Cognitive Functions

Week 1

Lecture 1: Learning – Classical Conditioning (CC)

Lecture 2: Learning – Operant Conditioning (OP)

Lecture 3: Learning – Cognitive & Social Learning Theories

Week 2

Lecture 4: Memory – Memory Systems & Short-term Memory

Lecture 5: Memory – Working Memory

Lecture 6: Memory – Long-term Memory & Amnesia

Cognitive Functions

Week 3

Lecture 7: Language & Communication

Lecture 8: Mental Imagery & Representation of Knowledge

Lecture 9: Volition & Motivation

Week 4

Lecture 10: Free Choice & Authorship

Lecture 11: Consciousness

Lecture 12: Repetition

Learning (part I)
Classical Conditioning

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Overview

Experimental Psychology

Principles of Classical Conditioning (CC)

- Pavlov's experiments
- *Watson's study with "Little Albert" (lab class)*

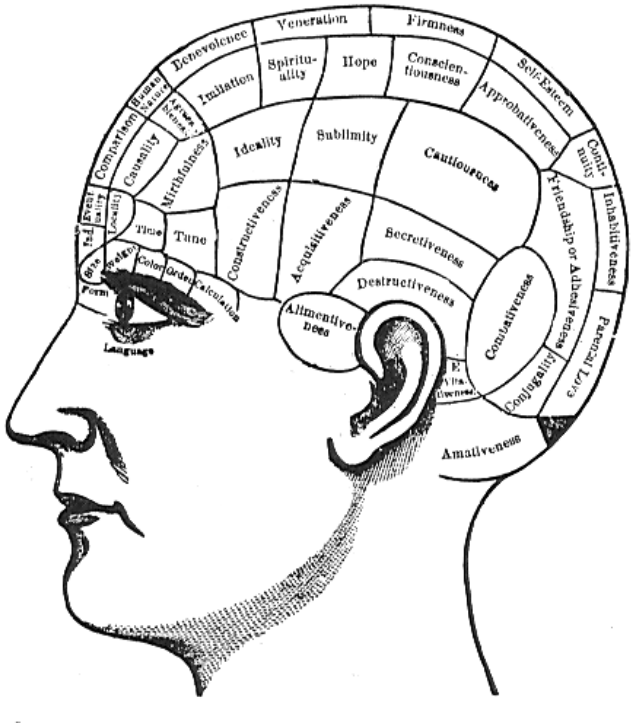
Applications of Classical Conditioning

- Phobias
- Alcohol and drug dependence
- Cognitive-Behavioural Therapy (CBT)

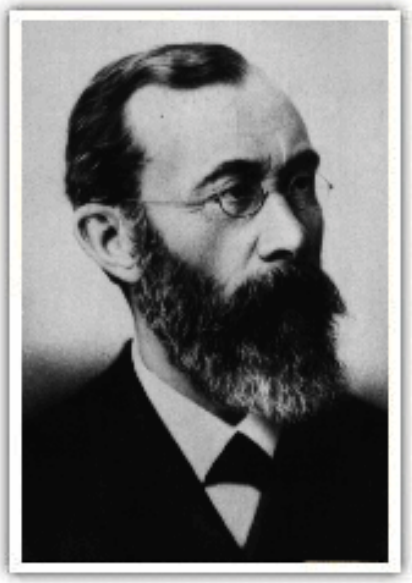
Experimental Psychology

Understanding the *mechanisms of the mind*

- How do we solve cognitive tasks?
- How do we acquire new knowledge?
- How do we remember events and facts?
- How do we retrieve and forget our memories?
- How do we process speech and visual objects?
- How do we want to do things?
- How do we form intentions?
- How do we become conscious of specific things?



Experimental Psychology



Understanding the *mechanisms of the mind*

Wilhelm Wundt (1832-1920)

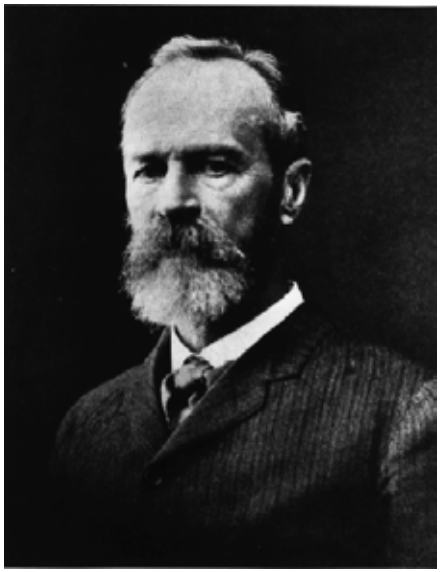
- first psychology laboratory (1875) at the University of Leipzig, Germany

