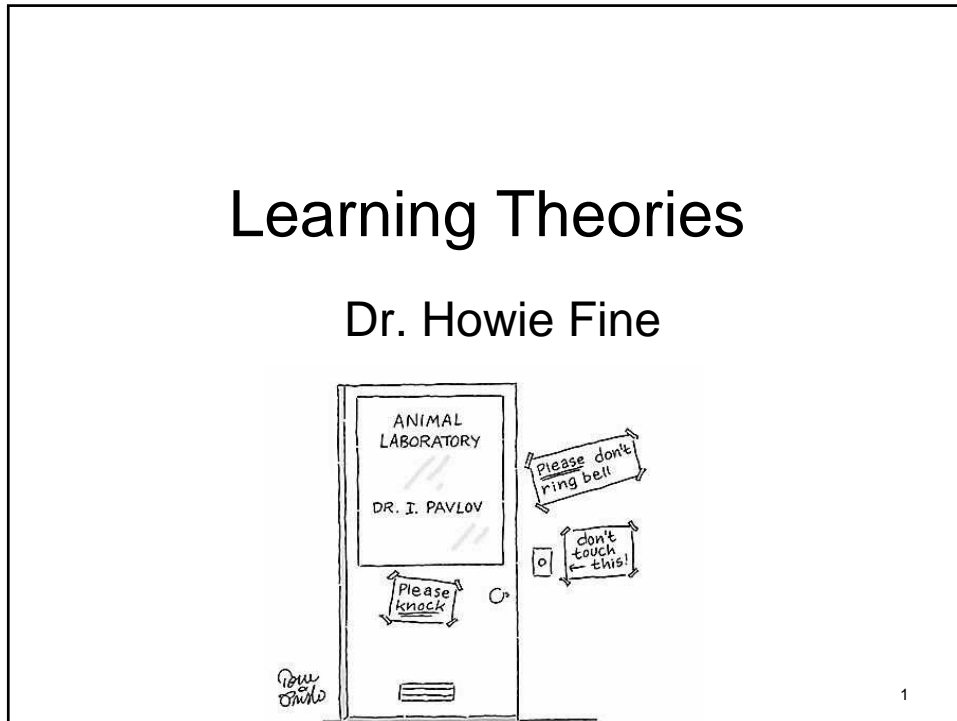


# Learning Theories

Dr. Howie Fine



## INTRODUCTION

- Learning is one of the most researched and discussed area in Psychology.

Learning – What? Vs. How?

- Laymen view learning generally in terms of what is being learnt (e.g. How to drive?) with an emphasis on the success of the end product and deliberate intention of learning (e.g. paying to acquire skills, resulting in a driving licence).
- Psychologists focus on the process of learning itself irrespective of the end product – i.e. *'How does it work?'* rather than *'What does it lead to?'*

## Discussion point

### ■ **INDIVIDUAL TASK**

- Develop a theory of learning based on simple observations

### ■ **SMALL GROUP TASK**

- Compare your theory with others in group :
- Find the pros and cons of each of those theories
- Try to reach an agreement on one or two aspects of your theories to present.

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## Psychology view of learning

- Psychologists investigate the process of learning where formal instruction has not taken place, either through:
  - Observation
  - Previous experience
- Generally agreed by psychologists that learning is:
  - Relatively permanent
  - Due to past experience
- Continuing arguments about:
  - What exactly changes when learning takes place?
  - What kind of past experiences are involved?

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## Definitions

- *“...a relatively permanent change in behaviour due to past experience.”*  
(Coon, 1983)
- *“...a relatively permanent change in behavioural potential which accompanies experience but which is not the result of simple growth factors or of reversible influences such as fatigue or hunger.”*  
(Kimble, 1961)
- *“...a biological device that functions to protect the human individual and to extend his capacities.”*  
(Howe, 1980)

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## Definition

- Learning occurs when there is a **more or less permanent** change in **behaviour or behavioural potential** that results from **experience**.
  - “**More or less permanent**” is used because we sometimes forget what we have previously learned.
- However, ideally the change in behaviour should be long lasting and stable (e.g. learning to ride a bike).
- It can be a change in “**behaviour**” (e.g., new ability to ride a bike) or “**potential behaviour**”.

