

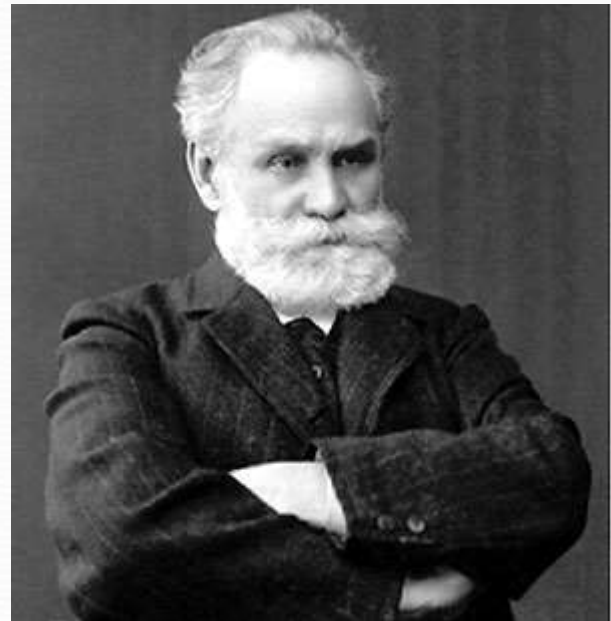
Lecture 12. Conditional reflexes

- In the early twentieth century, Russian physiologist Ivan Pavlov did Nobel prize-winning work on digestion. While studying the role of saliva in dogs' digestive processes, he stumbled upon a phenomenon he labeled "psychic reflexes." While an accidental discovery, he had the foresight to see the importance of it. Pavlov's dogs, restrained in an experimental chamber, were presented with meat powder and they had their saliva collected via a surgically implanted tube in their saliva glands. Over time, he noticed that his dogs who begin salivation before the meat powder was even presented, whether it was by the presence of the handler or merely by a clicking noise produced by the device that distributed the meat powder.

- Fascinated by this finding, Pavlov paired the meat powder with various stimuli such as the ringing of a bell. After the meat powder and bell (auditory stimulus) were presented together several times, the bell was used alone. Pavlov's dogs, as predicted, responded by salivating to the sound of the bell (without the food). The bell began as a neutral stimulus (i.e. the bell itself did not produce the dogs' salivation). However, by pairing the bell with the stimulus that did produce the salivation response, the bell was able to acquire the ability to trigger the salivation response. Pavlov therefore demonstrated how stimulus-response bonds (which some consider as the basic building blocks of learning) are formed. He dedicated much of the rest of his career further exploring this finding.

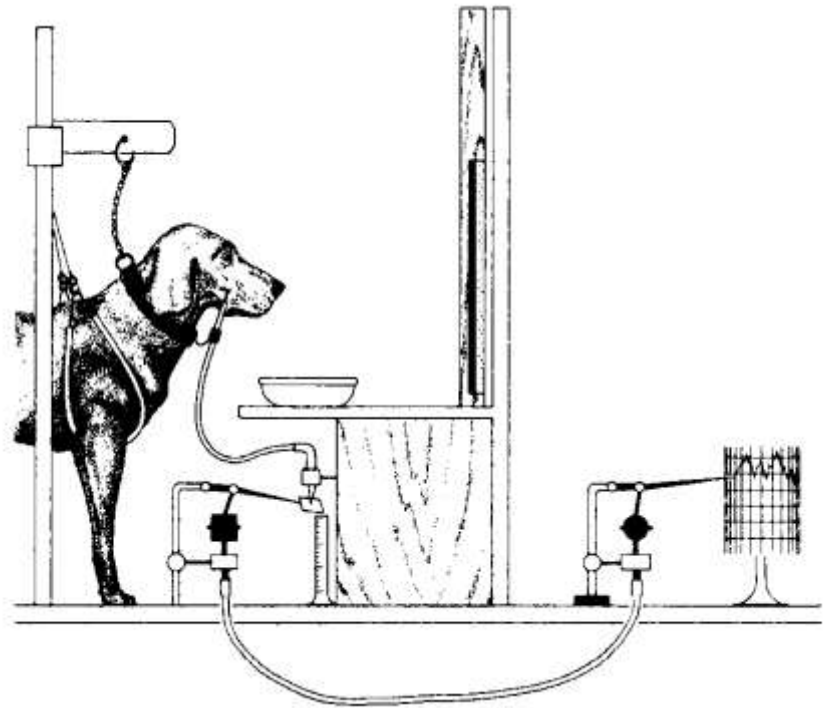
Ivan Pavlov (1849-1936)

- Pavlov, a Russian physiologist, first described classical conditioning in 1899 while conducting research into the digestive system of dogs.
- He was particularly interested in the role of salivary secretions in the digestion of food and was awarded the Nobel Prize for Medicine or Physiology in 1904.