- He used *experimental introspection*: trained to report inner processes

- Aim: discover the basic elements of thought (structuralism): laws by which mental elements combine into complex mental experiences

- The mind / consciousness was to be analysed into its elements, just as in the physical sciences

Experimental Psychology



Understanding the *mechanisms of the mind*

William James (1842-1910)

- School of *Functionalism*

- wrote “The Principles of Psychology” (1890)

- focused on the purpose (function) of consciousness, rather than on the structure of consciousness. He described the *stream of consciousness*, as opposed to the elements of consciousness

- was greatly influenced by the work of Charles Darwin: For him, psychology was a biological science

What is Learning?

- Learning is the process by which experience or practice results in a relatively permanent change in behaviour or in potential behaviour

- Many learning studies used animal subjects: these allow for the precise control of the conditions under which a behaviour is learned

- However, this assumes a level of similarity between species for generalisation of learning principles

Basic Principles of Learning: Classical Conditioning

Ivan Pavlov (1849-1936)

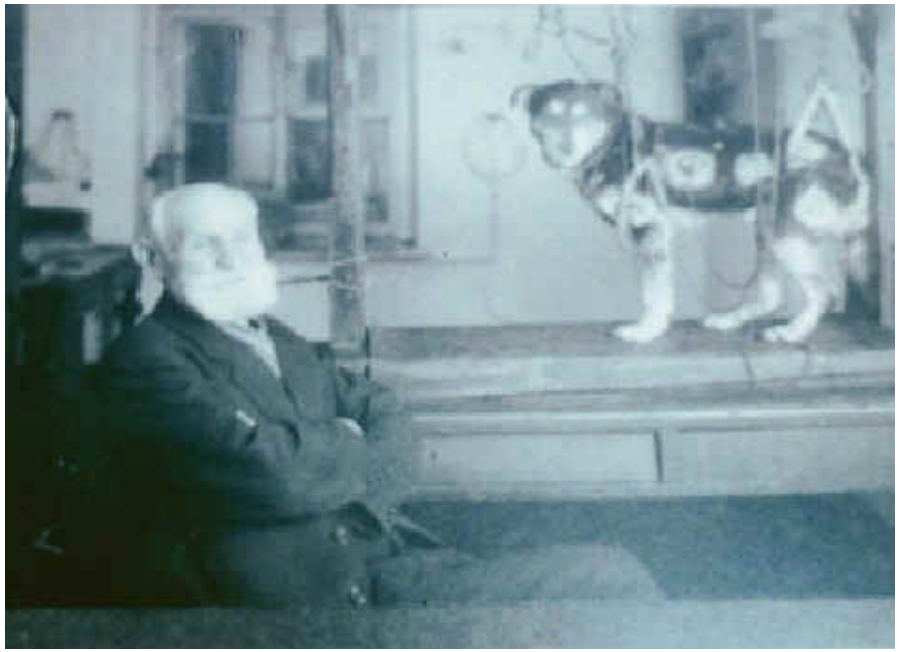
- The first experiments were performed by Pavlov, a Russian physiologist who was originally interested in digestion in dogs

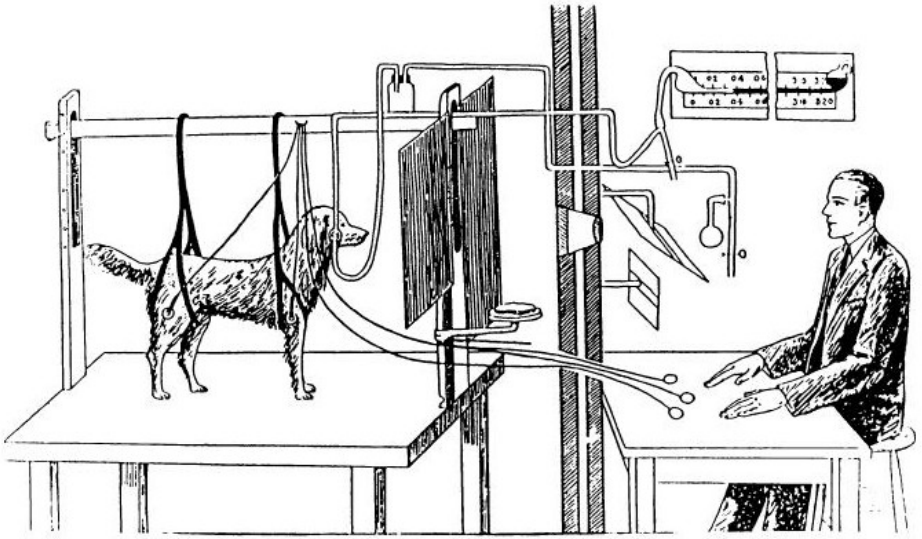
- In order to get the dogs to produce saliva, Pavlov would put food on their tongues