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## Three perspectives on learning

- **Behavioural Perspective** - attempts to characterize learning in terms of observable stimuli and responses.
- **Cognitive Perspective** - characterizes learning in terms of hypothetical mental entities - such as cognitive maps.
- **Ecological Perspective** - focuses on specialized learning mechanisms that have evolved through evolution to solve specific survival problems.
- .

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## Definitions

- Although we have a genetic predisposition towards certain kinds of behaviour, it is our experiences which will affect how those tendencies manifest themselves.
- The two basic mechanism underlying fundamental forms of learning are :
  - **Classical Conditioning** – Learning by association – Associative Theories
  - **Operant conditioning** – Learning by effect.
- Behaviourists (predominantly animal) argue that learning is essentially, a change in behaviour brought about as a result of experience. The new behaviour would appear under appropriate environmental conditions.
  - ⇒ Conditioning

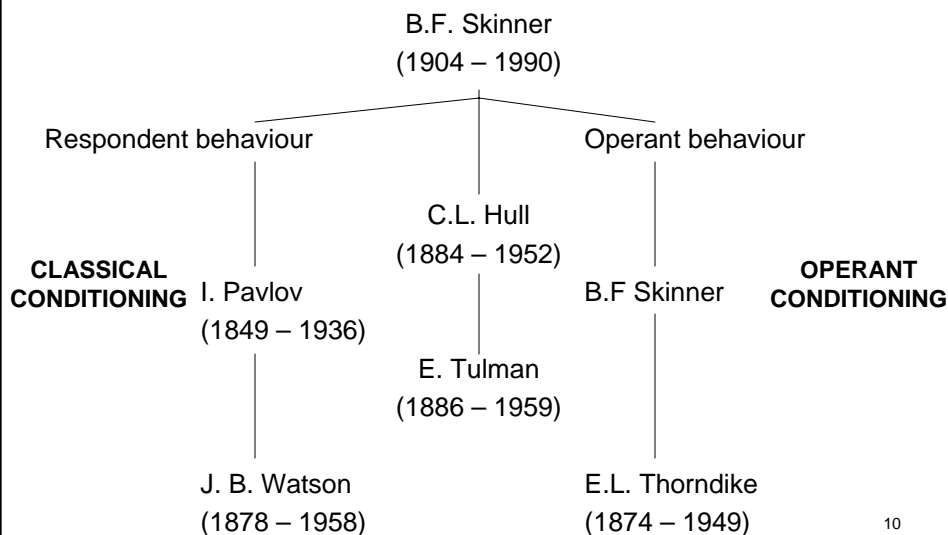
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# Learning

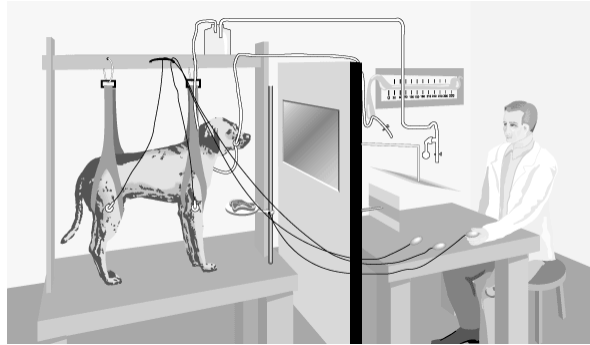
- The process by which practice or experience results in a relatively permanent change in behavior
- Conditioning
  - A simple form of learning in which a specific pattern of behaviors is learned in the presence of well-defined stimuli

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## Major figures in learning theory



# Classical Conditioning



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# Classical Conditioning

- Many Psychologists who study learning have agreed that the most basic learning mechanism which underlies most types of learning must be an **associative mechanism**.
- Learning in which a response naturally caused by one event comes to be elicited by a different, formerly neutral event
- These two events could be two environmental stimuli (S) which occur close in time and space, such as when Stimulus 1 (S1) is immediately followed by Stimulus 2 (S2).