Pavlov's Research

- Pavlov used an apparatus to measure the amount of saliva produced when a dog ate.
- The flow of saliva occurred naturally whenever food was placed in the dog's mouth, as salivation is an involuntary, reflex response.



Pavlov's Method

- Dog was restrained in a harness to avoid extraneous variables.
- Meat powder was placed directly on the dog's tongue or in the bowl.
- A tube was surgically attached to the dog's cheek near one of the salivary glands and a fistula was made so that the saliva drained straight out into a measuring device.
- Further on, more sophisticated measuring devices were used to measure the speed of saliva flow.

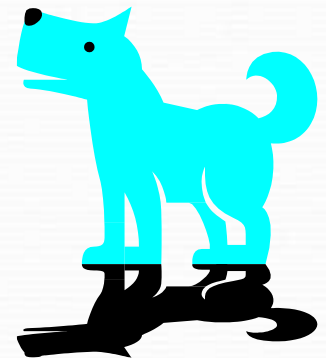


What did Pavlov observe?

- Pavlov observed that the dogs salivated not only at the sight of the food, but also at the sight or sound of the lab tech who had been preparing the food.
- Pavlov was intrigued by these unintentional observations & he decided to conduct further experiments.
- His subsequent experiments provided clear evidence of a form of learning based on the repeated association of 2 different stimuli.
- A **stimulus** is any event that elicits a response from an organism.
- A **response** is a reaction by an organism to a stimulus. In Pavlov's experiment, the stimulus of *food* initially produced the response of *salivation*.
- Eventually the sight or sound of the tech became the stimulus.

How is this response explained?

- The salivation response is controlled by the autonomic division of the PNS.
- Involuntary.
- The salivation had become associated with, and conditioned to, a new stimulus – the lab tech.
- This process is in essence the process of classical conditioning.



What is Classical Conditioning?

- Also known as respondent conditioning refers to a form of learning that occurs through the repeated association of 2 or more different stimuli.
- Learning is only said to have occurred when a particular stimulus consistently produces a response that it did not previously produce.
- In classical condition, a response that is automatically produced by one stimulus becomes associated, or linked, with another stimulus that would not normally produce this response.

Key Elements of Classical Conditioning

There are 4 key elements that are used to describe the process of classical conditioning.

1. Unconditioned Stimulus

- The unconditioned stimulus (UCS) is any stimulus that consistently produces a particular, naturally occurring, automatic response.
- In Pavlov's experiment, the UCS was the food (meat powder).



2. Unconditioned Response

- The unconditioned response (UCR) is the response that occurs automatically when the UCS is presented.
- A UCR is a reflexive, involuntary response that is predictably caused by a UCS.
- In Pavlov's experiments, the UCR was the salivation.



3. Conditioned Stimulus

- The conditioned stimulus (CS) is the stimulus that is *neutral* at the start of the conditioning process and does not normally produce the UCR.
- Yet, through repeated association with the UCS, the CS triggers a very similar response to that caused by the UCS.
- *Association* refers to the pairing or linking of 1 stimulus with another stimulus.
- In Pavlov's experiments, the bell and subsequently other stimuli were initially *neutral*, but each became associated with the meat powder.
- Once conditioning has occurred and the originally neutral stimulus produces the response of salivating, then it is called the CS.

4. Conditioned Response

- The conditioned response (CR) is the learned response that is produced by the CS.
- The CR occurs after the CS has been associated with the UCS.
- The behaviour involved in a CR is very similar to that of the UCR, but it is triggered by the CS alone.
- Pavlov's dogs displayed a CR (salivation) only when they began to salivate to a CS.
- When the dog responded to a CS, such as the sound of a bell, classical conditioning had taken place because salivation would not be a usual response to the sound of a bell.

