Module:
Psychological Foundations of Mental Health

Week 1
Introduction to cognitive psychology

Topic 1
Foundations of cognitive psychology from Plato to Pavlov – Part 2 of 3

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Lecture transcript

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How did we get to our current state of knowledge and understanding? This timeline shows just a few of the key periods and the figures that have contributed to making cognitive science and cognitive psychology what it is today.

In this first topic, we are going to travel along this timeline, covering the first 2,000 or so years rather quickly, before slowing down as we hit the 19th and 20th centuries, when psychology as we recognise it began. We will trace some of the key influences in the emergence of psychology as a scientific discipline and the splitting of cognitivism and behaviourism, before we see a recognisable cognitive psychology emerge in the mid-20th century.

A word of warning. This early history is dominated by men and, for much of the time, men with impressive beards.

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We start over 2,000 years ago. The philosophical traditions and schools of thought that have shaped modern cognitive psychology have their origins in ancient Greek philosophy, from figures such as Plato and Aristotle. The concept of psychology did not exist in the same way as we consider it today.

However, from its foundation, philosophy was fundamentally concerned with the working of what we would call the mind and particularly the human mind. The modern word "psychology" derives from the Greek word "psyche," which refers to the soul as distinct from the physical body. However, in the thinking at that time, the soul encompassed a wide range of concepts, including what we would call the mind.

Two broad schools of thinking emerged, called rationalism and empiricism, that still influence and echo through modern psychological theory today and are seen as complementary, rather than opposing. The rationalist schools of philosophy, such as that proposed by Plato, broadly held that we can explore the mind and other abstract ideas and constructs through a process of thinking itself, by examining personal experience and, through that, mental processes.

These include intuition, which can be considered a form of rational insight arising from exploration

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of an idea, and the process of deduction, where we use logical processes of reason to draw novel, general conclusions from existing knowledge and experience. Rationalist thinking also often presumes that much knowledge, including mathematical concepts such as quantity and logic, is innate or acquired through development, without the need for it to be learned.

This is a version of the nature view in the nature versus nurture dichotomy. This view also led to a broader generalisation that we all have an invariable core, our individual human nature, that cannot be altered or manipulated. It is this that makes each of us unique, whether good or bad.

The empiricists, such as Aristotle, a pupil of Plato, adopted a very different approach. First, they believed that the fundamental concepts of the mind and all knowledge comes from sensation and experience, rather than sitting there, waiting to emerge. Also, we are shaped by what happens to us, the nurture viewpoint. Later empiricists often had a sceptical distrust or more fundamental objection to the unobservable, preferring evidence of our senses and what emerged from them.

There was also a profound preference for simpler explanations, ones that were sufficient to account for what could be experienced and observed. Such simplicity was contrasted with explanations based on the internal and the unobservable. These tended to be more complex, arising from the rationalist exercise of intuition and reason alone.

Finally, an implication of the empiricist view was that human beings can be controlled and manipulated exceptionally easily. We are nothing other than what we experience and so can be influenced to do whatever we're taught, again, for good or bad.

Such empiricist and rationalist approaches, in many forms, have coexisted for thousands of years, sometimes peacefully and sometimes as bitter battles between rival factions. Today, rationalist and empiricist principles are not seen as contradictory or conflicting. Rather, they can be applied to different methods of inquiry and subject areas.

The modern scientific method involves the interplay between reasoning and abstract theorising, from which generalisations arise by deductive processes, and induction, where we use empirical methods, such as observation and experiments, to test the validity of those theories and so refine them. Similarly, the nature versus nurture debate that has raged for thousands of years is now seen as scientifically sterile and unhelpful, as well as fundamentally inaccurate as a dichotomy.

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Let's fast forward almost two and a half thousand years to the so-called European Age of Enlightenment and the start of the Scientific Revolution. Kant was a German, 19th century philosopher and one of the most influential figures in modern philosophy and arguably one of the founding influences on modern psychology. However, he could just as easily have killed it off before it started.

