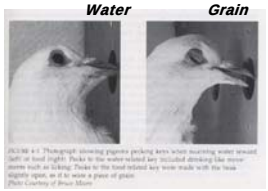
- Stimulus-Stimulus Associations
  - CS becomes directly associated with the UCS and so elicits a similar/related response to the UCR
- Stimulus-Response Associations
  - CS becomes directly associated with the UCR and so elicits the same response as the UCR

Pavlov

- Stimulus-substitution theory
  - A connection forms in the brain between the CS and the UCS activation sites
  - When the CS is activated alone following acquisition, it will automatically activate the UCS site in the brain
  - Therefore, the CR should be almost identical to the UCR (because the connection between UCS and UCR in the brain is hardwired)



Support: Stimulus Substitution

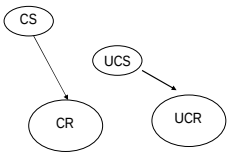


Jenkins & Moore (1973)

- Water Group
  - CS(light)→UCS(water)
  - Pigeons tried to "drink" the lit key
    - closed beak and open eyes
- Grain Group
  - CS(light)→UCS(grain)
  - Pigeons tried to "eat" the lit key
    - Open beak and closed eyes

Against Stimulus Substitution

- CR not always the same as UCR
  - When tone paired with shock, rats will jump to the UCS (shock), but the CR is typically freezing

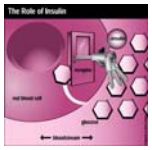


Other stimulus-response models

- Preparatory Response Model
  - Kimble
  - CR is a response that serves to prepare the organism for the upcoming UCS
  - CR eyeblink may actually prepare the person for the upcoming airpuff such that the eye would be partially closed when the airpuff occurs
- Compensatory Response Model
  - Siegel
  - Learned association between CS and UCS serves to elicit a CR that compensates for effects of UCS
  - Sometimes CR=UCR
  - Sometimes CR opposite of UCR

Siegel (1972)

- Gave rats repeated injections (CS) of insulin (UCS)
  - Insulin's effects are to reduce the level of glucose in the blood (UCR)
- Give rats injection of saline
  - Measured the CR (change in blood glucose levels)
- Glucose levels *increased*
- CR ≠ UCR, and the CR was definitely compensatory
- Evidence for compensatory response model



Conditioned Drug Tolerance

- Siegel, et al., 1978
  - *Experimental* Group: CS (light change & noise reduction) paired with UCS (injection of morphine) for 9 days
  - *Placebo* Control Group (CS paired with injection of saline)
  - Unpaired *Control* Group
- Test: present CS, inject every rat with morphine, place rat on hot surface
  - Measure latency to lick their paws (lick when they feel pain)