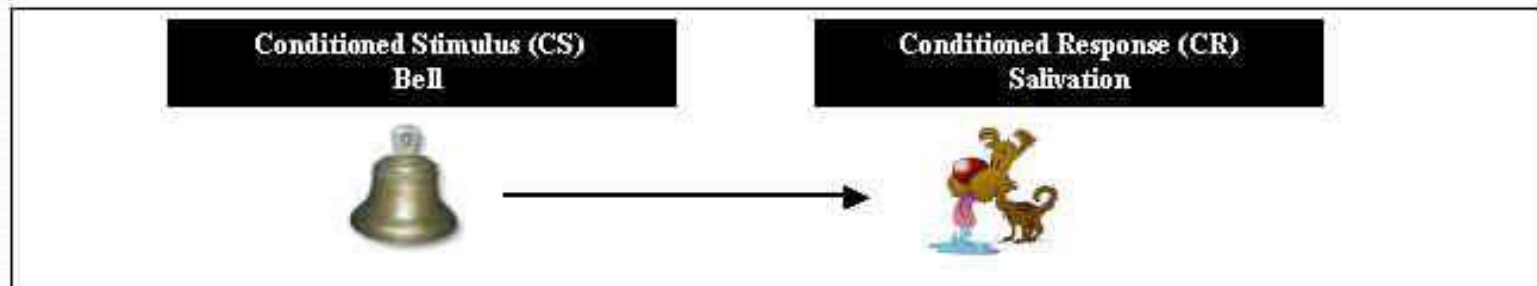
Before Conditioning



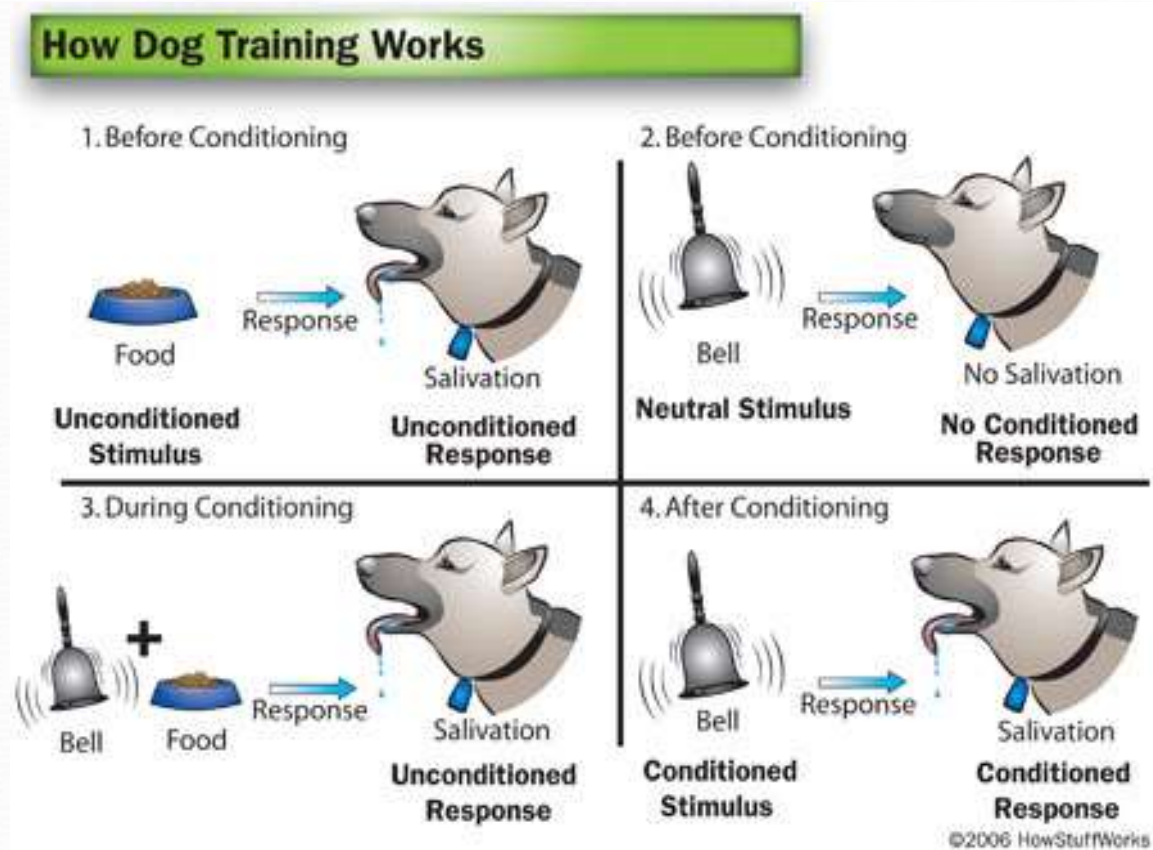
During Conditioning



After Conditioning



Another example...