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# Classical Conditioning

## ■ **Watson (1903) – Law of Exercise**

– Proposed that a learned association between a stimulus and response could be forged simply by repeating the two together often enough (Case of Little Albert).

- By exercising the association between the stimulus and the response, the association between the two would be strengthened..



# Conditional reflexes

## ■ Ivan Pavlov

- Physiologist interested in the process of digestion on dogs – awarded the Nobel prize in 1904.
- Accidentally discovered classical conditioning
- His experiments on salivation in dogs turned into research on learning



## Elements of Classical Conditioning

- **Unconditioned stimulus (US)**
  - A stimulus that automatically causes a specific response in an organism
  - An example of a US would be food
- **Unconditioned response (UR)**
  - The response caused by a US
  - The UR is automatic and unlearned
  - An example of a UR is salivation in response to food

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## Elements of Classical Conditioning

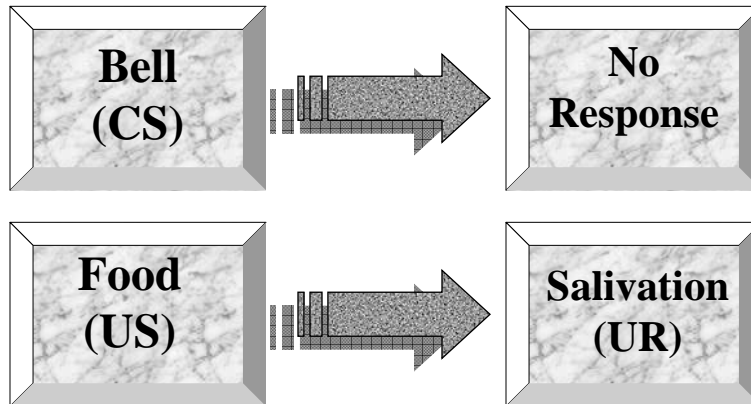
- **Conditioned stimulus (CS)**
  - A formerly neutral stimulus that is paired with a US and eventually causes the desired response all by itself
  - An example of a CS is the bell in Pavlov's studies
- **Conditioned response (CR)**
  - The learned response to the CS
  - An example is salivation in response to the bell

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# Classical Conditioning Procedure

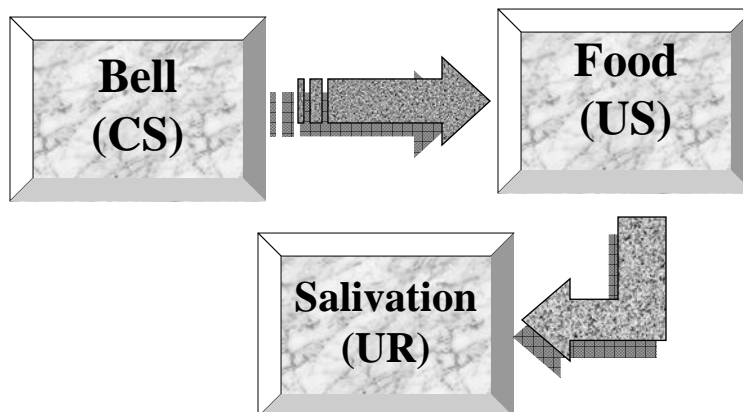
## Before Conditioning



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# Classical Conditioning Procedure

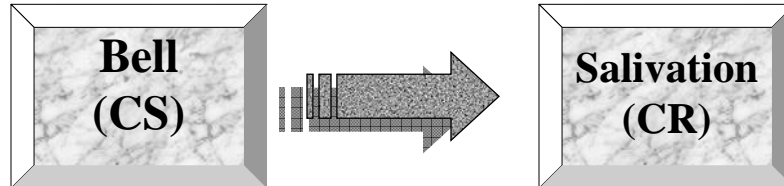
## During Conditioning



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# Classical Conditioning Procedure