He worked in an age of enormous growth in scientific understanding of the natural and physical world, in chemistry, in physics, and biology, through the use of precise measurement and experimental method to create mathematically definable descriptions and laws. In many of his works, especially in a Critique of Pure Reason, published in 1781, he addressed the issue of whether psychology, the study of the mind, could ever be an empirical science in the same way as the physical sciences, such as chemistry and physics, which he felt were governed by the immutable laws of mathematics, or whether it must remain within the realm of philosophy or natural science.

He concluded, albeit with some self-argument and contradictions, that it was not and could not be an empirical science, that the mind and its functions were not amenable to direct study. He based this conclusion on a number of arguments.

First, he believed that we can only rationally study our own thoughts and internal processes and

not those of others-- in other words, that the method of psychology must be introspection, the process of examining our own thoughts and feelings. However, he also reasoned that one person's introspection may be very different from another's and, therefore, a poor method to reveal any underlying laws governing the mind.

He also reasoned that introspection artificially forces us to separate things that may not be separable, that such so-called reductionism may lead to false conclusions when it comes to studying the mind. Finally, he argued that the process of introspection alters what we are attempting to observe and understand. So rather than challenging his first premise and concluding that the method, introspection, was fundamentally flawed and looking for another empirical method, Kant concluded that the scientific study of the mind was doomed. Goodbye, psychology.

Why then do we consider Kant an important figure in the history of cognitive psychology? Well, first, he defined the mind as a set of separate abilities or functions, but which work together as a whole to produce our experience and onto the level of knowledge and understanding. Essentially, he described what we would now call a cognitive architecture, linking elements of perception, cognitive transformation, and knowledge. It's described in one of his many famous quotes, as shown here.

Second, although rejecting the possibility of direct study and measurement, he proposed that, even if we cannot observe the mind, we can infer the conditions that must be present in the mind to explain our conscious experience, what he called a transcendental method. He viewed this as a philosophical rather than a scientific method. However, in suggesting that there are ways to infer what we cannot directly measure, he established the basic tenet of modern cognitive psychology. Today, fortunately, we have a wide range of empirical methods to test the validity of those inferences.

Fortunately, Kant did not kill off psychology. And it continued to develop over the early half of the 19th century in Europe and later in the USA. Over that time, various schools of psychology developed, driven by different underlying philosophies and schools of thought. Although none of these are dominant influences today, they have all contributed, in part, to what we recognise today as cognitive psychology.

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Wilhelm Wundt is often credited as being the father of experimental psychology. He set up one of the first ever experimental psychology laboratories in Leipzig, Germany, in 1879. Like Kant, Wundt believed that introspection was the most direct way to study the conscious mind, the only sort that he felt important. But he sought to make it an empirical tool fit for purpose, with his techniques of experimental introspection.

In his experimental method, he concerns himself primarily with introspection based on the sensations and the percepts, feelings, or thoughts that arose directly from them, the latter particularly in the form of visual images. After a warning, he presented stimuli, such as objects, sounds, words, and pictures for a brief but precisely controlled period of time, using electronically controlled apparatus in a dark and quiet room. The stimuli themselves were systematically varied to measure the effect this had on the resultant internal cognitive event.

Those doing the introspection were highly trained to attend to and describe their experiences without interpretation, with the goal being to understand how the initial exposure led first to automatic and what Wundt called passive associations-- in other words, how they had registered or attended to the presence of a stimulus, such as a sound, and its basic properties.

There was then the process of how that led to the conscious thought, when the precise nature of the stimulus was registered. Wundt's particular focus was on the formation of a mental image to the stimulus, a process Wundt called apperception This was seen to result from an active,

controlled, and voluntary process, and represented the higher function of the mind.

His school of thought is sometimes referred to as voluntarism. This separation of automatic and controlled cognitive processes is still important today, although, unlike Wundt, we no longer see the controlled ones as inherently superior.

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Wundt was interested in looking at conscious experience as a whole, rather than understanding the individual nature of the initial sensation or the resultant image. In a typical experiment, a subject might be shown a word, such as “apple”, and might immediately report an associated property, such as crisp or sweet or red. This will be reported as preceding conscious awareness of the whole object, the apple itself.

