

## Learning

- Learning (aka: conditioning)
  - Change in an organism's behavior due to experience
- We learn by association (2 types):
  - CLASSICAL CONDITIONING - Stimulus 1 and stimulus 2 go together (e.g., lightning is associated with thunder).
  - OPERANT CONDITIONING - Behavior and consequence go together (e.g., touching electric socket associated with painful shock).
- In either case, we know if learning has occurred by observing change in organism's behavior (e.g., does organism flinch next time lightning occurs, does organism not touch electric socket in future).

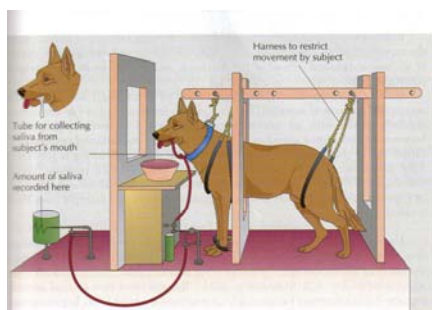
## Classical (Pavlovian) Conditioning



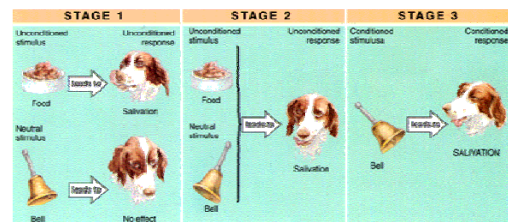
Surrounded by his research staff, the great Russian physiologist Ivan Pavlov (center, white beard) demonstrates his famous classical conditioning experiment with dogs.

- Ivan Pavlov
  - 1849-1936
  - Russian physician/ neurophysiologist
  - Nobel Prize in 1904
  - studied digestive secretions

## Pavlov's classic experiment

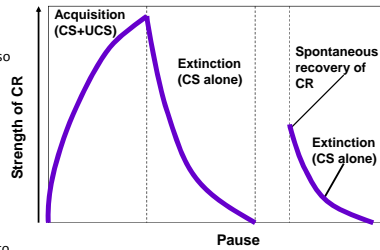


## Pavlov's Classic Experiment



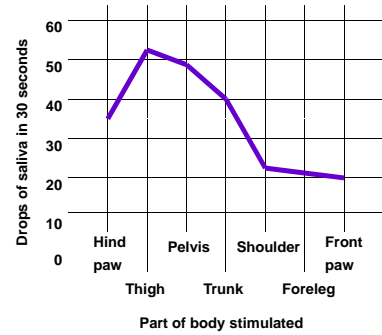
## Classical Conditioning

- Acquisition**
  - the initial stage in classical conditioning
  - the phase associating a neutral stimulus with an unconditioned stimulus so that the neutral stimulus (now the CS) comes to elicit a conditioned response
- Extinction**
  - diminishing of a CR
  - in classical conditioning, when a UCS does not follow a CS (which used to be the NS before acquisition).

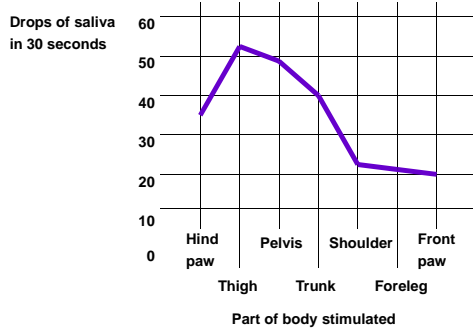


## Classical Conditioning

- Generalization**
  - tendency for stimuli similar to CS to elicit similar responses
- Discrimination**
  - learned ability to distinguish between a CS and other stimuli that do not signal a UCS



## Generalization & Discrimination



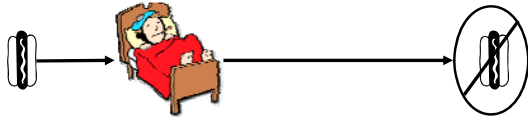
## Discrimination



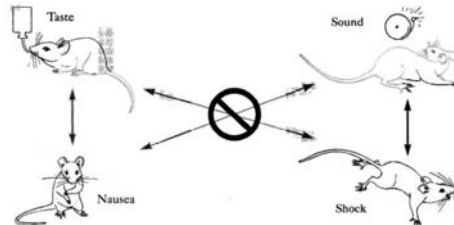
## Biological Predispositions

**Taste Aversion** A learned (conditioned) association between food and sickness.

- Illness can occur hours after food consumption, yet association is still made.
- Fast acquisition period (1 pairing is all it takes )
- Long extinction period (sometimes never extinguishes)
- Not likely to associate sickness with something unrelated to food (e.g., movie).



## Biological Predispositions



23 Biases in taste aversion learning. Although white rats can easily learn that certain taste cues will be followed by sensations of nausea and that certain sounds will be followed by skin pain caused by shock, they have great difficulty forming learned associations between taste and consequent skin pain or between sound and subsequent nausea. Source: Garcia et al. [423].

## John Watson



- *"Give me a dozen healthy infants, well formed, and my own specified world to bring them up in and I'll guarantee to take any of them at random and train him to become any type of specialist I might select – doctor, lawyer, artist, merchant-chief, and, yes, even beggar-man and thief"*
- *"Little Albert" Studies*

[YouTube Video of Little Albert Experiment](#)

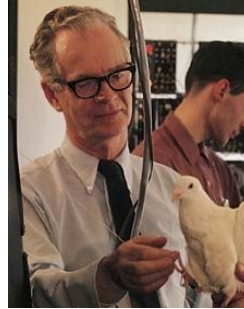
## Watson's interesting life...



