Psychology: Evolution of a Science

Psychology is defined as the scientific study of mind and behaviour. *Don't mix up mind* (perceptions, thoughts, memories, feelings, consciousness) *and behavior* (observable and measureable actions of humans and animals).

In modern psychology, technology has taken centre stage. Functional Magnetic Resonance Imaging (fMRI) allows active brains to be scanned. Much of its findings are *counter-intuitive*; for example jazz great Oscar Peterson's brain regions that control his piano playing are less active than a novice pianist, not more.

Psychological processes are *adaptive*; they promote the welfare and reproduction of those organisms that engage in those behaviours. A good way to understand adaptive behaviours is to observe what happens when they are not present. You may know someone who 'refuses to grow up', for example.

Understanding lapses, errors, mistakes, and other puzzles of human behaviour provides a vantage point for understanding the normal operations of mental life and behaviour.
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Psychology has its roots in philosophy. Two approaches emerged: **structuralism** (breaking down the mind into its basic components); **functionalism** (mental abilities that allow people to adapt to their environment).

Two philosophic approaches emerged, which we still use today: **nativism** (certain kinds of behaviour are inborn); **empiricism** (all knowledge is acquired through experience). Today we use the terms **nature** and **nurture**.

Philosophers had two distinctions: Descartes' **dualism**, who posed that mind (immortal and spiritual) and body (material and physical) are separate; Hobbes argued that the mind is what the body does, **monism**. Neuroscience is strictly monism, or **scientific materialism**.
Such a monist approach does not always lead to greater truths. Franz Joseph Gall invented the pseudo-science of phrenology, which suggested that psychological capacities were located in particular parts of the brain. The greater number of capacities a person has, the larger the number of lumps on the skull. We still use some of his terms, such as 'lowbrow'. His theory also had tragic consequences.

Phrenology paved the way for eugenics, which restricted immigration and education on the basis of race. Race was defined by craniometric measurement, that is the shape and size of the skull. Whites were considered superior to blacks, who were just a step away from the great apes.

Other scientists applied this approach in a more constructive manner. Pal Broca, who had the crucial insight that damage to a specific area of the brain impaired a specific mental function.

Physiological psychology under Helmholtz and Wundt began the scientific study of mental processes.
Helmholtz' research created the concept of **reaction time**. Subjects took longer to report the **stimulus** of a toe being touched, as compared to their thigh. This surprised scientists of the time, who believed thought and perception to be instantaneous.

Wilhelm Wundt believed that scientific psychology should focus on the study of **consciousness**. (a person's subjective experience of the world and the mind).

To study consciousness, he adopted the approach of **structuralism**, the analysis of the basic elements that constitute the mind. Wundt used the method of **introspection**, the subjective observation of one's own experience, such as hearing a sound. Wundt also carefully described the feelings associated with such elementary perceptions.

Wundt also used reaction times to examine the relationship between perception and interpretation of a stimulus. Some subjects were told to perceive the sound before they pressed a button, others told to press the button as soon as they heard the sound. The second group were significantly faster at pressing the button (pgs. 5&6).
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- Tichener brought structuralism to the United States, but it languished because replication of subjective experience was impossible at that time (more on that later!). What he did find (and we now know to be true) that the majority of conscious experience is either visual or auditory.

- It was William James, however, who made psychology a cornerstone in the academic world. He did this applying some of Wundt's work in a new way, which James called functionalism. He believed that consciousness was better understood as a flowing stream, and that the proper study of psychology would be to determine how mental functions—such as problem solving—evolved to help humans survive and reproduce. William James was indebted to Darwin for much of his thinking.

- Today, we apply the functionalist approach in many areas, but most commonly in developmental psychology and in evolutionary psychology. James's colleague Hall believed that children repeat the evolutionary stages of human history. The mental capacities of children resemble those of our ancestors. A (debunked) version is the Bicameral Mind. https://en.wikipedia.org/wiki/Bicameralism_
%28psychology%29
Freud and Psychoanalysis: He became interested in the phenomena of hysteria, a temporary loss of cognitive or motor functions usually as a result of emotionally upsetting experiences.

He worked with Charcot, who advocated the use of hypnosis to understand the nature of these hysterias. Charcot theorized along with James that the brain can create many unconscious selves that are not aware of each other's existence.