**After Conditioning**



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## Extinction & spontaneous recovery

- After dogs have been conditioned to salivate to a bell, if the bell was repeatedly presented without food, the CR of salivation became gradually weaker and eventually stopped altogether.
  - ⇒ Termed ***Extinction***

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# Classical Conditioning In Humans

- Many phobias are the result of classical conditioning
  - Watson’s “Little Albert” experiment demonstrated a classically conditioned phobia
- Desensitization therapy
  - Jones (1924) – Little Peter
  - Original extreme fear of rabbits, rats, fur, feathers, cotton wool, frogs, and fish. In a series of stages, Rabbit cage brought progressively closer to Peter of 17 steps, eventually Peter able to stroke rabbit.
  - ⇒ Early example of systematic desensitisation – removing phobias
  - A technique that uses classical conditioning to treat phobias
  - Person learns to relax in presence of stimulus that used to be upsetting

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# Classical Conditioning in Humans

- Classical conditioning is selective
  - *Preparedness* is the notion that humans are predisposed to develop certain phobias because they have survival value
  - May explain common fears such as snakes and heights
    - Ophidiophobia (snakes) - Poisonous snakes have been a threat to primates and hominids for the last few million years.
    - Acrophobia (heights) - Humans are relatively large animals and falling has always posed a grave danger - acrophobia usually provokes a freezing reaction making it less likely that a person will fall.

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## Classical Conditioning in Humans

### ■ Taste aversion

- Learned association between the taste of a certain food and a feeling of nausea or revulsion
- This learning can occur quickly, often with only one pairing
- Speed of learning is likely related to survival instincts

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## Operant Conditioning

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# Operant Conditioning

- Learning in which an organism's behaviour is followed by a reward or punishment
- Organism learns to perform behaviour in order to gain a reward or avoid a punishment

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## Thorndike (1911)



- Investigated trial-and-error learning using a **Puzzle Box**.
- Noted that the amount of time which the cats took to escape from the box became steadily less as they had become more experienced.

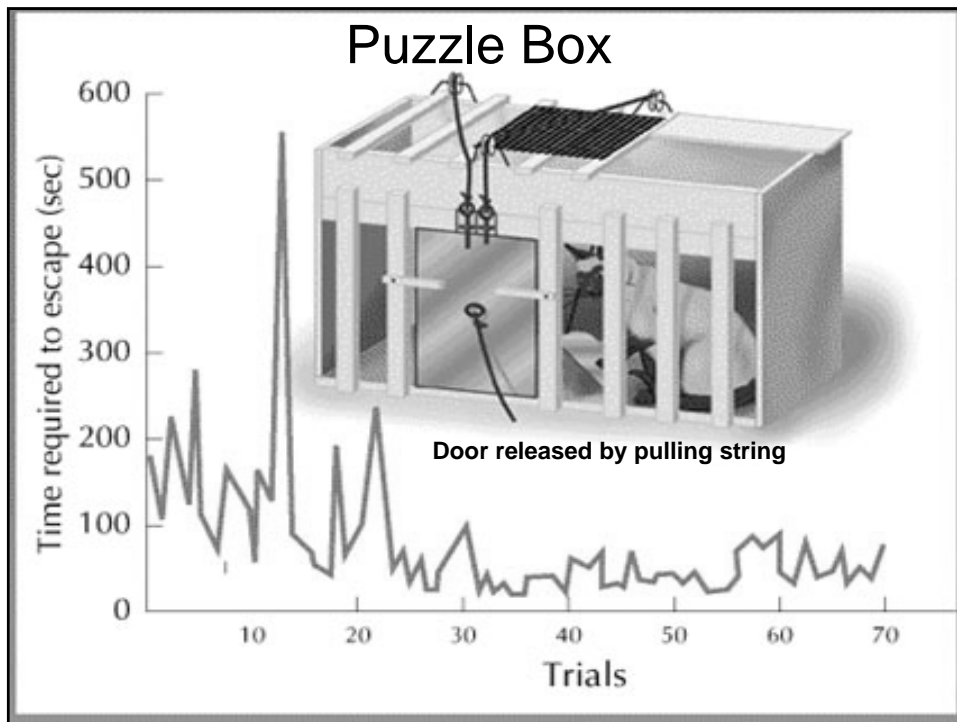
⇒ **Learning curve**

- **How was the learning taking place?**
- Thorndike proposed that a given behaviour is likely to be repeated if it produces a pleasant effect.