From such results, Wundt reasoned that our thoughts had structure, that when the mind was presented with an apple, it received a set of properties that defined its structure before being combined to form the thought or mental image, a principle called structuralism.

Wundt attempted to measure these processes further, through the use of electromechanical devices to record reaction times from the presentation of the stimulus to the introspective response. In this way, he sought to separate out the time course for his core processes of attention and apperception an approach he called mental chronometry.

His trained researchers would react as quickly as they could by pressing a button, either when they had registered the stimulus or when they had formed the image. He used the so-called subtractive procedure, the time difference between the two different introspective products, to estimate the extra time needed for apperception to take place, he estimated to be about 1/10 of a second or 100 milliseconds.

Significantly, Wundt did not attempt to study what we would now recognise as core aspects of cognition, such as learning and memory, language, or reasoning. This was not because he denied that they existed or felt that they were unimportant, more that they were less accessible to his experimental methods and to introspection. Thus, Wundt limited his methods and theories only to what could be studied.

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Edward B Titchener was born in the UK and studied with Wundt in Leipzig, before moving to Cornell University in the US. Like Wundt, he used the experimental approach of introspection. But unlike Wundt, who was interested in the final, whole, conscious experience, Titchener was interested in using experimental introspection to reveal and understand the elemental parts of conscious experience, by breaking them down, an approach that his teacher, Wundt, strongly and vocally disagreed with.

Titchener’s approach to psychology was fundamentally structuralist, taking the basic principle of Wundt to extremes and extending it greatly. At the same time, he was not greatly interested in holistic processes involved in properties of the mind, such as the will. Titchener’s experimental methods were described in his two volume book, Experimental Psychology, a Manual of Laboratory Practice, published in 1902.

Even more than Wundt, he sought to standardise the experimental method of introspection to improve its accuracy and reproducibility. Titchener’s psychology and the methods used was very much focused on the immediate and mental experience, the sensation, rather than what use was made of that sensation or the function it served.

In other words, how the brain answers the question, what is it? Rather than, what is it for? He believed that cognitions arose from sensations. And so we need a science of sensation as the

essential foundation to understand the mind.

He proposed that every sensation, whether sound or smell, was made up of four independent properties-- its intensity, quality, duration, and spatial extent. For example, a presented image could be bright, its intensity; pale red, its quality; brief, its duration; and small, its extent. These properties could then each be sub-classified further.

He applied his model of reductionist classification to a fantastic degree and, in an earlier book, suggested a list of over 40,000 elemental qualities that would be worthy of study. Here's a quote that gives a flavour of Titchener's structuralist thinking.

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For the structuralist, presented with an apple, the aim was to identify the key sensory features that defined apple-ness and so permitted the identification of the apple as an object. That same set of features would also permit discrimination between one fruit and another or between an apple and a ball. Whether or not an apple is simply defined as the sum of its sensory parts is debatable.

But the idea of what we would now call feature analysis, as a means of object identification, remains in more contemporary cognitive theories. However, feature analysis is typically seen only as the first step in a range of ever more cognitive and independent stages of analysis and decision making. There is more to making a decision to pick up an apple and eat it than breaking down its features into their component parts and coming up with "apple."

However, the structuralist approach as a primary model of psychology was fundamentally limited by its focus on sensation. Like Wundt and voluntarism, Titchener's psychology was defined by what we could see and measure. Although cognitive in some respects, it neglected whole areas of what we now consider to be contained within the realm of cognitive science-- memory, perception, decision making, and so on, let alone areas such as consciousness and the will.

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Around the same time as Wundt, Titchener, and others were working in Europe, using introspection and experimental methods to study the structure of the mind, another important influence on modern psychology came out of the USA from the writings of William James, brother of the novelist Henry James. William James brought together a disparate body of work in his seminal, two volume work, Principles of Psychology, published in 1890, taking him 12 years to write. He authored the first ever university course in psychology in the US at Harvard University.