Key Processes in Classical Conditioning

Pavlov distinguished several key processes that are involved in classical conditioning. These are known as:

- Acquisition, extinction, stimulus, generalisation, stimulus discrimination and spontaneous recovery.

Acquisition

- Each paired presentation of the CS with UCS is referred to as a trial.
- Acquisition is the overall process during which the organism learns to associate 2 events.
- The rate of learning is often very fast in the early stages of the acquisition phase.
- Timing of the CS and UCS pairing is critical.
- Pavlov found that a very short time between presentations of the 2 stimuli was most effective.
- Acquisition is more rapid when the CS occurs and remains present until the UCS is presented.
- The end of the acquisition stage is said to occur when the CS alone produces the CR.

Extinction

- A conditioned stimulus-response association can fade over time or disappear altogether.
- Extinction is the gradual decrease in the strength or rate of a CR that occurs when the UCS is no longer presented.
- Extinction is said to have occurred when a CR no longer occurs following presentation of the CS.
- E.g. Pavlov's dogs eventually ceased salivating (CR) in response to the bell (CS) presented alone after a number of trials in which the food (UCS) did not follow the sound of the bell).
- There is some variation between individuals in the rate at which extinction of the same conditioned response will occur.
- There is also considerable variation between the rates at which different response will be extinguished.

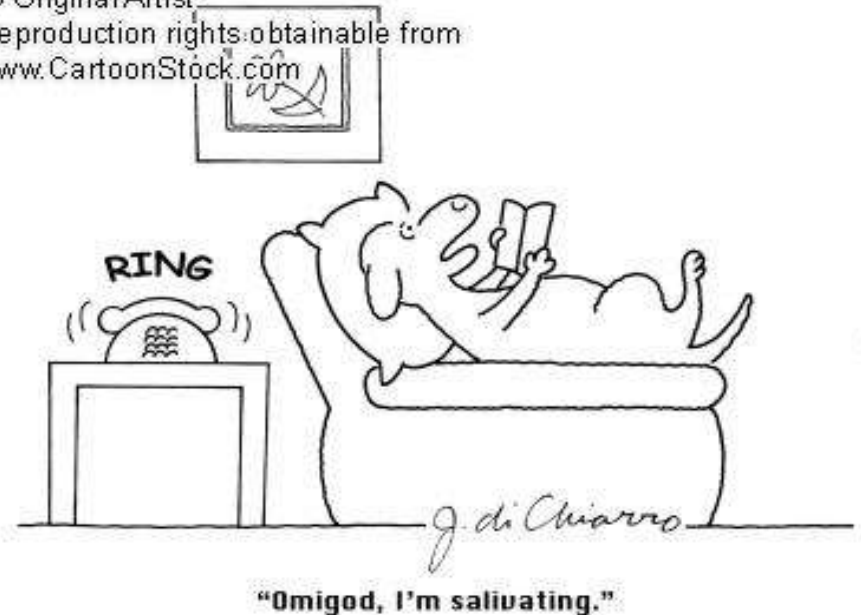
Spontaneous Recovery

- Extinction of a CR is not always permanent.
- In CC, spontaneous recovery is the reappearance of a CR when the CS is presented, following a rest period after the CR appears to have been extinguished.
- Spontaneous recovery does not always occur and when it does it is often short-lived.
- Furthermore the CR tends to be weaker than it was originally.

Stimulus Generalisation

- Pavlov observed that his dogs salivated to other noises that sounded like a bell.
- This is known as **stimulus generalisation** which is the tendency for another stimulus to produce a response that is similar to the CR.
- The greater the similarity between stimuli, the greater the possibility that a generalisation will occur.
- E.g. is a stimulus generalisation to the sounds of a bell occurred with one of Pavlov's dogs, the dog might also salivate in response to the ringing of the front-door bell.
- However, the amount of saliva produced by the dog would tend to be less than the amount produced by the original bell to which the dog was conditioned.

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Stimulus Discrimination

- Stimulus discrimination occurs when a person or animal responds to the CS only, but not to any other stimulus that is similar to the CS.
- E.g. in a CC experiment, stimulus discrimination would be observed when a dog salivated *only* in response to the sound of the 'experimental bell', and not in response to any other similar sound such as a door bell.
- For more info on CC, click the link to this website
<http://sun.science.wayne.edu/~wpoff/cor/mem/conditnl.html>
- There is plenty of info and diagrams and an online quiz.