⇒ **Law of effect**

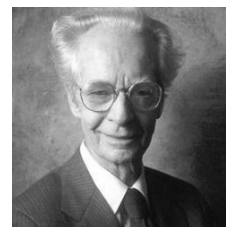
- Being released from the box was a pleasant outcome for the animal and so was reaching the food – **positive reinforcement**.

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## B. F. Skinner (1904 – 1990)

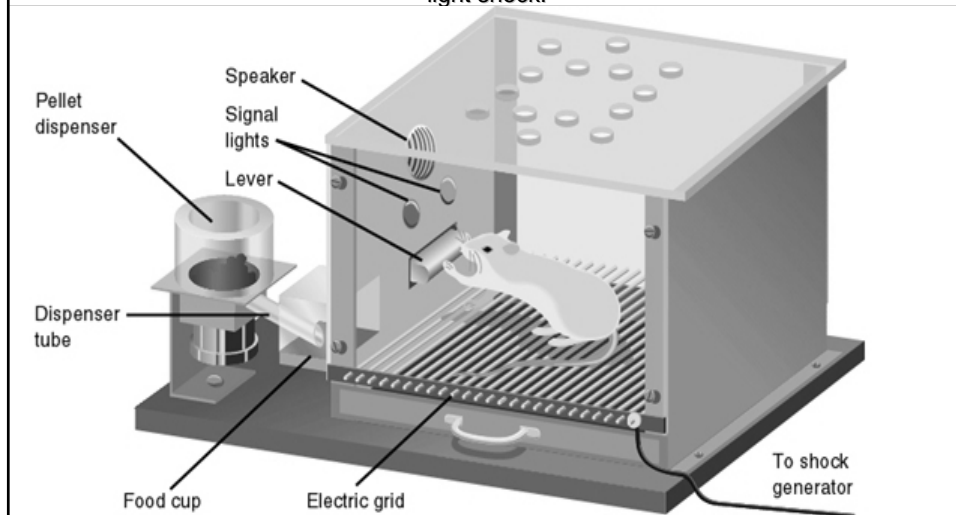
- Investigated the ***Law of Effect*** (1938), testing out factors affecting learning, by training animals in the Skinner Box.
- Skinner proposed that Operant Conditioning could account for all human behaviour as well as the acquisition of language.



## Skinner Box

This was a box where animals could be deliberately trained to produce a response.

Typically the box would contain a lever for the animal to press (this would be the behaviour that was being trained); a food delivery chute for giving the animal a reward when it performed the behaviour correctly; a light to signal when the response should be made; and SOMETIMES a mesh floor which could be electrified to give the animal a light shock.



## Elements of Operant Conditioning

### ■ Reinforcer

- A stimulus or event that follows a behaviour and makes that behavior more likely to occur again

### ■ Punisher

- A stimulus or event that follows a behaviour and makes that behavior less likely to occur again

# Reinforcement

- The central idea behind Skinner's theory was that any given organism will produce **Operants** (small actions which have an effect on the surrounding environment).
- If these operants have a pleasant effect (**Positive reinforcement**), they may be shaped into large and increasingly complex units of behaviour.
- Skinner, further developed Thorndike's ideas by introducing **Negative reinforcement**, eliciting behaviour to avoid an unpleasant experience.
- As with Classical conditioning, operant conditioning will become extinguished if it is not reinforced.
- Skinner demonstrated how different methods of administering reinforcement may produce differences in extinction rates.