Unlike Titchener and Wundt, he was not a great experimentalist and complained about the tedium of lab work. Freed from the constraints of the experimental methods of the time, James's writings could range wider and include a consideration of psychological functions such as consciousness, instinct, and emotion. Like others, he used introspection to inform his theories.

However, in contrast to the experimentally driven structural approaches, James adopted a functional approach. Informed by Darwin's evolutionary theory, he attempted to explain how the mind adapts to meet the needs of the organism. As a proponent of the functionalist school of psychology at the time, he was interested in mental processes, rather than mental structures-- for example, what was the purpose of consciousness or the will, rather than trying to dissect and define its constituent parts.

To use a crude analogy, a structuralist who wants to understand how a car worked would stop it, break it down into its parts, and attempt to work backwards from that knowledge. A functionalist would drive the car and you use that experience to understand how its constituent parts worked together and allowed it to move, start, stop, and turn.

Again, James's methods have long since been replaced by modern experimental approaches.

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However, functionalism remains a core part of modern psychology, with its focus on cognitive processes and how would they serve adaptive behaviour. However, it has merged with other aspects of the structuralist tradition to form an overarching framework to make up cognitive psychology.

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At the same time as the introspective approach held dominance within psychology, others were applying experimental methods to understanding more directly important properties of the brain and how it works psychologically. A key pioneer of what we would now recognise as experimental cognitive psychology is the German psychologist Hermann Ebbinghaus. Unlike Wundt and Titchener, he believed that memory was amenable to systematic scientific study, without the need to rely on the limitations imposed by the introspective method.

In 1885, he published a landmark paper called "Memory, a Contribution to Experimental Psychology." This remains today a classic description of the basic principles of experimental psychology and research methods. This included the use of precise control over conditions of the experiment, a tradition shared by others, such as Wundt and Titchener, but also accepting the inevitable impact of extraneous factors impacting on the results.

Such measurement error interferes with our ability to accurately test the particular process that we are interested in. For this reason, Ebbinghaus emphasised the need for statistical approaches to estimate the effects that were of interest from the average of the repeated measurements, while at the same time, obtaining estimates of the measurement error.

This statistical approach was fundamentally different from what came before. Ebbinghaus applied his method to repeated measurements with himself as the sole subject over prolonged periods. Today, we are much more likely to test repeated research participants.

Perhaps the most well-known contribution is the Ebbinghaus forgetting curve. Although it may seem obvious to us, no one had previously measured the time course over which we seem to forget information. Clearly, we can retain some information for years or for our entire life, while other information can be lost to our memory very quickly.

In developing his experimental methods, Ebbinghaus reasoned that some information, such as poetry, carries with it a complex set of associations, images, and meanings beyond the words or syllables that make it up. These may allow us to recall a sentence or even a whole verse after a single reading. Such material was not ideal for Ebbinghaus's purposes. So he chose instead to use a standard set of supposed nonsense syllables, such as "buh" and "pluh" and "kik," that have no meaning in his language.

Before being able to measure forgetting, the set of syllables first had to be learned. And this was done through repetition, until the set could be repeated back 100% accurately, a level of performance known as the criterion. He then measured how much was retained in his memory after a delay that he varied from minutes to several days.

To measure retention, he learned the same list of syllables to see how many repetitions it took to get back to the criterion of 100%. The difference between the original and the late learning was known as the savings score. The better retention, that is, the less the forgetting, the fewer repetitions he would need to relearn, and so the larger the savings score.

Once done, he started again with a new set of nonsense syllables. When averaged over many individual trials with different delays or attention intervals, the result was the classic Ebbinghaus forgetting curve. This shows that most forgetting happens very quickly in the first minutes and hours. But then, forgetting slowsdown such that there is very little further forgetting of material after four days, even when intervals of a month were measured.

Through these precise, repeated experimental methods, Ebbinghaus offered some fundamental insights into the processes of memory that were inaccessible to the method of introspection and paved the way for experimental cognitive psychology of memory that you'll learn more about next week.