- After some days the dogs started to produce saliva automatically, *before* he put the food on their tongues

- Dogs learned to *associate* the food with a signal (his footsteps) and salivated in anticipation (reflex behaviour)

Basic Principles of Learning: Classical Conditioning





- Classical conditioning always involves a *reflex behavior*

- A reflex is a simple, *unlearned* response governed by the nervous system that occurs *naturally* in response to stimulus

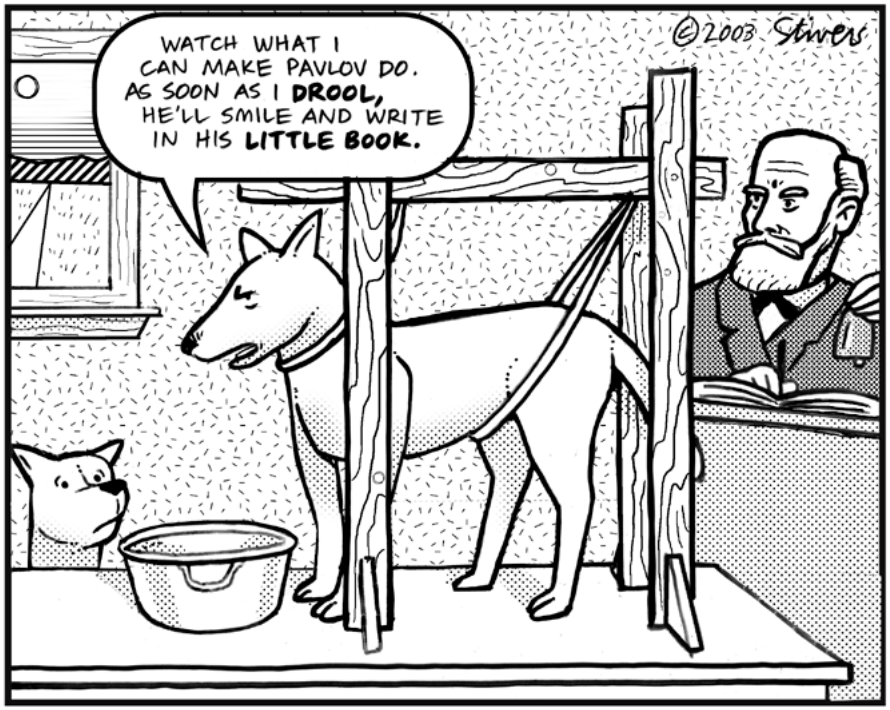
Basic Principles of Learning: Classical Conditioning

- New stimulus-response relationship is *learned by association*

- Pairing a *neutral stimulus* with a natural (unlearned stimulus) that automatically elicits a reflex response

- Pavlov first rang a bell (initially neutral), then gave the dog food

- The dog learned to salivate when bell sounded (conditioned response)



Basic Principles of Learning: Classical Conditioning

Unconditioned Stimulus (UCS)

A stimulus that always causes an organism to respond in a specific way (e.g., food)

Unconditioned Response (UCR)

A response that takes place in an organism whenever an unconditioned stimulus occurs (e.g., salivation to food)