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# Types of Reinforcement

- |   |  |
|---|--|
| <ul style="list-style-type: none"><li>■ <b>Positive reinforcer (+)</b><ul style="list-style-type: none"><li>– Adds something rewarding following a behavior, making that behavior <i>more</i> likely to occur again</li><li>– STRENGTHEN behaviours which result in their PRESENTATION.</li><li>– E.g. Giving a dog a treat for fetching a ball</li></ul></li></ul> | <ul style="list-style-type: none"><li>■ <b>Negative reinforcer (-)</b><ul style="list-style-type: none"><li>– Removes something unpleasant from the environment following a behaviour, making that behaviour <i>more</i> likely to occur again</li><li>– STRENGTHEN behaviours which result in their REMOVAL or AVOIDANCE.</li><li>– E.g. Taking an aspirin to relieve a headache<sup>32</sup></li></ul></li></ul> |
|---|--|



# Schedules of Reinforcement

## ■ Interval schedules

- Reinforcement depends on the passing of time
- Fixed-interval schedule
  - Reinforcement follows the first behavior after a fixed amount of time has passed
  - E.g. receiving a monthly paycheck
- Variable-interval schedule
  - Reinforcement follows the first behavior after a variable amount of time has passed
  - E.g. pop quizzes

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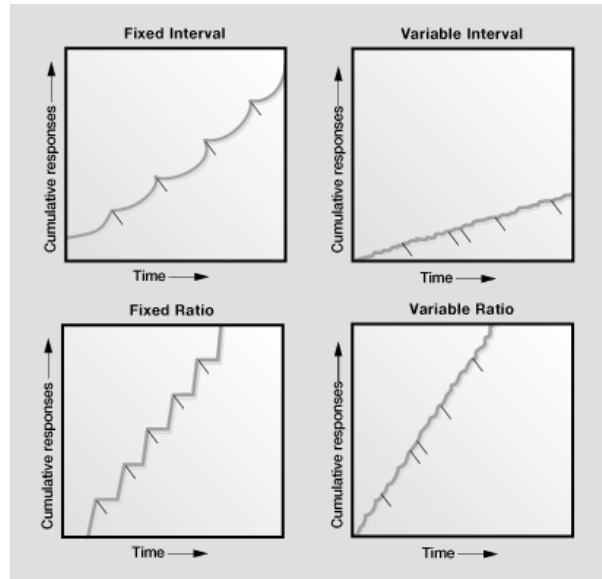
# Schedules of Reinforcement

## ■ Ratio schedules

- Reinforcement depends on the number of responses made
- Fixed-ratio schedule
  - Reinforcement follows a fixed number of behaviors
  - E.g. being paid on a piecework basis
- Variable-ratio schedule
  - Reinforcement follows a variable number of behaviors
  - E.g. playing slot machines

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# Response Patterns to Schedules of Reinforcement



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## Punishment

- Goal of punishment is to decrease the occurrence of a behaviour
- Weakens behaviour, therefore making it less probable, through the presentation of an aversive stimulus.
- Effective punishment
  - Should occur as soon as possible after the behavior
  - Should be sufficient, i.e., strong enough
  - Should be certain, occurring every time the behavior does
  - Should be consistent

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## Punishment

- Not as effective as reinforcement
- Does not teach proper behavior, only suppresses undesirable behaviour
- Causes upset that can impede learning
- May give impression that inflicting pain is acceptable
  
- Skinner argues that +ve and –ve reinforcement are a more potent influence on behaviour than punishment, both for animals and humans.
  - mainly because you cannot teach anything new through punishment alone.

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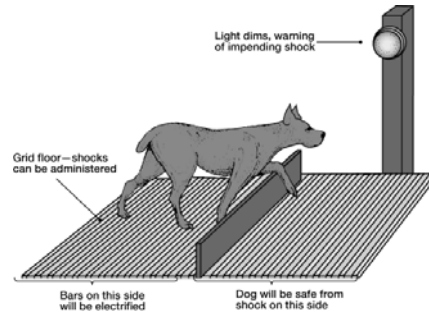
## Operant Conditioning is Selective