Working with Breuer, Freud theorized that many of the patient's problems could be traced to the effects of painful childhood experiences that the person could not remember.

This led to the theory of the unconscious mind, the part of the mind that operates outside conscious awareness but influences conscious thoughts, feelings & actions.

From this Freud developed psychoanalytic theory, an approach that emphasizes the importance of unconscious mental processes in shaping feeling, thoughts & actions.

Psychoanalytic theory became quite controversial because it suggested that a person's thoughts, feelings & actions required a thorough exploration of a person's early sexual experiences and
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- Freud's view of human nature was a dark and pessimistic one, focused on limitations and problems. Because of this, humanistic psychology arose in the 1960's.

- Maslow and Rogers pioneered this approach, first replacing the term 'patients' with 'clients'. The goal was to emphasize a positive potential of human beings.

- Humanistic psychologists focused on the highest aspirations, rather than viewing people as prisoners of events in their remote pasts. Humans were viewed as free agents who have an inherent need to develop, grow & attain their full potential.

- Humanistic psychology's greatest weakness was its underestimation of the capacity in some people for evil; it's second greatest weakness led to the emergence of the 'me' generation in the 1970s.

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• With respect to structuralism, functionalism & psychoanalysis, the unreliable nature of the methodology--for example, one can't ask babies to describe their innermost thought--brought about a completely different approach, one that dominated North America for most of a century.

• This is behaviourism, which advocated that psychologists restrict themselves to objectively observable (and measurable) behaviours.

• Watson believed that private experience was too idiosyncratic and vague to be an object of scientific inquiry. Science required replicable, objective measurements of phenomena accessible to all observers. Simply put, observe what people do, not what they say they are experiencing.

• The goal of scientific psychology according to Watson, should be to predict and control behaviour in ways that benefit society.

• Watson argued against animals having any sort of private experience, as contrasted to Washburn, he advocated that the only way to understand how animals behave and adapt was to focus solely on their behaviour, and that the study of human beings should proceed on the same basis.

• Watson has influenced by the work if Ivan Pavlov, who carried out pioneering work on the physiology of digestion. Pavlov noticed that dogs not only salivated at the sight of food, they also did this at the sight of the person who fed them.
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- Pavlov developed a procedure in which he sounded a tone every time he fed the dogs; after a while he observed that the dogs would salivate when they heard the tone alone.

- In Pavlov's experiments, the sound of the tone was a **stimulus** (sensory input from the environment) that influenced the salivation of the dogs, which was a **response**.

- A response has a strict definition in Pavlovian terms: an action or a physiological change **elicited** by a stimulus.

- Watson believed that the environment is a powerful influence on human behaviour, although he did not believe it was the only influence.

- Skinner took the opposite approach. He observed that animals **act on their environments** to find food, shelter, or mates.

- Skinner saw evidence for the principle of **reinforcement**, that is, the consequences of a behaviour will determine whether it will more or less likely to occur again.

- He developed the **teaching machine**, which broke a subject down into small steps, rewarding the student for the successful completion of each step. Questions increased in difficulty as the student progressed through the subject's stages.

- Skinner argued that an understanding of the principles by which behaviour is generated could be used to increase social welfare.
Neisser described his experience of academic psychology: “no psychological phenomenon was real unless you could demonstrate it in a rat.”

Behaviourism, however, was unable to explain two very important phenomena: (1) how children acquire language; (2) why rats associate nausea with food rather than with a tone or a light.

Wertheimer focused on the study of illusions, errors of perception, memory or judgment in which subjective experience differs from objective reality.

His 'light slit' experiments led to the development of Gestalt psychology, which emphasizes that we often see a whole instead of the sum of its parts. The mind imposes organization on what it perceives.

Ebbinghaus and Bartlett studied memory from very different perspectives: the first using nonsense syllables as memorization tools: the second using real-world memories. Ebbinghaus stressed the aspect of recall (retrieving memories without an external cue). Bartlett stressed the contrast between subject's 'should have' and 'expected to' memory recall with the object reality of the memory.

Bartlett reasoned correctly that memory is not a photographic reproduction of past experience, but an interpretation influenced by knowledge, beliefs, hopes, aspirations, and desires.