Classical Conditioning of Behaviour



- Behaviours that have been classically conditioned may occur so automatically that they appear to be reflexive.
- CC behaviours are like reflexes in that they occur involuntarily, but they are unlike reflexes in that they are learned.
- A **conditioned reflex** is an automatic response that occurs as the result of previous experience.
- A conditioned reflex involves little conscious thought or awareness on the part of the learner.
- E.g. listening for thunder when you see lightning.

Conditioned Emotional Response

- An emotional reaction such as fear of a specific stimulus is learned through CC.
- A *conditioned emotional response* is an emotional reaction that usually occurs when the autonomic nervous system produces a response to a stimulus that did not previously trigger that response.
- E.g. fearing the sound of the dentist's drill.



Watson's 'Little Albert' experiment

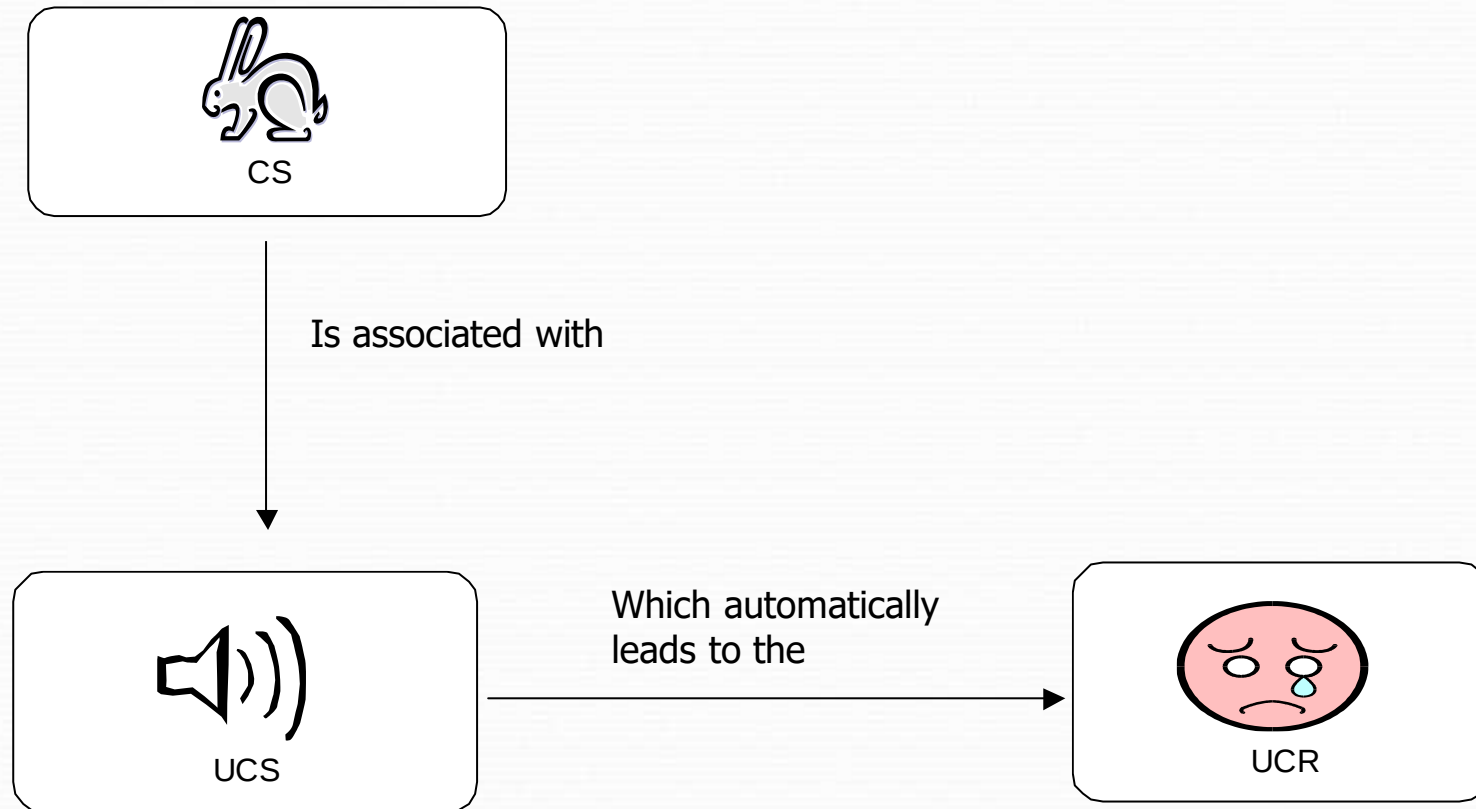
- American psychologist John B. Watson and his graduate student, Rosalie Rayner first used CC to elicit an emotional response.
- Aim to test the notion that fears can be acquired through CC.
- The research participant was Albert B. (Little Albert), the 11 moth old son of a woman who worked at the same clinic as Watson.