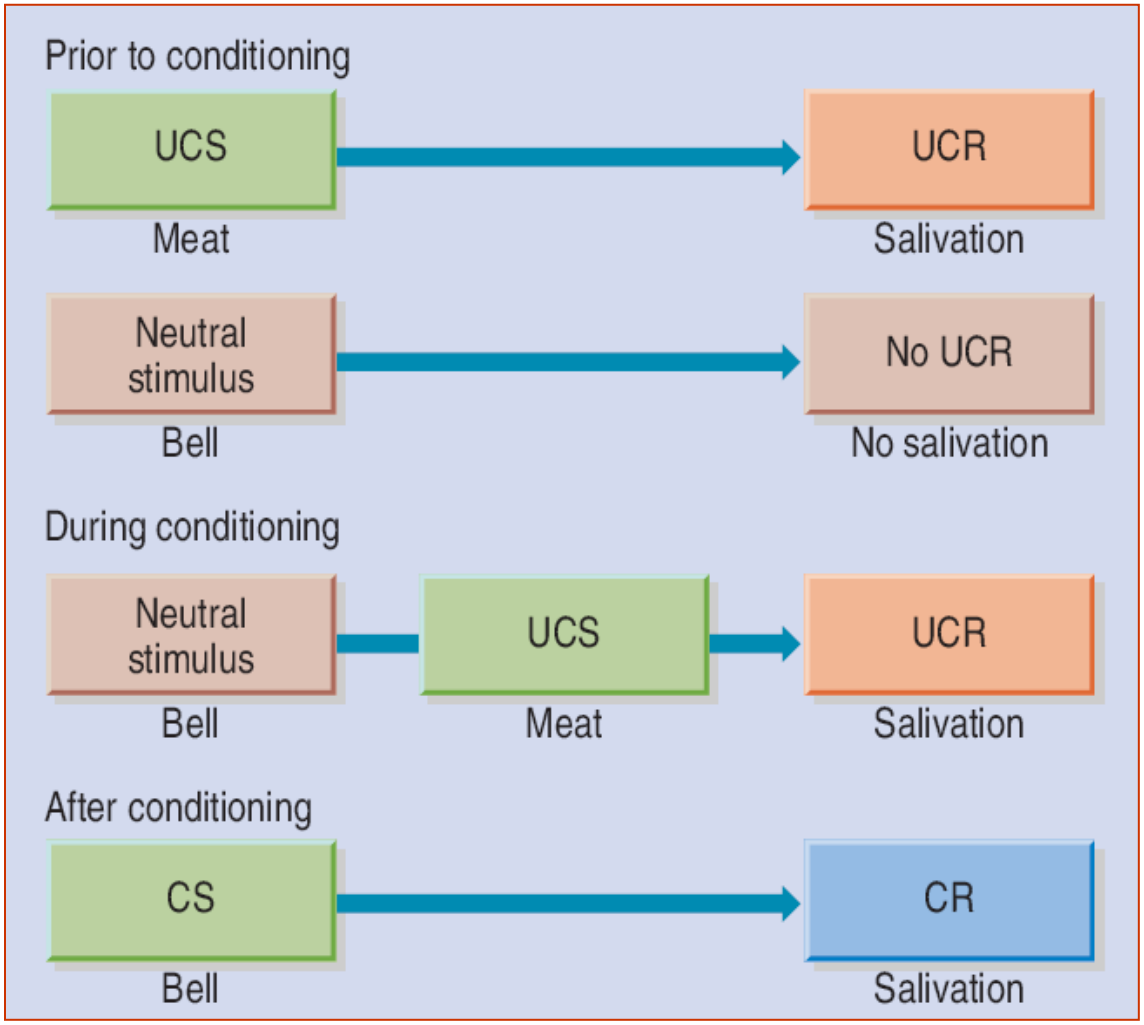
Conditioned Stimulus (CS)

An originally neutral stimulus that is paired with an unconditioned stimulus and eventually produces the formerly unconditioned response (e.g., the bell)

Conditioned Response (CR)

After conditioning, the CR is the response produced when the CS is present (e.g., salivation to bell)

Basic Principles of Learning: Classical Conditioning



Basic Principles of Learning: Classical Conditioning

UCR and the CR *are the same behavior* (salivation). What distinguishes them is the *stimulus* that preceded them:

- *natural* response – UCR

- *learned* response – CR

Conditioning is *strengthened* by:

a) *frequent pairings* of the CS and the UCS

b) *timing*: CS is presented immediately prior to the UCS to make the CS *predictive* of the UCS

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Basic Principles of Learning: Classical Conditioning

Phenomena in classical conditioning

Extinction: gradually weakening conditioned responses – occurs when CS is repeatedly presented without the UCS

Spontaneous recovery: The reappearance of a previously extinguished response – occurs when the dog was allowed a few hours rest, and after extinction the CS would again elicit the CR

Rapid reacquisition: Once extinction occurred, re-learning is substantially faster when a second acquisition phase is introduced

This shows that extinction is not an unlearning of the conditioned response but *a learned inhibition* of responding. The initial learning is not lost, just *inhibited*

Limits of Classical Conditioning

<u>Can everything be conditioned</u>?