## Operant Conditioning

- **Operant Conditioning**
  - type of learning in which behavior is strengthened if followed by reinforcement or diminished if followed by punishment
- **Law of Effect**
  - Thorndike's principle that behaviors followed by favorable consequences become more likely, and behaviors followed by unfavorable consequences become less likely

## Operant Conditioning



- **B.F. Skinner (1904-1990)**
  - elaborated Thorndike's Law of Effect
  - developed behavioral technology

## Operant Chamber



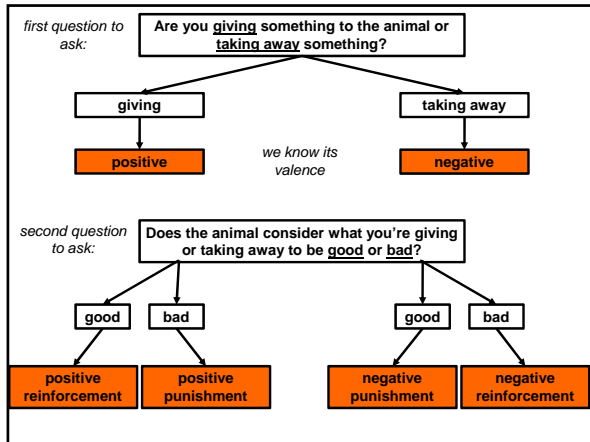
[YouTube clip on Skinner and conditioning.](#)

## Punishment and reinforcement


	Give	Take away
Something that's good	Positive reinforcement	Negative punishment
Something that's bad	Positive punishment	Negative reinforcement

**Reinforcement (reinforcer)** = makes behavior *more* likely in future.

**Punishment (punisher)** = makes behavior *less* likely in future.




## Superstitious behavior



- Superstition: A belief, practice, or rite irrationally maintained by ignorance of the laws of nature or by faith in magic or chance.
- Skinner (1947) 'SUPERSTITION' IN THE PIGEON
- Placed hungry pigeons in Skinner-box and delivered food pellets at 1-minute intervals.
- % of pigeons developed superstitious rituals.
- "[One bird] repeatedly thrust its head into one of the upper corners of the cage. [Another bird] developed a 'tossing' response, as if placing its head beneath an invisible bar and lifting it repeatedly. Two birds developed a pendulum motion of the head and body, in which the head was extended forward and swung from right to left with a sharp movement followed by a somewhat slower return."
- Arises when delivery of reinforcer or punisher occurs close together in time with behavior. Behavior is accidentally reinforced or punished, increasing likelihood of behavior occurring again.
- For example, you walk under a ladder and a minute later you trip and fall. It is easy to attribute your accident to "bad luck" and the irrelevant ladder.

## Principles of Reinforcement

- **Primary Reinforcer**
  - innately reinforcing stimulus
  - ... satisfies a biological need
- **Conditioned Reinforcer**
  - stimulus that gains its reinforcing power through its association with primary reinforcer
  - secondary reinforcer



## Schedules of Reinforcement

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    graph TD
      CR[Continuous Reinforcement] --- IR[Intermittent Reinforcement]
      IR --> RS[Ratio Schedules]
      IR --> IS[Interval Schedules]
      RS --> FR[Fixed Ratio]
      RS --> VR[Variable Ratio]
      IS --> FI[Fixed Interval]
      IS --> VI[Variable Interval]
      FR --- FRD[very fast responding; VR schedule has long extinction period]
      VR --- VRD[slow responding with peaks and valleys]
      FI --- FID[slow and steady responding]
      VI --- VID[slow and steady responding]
  
```

**Continuous:** Reinforce every instance of behavior.

**Intermittent:** Reinforce periodically.

**Ratio:** Frequency of reinforcement based directly on frequency of behavior.

**Interval:** Frequency of reinforcement based on time.

**Fixed:** Reinforce every  $n^{\text{th}}$  button press/minute.

**Variable:** Reinforce on average every  $n^{\text{th}}$  button press/minute.

**Examples:**  
 FR: Sales commission  
 VR: Slot machines  
 FI: Scheduled paychecks, exams  
 VI: Pop quizzes, fishing

## Cognition and Operant Conditioning

- **Extrinsic Motivation**
  - Desire to perform a behavior due to external rewards or threats of punishments
  - This is what Skinner was interested in
- **Intrinsic Motivation**
  - Desire to perform a behavior for its own sake and to be effective
  - Skinner would have scoffed at this idea!
- **Overjustification Effect**
  - the effect of promising a reward for doing what one already likes to do
  - the person may now see the reward, rather than intrinsic interest, as the motivation for performing the task

## Biology and Operant Conditioning

- **Instinctual drift:**
  - In general, instincts (i.e., genetic, biological tendencies) are stronger than conditioning.
  - Animals tend to revert to their instinctual selves after they've been conditioned.
- **Example: Training a pig to drop coins into a "piggy bank".**
  - You can do this, using food as reinforcement.
  - But a pig is a pig, and a pig is going to act like a pig eventually.
    - Eventually, the pig will drop the coin on the ground and do what it does to all food.
    - Root it around with its snout.



*Roy Horn (of Siegfried and Roy) was the "victim" of instinctual drift.*