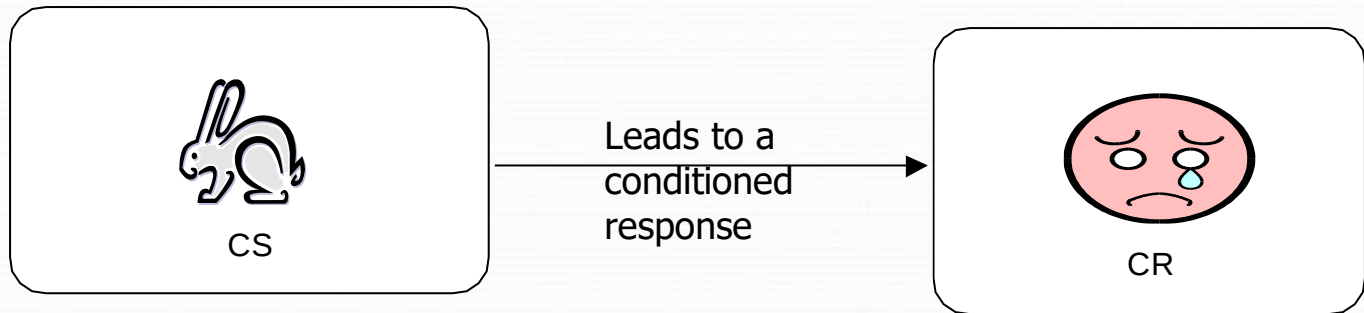
How was Little Albert conditioned to hate the rat?

- They placed him on a mattress in a room where a white lab rat (CS) was within reaching distance.
- Albert showed no initial fear of it and played with it.
- They then struck a hammer on a steel bar behind Albert (loud noise, UCS) and Albert began to cry.
- For the next 17 days Watson and Rayner began a series of fear-conditioning experiments.
- They also conducted tests to find out if Albert's fear response could be generalised.
- Albert also seemed to fear a white rabbit, a dog and a seal skin coat.

During Conditioning (Association & Acquisition)



After Conditioning



Ethical considerations?

- Albert's mother left her job and Watson and Rayner reported that they were denied the opportunity to remove the conditioned emotional responses.
- This has been disputed, as it is believed they were aware of Albert's departure a month in advance.
- Some believe Albert's mother may not have been fully aware of the experimental condition and effect on her son.
- *Informed consent* is not mentioned in Watson original article, so a judgement cannot be made about this ethical issue.
- Also possible that Albert was vulnerable to psychological harm as a result of the experiments.
- Yet Albert was subjected to severe anxiety and distress & the experimenters made not attempt to end the experiment and attend to his distress in an appropriate way.

Albert after the experiments?

- Some psychologists have suggested that Albert's conditioned fears might have disappeared over time, however it is reasonable to assume that Albert was not only emotionally traumatised by the experimental procedures to which he was subjected, but was also likely to have suffered some kind of lasting psychological harm.
- Experiments using any human participant in this way would be considered unethical today and would not be permitted.



Classical Conditioning in Practice

CC is used in a range of different settings, many of which are concerned with therapeutic benefits. These include:
Aversion therapy and systematic desensitisation.

Aversion Therapy

- When people develop behaviours that are habitual and harmful to themselves or to others, such as substance dependence, it is difficult to help them permanently stop the unwanted behaviour.
- **Aversion therapy** is a form of behaviour therapy that applies CC principles to inhibit or discourage undesirable behaviour by associating it with an aversive stimulus.
- The aim of aversion therapy is to suppress or weaken undesirable behaviour.
- E.g. to stop unwanted behaviour such as nail biting, we might paint our nails with a foul-tasting substance.
- The association between nail biting and the unpleasant taste is learned quickly.



When was aversion therapy first used?