- Operant conditioning techniques work best with behaviours that would typically occur in a specific situation
- Superstitious behaviour
  - Tendency to repeat behaviours that are followed closely by a reinforcer, even if they are not related
  - For example, a particular pair of socks might become “lucky” if something good happened when you wore them

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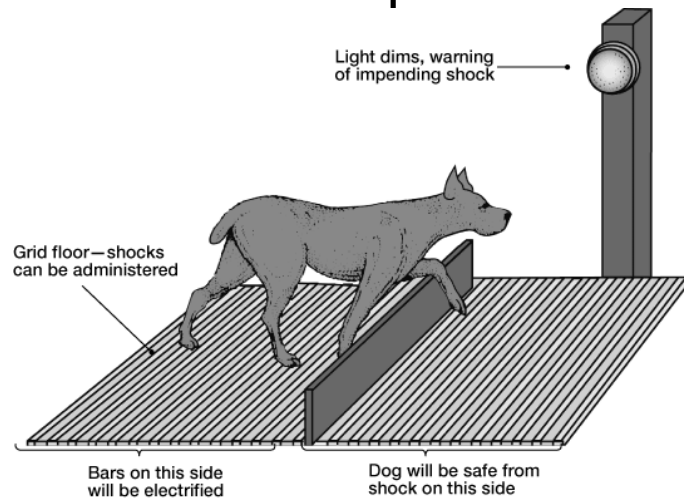
# Learned Helplessness

- Failure to try to avoid an unpleasant stimulus because in the past it was unavoidable
- Possible model for depression in humans
  - Emotional deficit – Sad, anxious, melancholic.
  - Motivational deficit – Everything fail so why continue to try?
  - Cognitive deficit – Future difficulties in learning to control events.



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# Learned Helplessness



- **Overmier & Seligman** (1967) – Demonstrated the theory of Learned Helplessness.

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## Learned Helplessness

- If the consequences of being exposed to uncontrollable and unpredictable shock were not limited to subsequent failure to escape from the shocks - dogs also developed several other deficits :
  - Emotional deficits - Similar to the sad and depressed state that a person might feel after learning that reinforcers are uncontrollable.
  - Motivational deficits - The dogs did not even try to escape the shock when they were later given the opportunity to do so.
  - Cognitive deficits – the dogs were unable to learn that the shocks were controllable during the last phase of the studies.

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## Learned Helplessness

- These effects could in principle be explained in several different ways :
  - The dog's responses may have been extinguished because none of them were followed by the reinforcer (shock termination).
  - A passive behaviour became superstitiously associated with shock termination (Balleine & Job, 1991).
- NOTE : According to LHT, it is the lack of control over reinforcers, rather than the absence of reinforcers, that produces the deficits (Abramson et al, 1978).

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## Behavioural Change Using Biofeedback

- Biofeedback is an operant technique that teaches people to gain voluntary control over bodily processes like heart rate and blood pressure
- When used to control brain activity it is called neurofeedback
  - E.g. stress control

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## Comparing Classical And Operant Conditioning

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## Response Acquisition

- Classical conditioning
  - Naturally occurring responses are attached to conditioned stimulus by pairing that stimulus with the unconditioned stimulus
  - Spacing of trials effects rate of training
- Operant conditioning
  - Learning process in which desired responses are followed by reinforcers
  - Shaping, reinforcing successive approximations to a target behavior, can speed up acquisition

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## Extinction and Spontaneous Recovery

- Classical conditioning
  - US and CS are no longer paired, eliminating the CR
  - Spontaneous recovery occurs when the CR temporarily returns without additional training
- Operant conditioning
  - Extinction occurs when reinforcement is stopped, eliminating the conditioned behavior
  - Spontaneous recovery occurs when behavior temporarily returns without additional training

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# Generalization and Discrimination