Jean Piaget studied and theorized about the developing mental lives of children. His principle of conservation of mass studies demonstrated how the errors of reasoning in small children illustrate the development of their mental abilities.
Lewin argued that a person's behaviour in the world could best be predicted by that person's subjective experience of that world. It was not the stimulus but the person's construal of that stimulus that would predict subsequent behaviour.

His topological theories (applying mathematical models to psychological behaviours) was not particularly influential, but construal and modeling are still used today.

The advent of computers changed psychology, as the discipline moved away from comparing the mind to cameras and phonographs to the new technology.

Computers are information-processing systems, and our mental events such as remembering, attending, thinking, believing, evaluating, feeling, and assessing are a flow of information.

This new model led to cognitive psychology, the scientific study of mental processes, including perception, thought, memory and reasoning.

The great flaw in this comparison is that our newest and best computers cannot do what a human brain does, as the architecture is fundamentally different. We are presently learning to create new computing architecture (both hardware and software) that mimics a human brain more closely.

The best explanation comes from the 2014 film 'Ex Machina'.

https://www.youtube.com/watch?v=ruOXWHbyfjo
These competing schools of psychology were resolved by WWII. Radar operators had to pay close attention to their screens for long periods of time, trying to decide if blips were friendly aircraft, enemy aircraft, or flocks of wild geese. Equipment engineers had to consider perception, attention, identification, memory, and decision making.

Broadbent observed that pilots cannot attend to many different instruments at once and must actively move the focus of their attention to one or the other. A limited capacity to handle incoming information is a fundamental feature of human cognition.

Miller determined that the average human can hold 5 items in memory at a time, plus or minus 2.

Chomsky demolished the behaviourist's analysis of language acquisition. Language relies on mental rules that allow us to understand and produce novel words and sentences. The ability of even the youngest child to generate new sentences that they had never heard before flew in the face of behaviourist claim that children learn to use language by reinforcement. It is a good idea to remember that behaviourism works strictly with observables and measureables.
Our mental faculties often seem so natural and effortless--noticing the shape of an object, using words in speech or writing, recognizing a face as familiar--that we fail to appreciate the fact that they depend on intricate operations carried out by the brain. Here, also, the comparison between brains and computers breaks down. **Computers have hardware and software, whereas brains have wetware.**

For example, damage to a certain location in the brain will lead to **prosopagnosia**, in which the person cannot recognize human faces (they can't assemble a complete face, only bits of it), and **Capgras syndrome**, where a person believes that a close family member has been replaced by an impostor.

These and other problems have led to **behavioural neuroscience**, an approach that links psychological processes to activities in the nervous system and other bodily processes. *This is the game-changer, and it is only 25 years old!*

How is it done ethically? By studying birth defects, accidents, and illnesses. This has led to **cognitive neuroscience**, which is the focus of this course.

Figure 1.2 will be on the first midterm. **PET (Positron Emission Tomography)** A person suffering from Alzheimer's, compared with a healthy person, shows more extensive areas of lowered activity toward the front of the brain.
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- Behaviourism was also challenged by real-world observations that a rat's ancestors' learning history had an effect on its present learning capacity.

- This has led to the highly-contested area of study called **evolutionary psychology**, which explains mind and behaviour in terms of the adaptive value of abilities that are preserved over time by natural selection. For example, it can be used to explain why obesity is an epidemic, as the most desireable foods in the ancient world--fats and sugars-- were rare and we evolved taste buds to seek them out. Now that we have abundant fats and sugars (yeah fast food!) obesity is on the rise.

- Evolutionary psychologists subscribe to the **modular model** of the brain. Our brains evolved to solve the problems of survival 100,000 years ago; this means that they excel in solving Stone Age problems--a time when jealousy and rage were useful emotions--and are often not well suited to our technological age.

- Critics of this view look to the explanation for feathers, which we know from archeological evidence emerged 120 million years ago in the early Jurassic as a method of regulating body temperature in infant dinosaurs, and in adulthood, as a display for mating. Only later were feathers adapted to flight.

- Finally, evolutionary psychology is now primarily focussed on **molecular biology**. In 2010, the Neanderthal genome was sequenced, and we now know that inherited Neanderthal genes increase the risk for depression and addiction. https://www.newscientist.com/article/2077269-our-neanderthal-genes-linked-to-risk-of-depression-and-addiction/