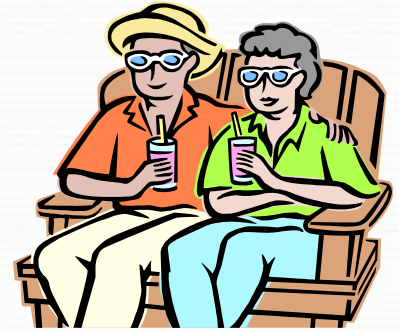
- 1930s to treat alcoholism.
- Alcoholics were administered painful electric shocks whenever they could smell, see or taste alcohol.
- Today, nausea-inducing drugs are paired with alcohol consumption to make the alcoholic feel ill.



Association becomes so strong that the person begins to anticipate nausea as an inevitable result of consuming alcohol.

Limitations of aversion therapy

- The learned aversion often fails to generalise.
- This may be due to conditioning being dependent on cues that indicate the aversive stimulus will follow.
- People may experience the aversion only when they *know* that the UCS is going to coincide with alcohol consumption.



Systematic desensitisation

- Developed on the 1950s by psychiatrist Joseph Wolpe, **systematic desensitisation** is a kind of behaviour therapy that attempts to replace an anxiety or fear response with a relaxation response through a classical conditioning procedure.
- The client associates being relaxed with the anxiety or fear-arousing stimulus by means of a series of graded steps.
- Basic principle is that the client is gradually desensitised to anxiety or fear-arousing objects, activities or situations.

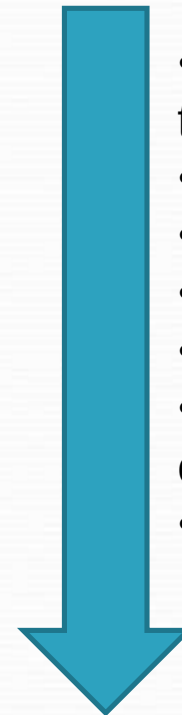


Wolpe's procedure:

1. Person is taught to relax.
2. Break down the fear arousing situation into a logical sequence of steps (steps are ranked from least to most fear-inducing).

- Case study: fear of flying.

Most frightening



- Experiencing mid air turbulence
- Taking off
- Taxiing down the runway
- Boarding the plane
- Waiting to get on the plane
- Travelling to the airport in a car
- Buying a place ticket.

Least frightening

Procedure cont...



- Once the steps are ranked, the therapist then teaches the person deep muscle relaxation and asks them to imagine the least frightening scene on the list and so on...
- In the end the person learns to imagine the most frightening scene without becoming afraid.
- The best results seem to occur using real life desensitisation, such as the therapist sitting in a plane with the person or introducing them to the pilot for reassurance.
- By allowing the client to confront the phobia under such supportive circumstances, the fear of flying is eventually overcome.

Enuresis (bedwetting)

- Some children continue to wet their beds long after they are toilet trained and out of nappies.
- This is known as **enuresis** (persistent involuntary discharge of urine after the age of when bladder control is expected)
- Some cases of enuresis are caused by physiological problems (e.g. weakness of muscles near bladder), yet the condition is mostly associated with:
 - problems during toilet training
 - stressful situations such as hospitalisation
 - underlying emotional problems relation to entering school or the birth of a sibling.



Treatment of persistent bedwetting

- CC procedures have been successfully applied in treating enuresis.
- E.g. Wickes (1958) and a team of research assistants successfully treated 100 cases of enuresis in participants aged between 5 & 17.
- Wickes believed the individual had simply failed to learn to wake up in response to the stimuli arising from a full bladder and that this necessary learning could be brought about by CC.
- Wickes decided to use the sound of a buzzer as a UCS to reliably awaken a person sleeping.
- The sound would follow the stimulation from a full bladder (CS).
- After a series of such paired presentations, the response of waking up – buzzer (UCR) – should begin to occur in response to stimulation from a full bladder (CR)
- Then the person would go to the toilet instead of wetting the bed while asleep.

Treatment cont...

- Problem – to arrange for a buzzer to sound shortly after the person's bladder was full.
- Solution – have the person sleep with a gauze pad appropriately positioned so that the first drop of urine closed a circuit that set off the buzzer.
- Wickes found that his treatment proved to be an effective method for curing enuresis, as many children and adolescents began to wake up in response to the stimulation from a full bladder-before wetting the bed.
- The recent modification of using a small ultrasonic monitor mounted on an elastic belt worn around the abdomen, has been made to Wickes' method.
- The belt triggers an alarm when the bladder capacity reaches a certain level.