- |   |   |
|---|---|
| <ul style="list-style-type: none"><li>■ Classical conditioning<ul style="list-style-type: none"><li>– Stimulus generalization<ul style="list-style-type: none"><li>■ Organism learns to respond to other similar stimuli</li></ul></li><li>– Stimulus discrimination<ul style="list-style-type: none"><li>■ Organism learns to respond only to specific stimuli</li></ul></li></ul></li></ul> | <ul style="list-style-type: none"><li>■ Operant conditioning<ul style="list-style-type: none"><li>– Response generalization<ul style="list-style-type: none"><li>■ Stimulus generates similar responses</li></ul></li><li>– Response discrimination<ul style="list-style-type: none"><li>■ Only specific responses are reinforced in the presence of specific stimuli</li></ul></li></ul></li></ul> |
|---|---|

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# New Learning Based on Original Learning

- Higher-Order Conditioning in Classical Conditioning
  - New conditioning based on earlier conditioning
  - Earlier CS is used as a US for further training
  - Desensitization is based on this principle

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## New Learning Based on Original Learning

- Secondary reinforcers in operant conditioning
  - Primary reinforcer
    - Intrinsically rewarding
    - Food, water, sex
  - Secondary reinforcer
    - Acquire rewarding properties by being associated with primary reinforcers
    - Provide ability to obtain primary reinforcer
    - Example would be money

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## Contingencies in Classical Conditioning

- Research has shown that a CS must provide information about the US in order for conditioning to occur
- This predictive relationship between the CS and US is referred to as a contingency

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## Contingencies in Operant Conditioning

- Behaviours that are reinforced intermittently are more resistant to extinction
- Most behaviour is reinforced with some type of intermittent schedule

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## Cognitive Learning

- Learning that depends on mental activity that is not directly observable
- Involves such processes as attention, expectation, thinking, and memory

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## Insight and Learning Sets

- *Insight* is when learning seems to occur in a sudden “flash” as elements of a situation come together
- *Learning sets* refer to increasing effectiveness at problem solving through experience, i.e., organisms “learn how to learn”

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## Learning by Observing

- Social learning theory focuses on what we learn from observing other people
- Observational or vicarious learning occurs when we see the consequences of other people’s behavior
- Vicarious reinforcement or vicarious punishment affects the willingness of people to perform behaviors they learned by watching others

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## Cognitive Learning in Nonhumans

- Nonhumans are capable of classical and operant conditioning
- Nonhumans are also capable of latent learning
- Research has also demonstrated that animals are capable of observational learning

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## References

- *British Journal of Developmental Psychology.* \*
- Dickinson, A. (1980) *Contemporary Animal Learning Theory.* C.U.P., Cambridge.
- Domjan, M. (1998) *The principle of Learning and Behaviour.* Brooks.Cole Pubs., Pacific Grove, CA.
- Pavlov, I. (1927) *Conditioned Reflexes.* Clarendon Press, London.
- Skinner, B.F. (1953) *Science and Human Behaviour.* Macmillan, NY. \*
- Tarpy, R. M. (1997) *Contemporary Learning Theory and Research.* McGraw-Hill, NY.

\*Books available at the Birkbeck library

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## Internet links

- <http://www.wabash.edu/depart/psych/Courses/Psych97A/STUDENT%20PROJECTS/Skinner/hammondk/> - Site dedicated to Skinners' experiments and theories.
- <http://www-hcs.derby.ac.uk/tip/index.html> -Links to articles on major learning theories.
- <http://www.biozentrum.uni-wuerzburg.de/~brembs/classical/classical.html> - Covers all aspects of Classical conditioning.
- <http://www.uwm.edu/People/jcm/psy551/skinner.1/ho3> - Outlines the differences between Operant and Classical conditioning.

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## Review questions

- How are S-S and R-O associations acquired?
- How does Human learning differ from Animal learning?
- Demonstrate the difference between negative reinforcement and punishment?

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## Further background reading

- Classical Conditioning – Autonomic responses (*Menzies*, 1937)
- Latent Learning and Cognitive Maps
- Models of Skill Learning
  - Animals
  - Human
- The role of Motivation in Learning
- The role of Social Learning
- Insight and Learning vs. Trial-and-Error Learning

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## Homework

- Compare your theories with those presented.
- Could you improve on them?
- Devise in rough experiment to test your theory.

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