- *learned taste aversion* (John Garcia, 1950s): an organism's innate behavior patterns can affect what is learned and how quickly it is learned

- Classically conditioned dislike for / avoidance of a particular food develops when illness occurs after eating that food

- However, it does *not require repeated* exposure - one bad experience is enough!

- Additionally, the time span between CS (formerly benign food) and CR (vomiting) can be hours, not seconds

- We seem to have a biological predisposition for learning this fast – however, this observation violates the basic assumption that everything can be conditioned in the same way

Limits of Classical Conditioning

Can everything be conditioned?

- Seligman proposed the principle of “Biological Preparedness”: no equivalence of associability – Organisms are biologically prepared to learn certain associations quickly because they ensure survival

Example 1: Learned taste aversion in chemotherapy:

- Associations between nausea and food are acquired during treatment in chemotherapy, despite awareness that the food is not what is causing the nausea, but the treatment

Example 2: Colour and taste

- Wilcoxon et al. (1971) presented quails and rats with blue-sour water followed by nausea (conditioning). Then they tested separately what the animals would avoid later:
- Quails avoided the blue water, rats avoided the sour water
- The reason is that quails select food on basis of vision, but rats select based on smell

Limits of Classical Conditioning

Can everything be conditioned?

- Another example for biological preparedness are *phobias*

- Phobias are extreme, irrational fears of specific objects, animals or situations

- Particular stimuli are more likely to generate phobias because of their *salience to survival* (e.g. natural objects, situations)

Limits of Classical Conditioning

Can everything be conditioned?

- Conditioning will not allow just any phobia to be acquired

- It is easy to create a phobia of snakes by pairing an image of a snake with an electric shock, but hard to create a phobia for flowers

- A snake phobia also harder to extinguish

- Phobias for other (very dangerous but evolutionary novel) objects can't be acquired at all...

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Applications of Classical Conditioning

CC as an element in psychotherapy

- Phobias can be *unlearned* via gradually pairing phobic stimulus with positive experience: exposure in *Cognitive-Behavioural Therapy* (CBT)

- *Desensitisation Therapy* (Wolpe, 1973): relax in the presence of fearful stimuli (you can't be both fearful and relaxed at the same time)

- Using the conditioned response to drugs: A placebo response occurs as a physiological reaction to an inert (fake) drug because of the initial repeated pairing of "pill" with effect (therapeutic response)

Applications of Classical Conditioning

CC as a mechanism in drug use

- Unfortunately, similar mechanisms contribute to the effects of addictive recreational drugs (their aim is to alter normal functioning)

- The anticipation of a drug (similar to Pavlov's bell) elicits a *conditioned compensatory response (CCR)* – the *natural tendency to reverse the anticipated effect* to restore homeostasis

- Situational cues (e.g. the pub), which were initially neutral can become conditioned stimuli (CS) and trigger the conditioned compensatory response. This can explain:

- withdrawal symptoms (environment without the drug)

- tolerance (needing more to create the same effect because of CCR)

- overdose: *same* doses in *different* environment (no cues) stronger because no conditioned compensatory response

- relapse: Spontaneous recovery from extinction, re-entering the world with all old situation cues

Modern views on Classical Conditioning

- Conditioning reveals how organisms learn to *mentally represent* aspects of their world – we can learn something about cognitive models

- Rescorla (1980): Effectiveness of CS determined by its *predictive (informational) value*

If you want to know more:

Rescorla, R.A. (1988). Pavlovian Conditioning: Its not what you think it is. *American Psychologist, 43,* 151-160.

Siegel, S., Baptista, M.A., Kim, J.A., McDonald, R.V. & Weise-Kelly, L. (2000). Pavlovian psychopharmacology: The associative basis of tolerance. *Experimental and Clinical Psychopharmacology, 8,* 276-293.

Watson, J.B. & Rayner, R. (1920). Conditioned emotional reactions. *Journal of Experimental Psychology, 3,* 1-14.