Ethical issues in conditioning behaviour

- All research with human participants must abide by a set of ethical principles and guidelines called the *National Statement on Ethical Conduct in Research Involving Humans*.
- CC research demands particular attention as learning happens passively and a participant might unknowingly and unwillingly acquire new behaviours.
- Watson and Rayner's research with Little Albert would not be approved by an ethics committee today for various reasons, such as:
 - Beneficence
 - Respect for persons
 - Participant's rights
 - Voluntary participation
 - Confidentiality
- With a partner, discuss and then outline in your exercise books, why each of the above dot points were not adhered to by Watson and Rayner.

A Clockwork Orange (1971)

- Stanley Kubrick film – a social commentary on aversion therapy as dehumanising.
- Alex (main character, part of an aggressive gang) consents to having aversion therapy to reduce the length of his jail sentence.
- Aggression towards women was the unwanted behaviour and electric shocks were the aversion.
- The mild electric shock was paired with images of women he was *forced* to watch.
- He could not exercise withdrawal rights and became visibly distressed during the aversion therapy.
- He is forced to be good, he does not become better behaved because of any conscious decision on his part to reform.

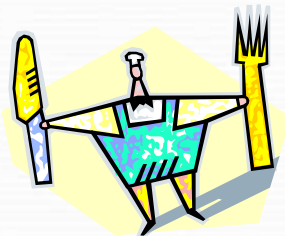
One-trial Learning & Taste Aversion

- A taste-aversion is a conditioned response that results from a person or animal establishing an association between a particular food and being or feeling ill after having consumed it at some time in the past.
- The association is usually the result of a single experience & the particular food will be avoided in the future.
- Similar to CC as there is an *association* between a CS(smell/taste of food) and the UCS (nausea producing substance).
- This tends to happen with one trial.
- One-trial learning is a form of learning involving a change in behaviour that occurs with only one experience.
- Whether one-trial learning is a particular type of CC is still a topic of some debate.



CC vs. One-trial learning

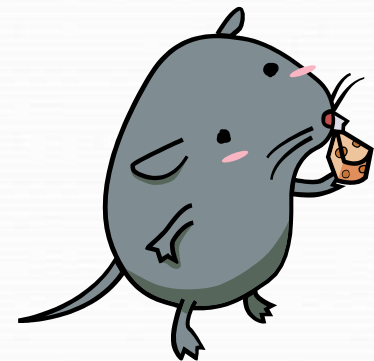
- CC responses usually take a number of associations or pairings to occur & can extinguish relatively quickly.
- In CC, the CR occurs immediately after the CS is presented.
- One trial learning is quickly acquired & considerably resistant to extinction (because UCR, feeling sick, is very powerful).
- In one-trial learning, the CR could occur as much as a day or so after the food (CS) was consumed.



**CC and one-trial learning both involve automatic, involuntary responses that are acquired in a passive manner, i.e., the person or animal does not make a deliberate decision to perform a behaviour for an intended outcome.*

Garcia Effect

- John Garcia demonstrated that taste aversion is different from standard CC.
- Garcia and Koelling (1966) accidentally discovered the occurrence of a taste aversion when investigating the effects of radiation on rats.
- Their findings suggest that animals tend to associate aversive stimuli in certain ways that foster their survival, but do not associate aversive stimuli if these do not threaten their survival.
- Learned taste aversion based on just one exposure can be very adaptive (i.e. their chance of survival is high).



Garcia's 1st Experiment



- Thirst rats were allocated to 1 of 2 experimental groups.
- Both groups offered saccharine-flavoured water to drink from a tube.
- Whenever rats in either group licked the tube, a bright light was flashed and a clicking noise sounded.
- Later, rats in one group received a painful shock to their feet, while those in the other group received a dose of illness-inducing X-rays.
- Subsequently, when rats were offered saccharine flavoured water, they refused it.
- It seemed the rats had been classically conditioned to acquire a taste aversion to saccharine flavoured water.
- But had the rats learned to avoid all parts of the CS, or just some of them? (CS – combo of saccharine flavoured water, bright light and clicking noise).

Garcia's 2nd Experiment

- Tested same rats under a different condition.
- The rats were given either saccharine-flavoured water that was not paired with either light or noise, OR unflavoured water that was paired with the same light and noise that had been present during the previous condition.
- Result: rats that had become ill because of the effects of the X-rays avoided the saccharine flavour, but were quite content to drink water accompanied by the same light and noise.
- In general, results indicate the UCS influenced what the rats had learned.