Module:
Psychological Foundations of Mental Health

Week 1
Introduction to cognitive psychology

Topic 3
The cognitive (r)evolution – Part 3 of 3

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Lecture transcript

Slide 2
As we approach the end of this topic, I want to turn now to one particularly important hypothetical construct in cognitive psychology known as the schema. Just to note, the plural of a schema is either schemas or schemata. We will use the former here, but you may see the term, schemata, in your reading.

Schemas have been around in psychology for a long time. Kant used the term in a similar concept in his writing in the 18th and 19th century. They came to prominence again in the 20th century through the work of the Swiss psychologist, Jean Piaget, and his study on infant and child development. However, they became part of the cognitive mainstream with the 1967 publication of a seminal book called simply Cognitive Psychology, written by the psychologist Ulric Neisser. This book arguably marked the true birth of the discipline and is still worth a read.

Slide 3
What is a schema? A schema is an organised abstract representation of knowledge about a particular situation or thing. Most schemas are assumed to be built up over our lives based on a combination of our own direct, personal experience combined with indirect knowledge through communications with others and other media, such as print or TV.

Let's look at a everyday example. We're invited to someone's house and then asked to come into their kitchen. Before we even walk through the door, we will have a pretty good idea in our mind of what to expect in general terms. Even if we have never been in the house before, we will be expecting to see things such as a cooker, a fridge, a sink, and possibly tables and chairs. We would not expect to see a grand piano or a double bed. In other words, we share a common, culturally appropriate schema for kitchen and what it includes, but also what it does not include.

Schemas, such as a kitchen schema, will have been built up over years of exposure to kitchens-- our own, others we have visited, seen on TV or in magazines. We will have built up a set of common features associated and stored in memory that define kitchen, but also define non-kitchen.

It follows that someone who comes from a different culture, such as the Amazonian jungle, and seeing only longhouses and open fires will not only lack a word for kitchen in their vocabulary, but also lack the cognitive schema and its associations. They will, however, have their own schema, ones

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that we lack.

It is hypothesised that particular cognitive representations, for example a kitchen schema, rather than a bedroom schema, can be activated by a range of different triggers, whether it is the word, kitchen, or the sight, of looking through the door, even the smell of fried bacon or the sound of the kettle boiling. Which schema is activated will depend on the nature of the trigger.

Sometimes, we find ourselves in ambiguous situations that seem to match more than one schema at the same time. This is sometimes referred to as a form of cognitive dissonance. Where these schema are opposing or contradictory, we tend to find the situation uncomfortable. Typically, we tend to adjust our perceptions or interpretations to allow us to fix on one of the two alternative schemas, or combine them to form a new one.

Why should we have schemas? What function might they serve? Well, schemas are potentially important because they allow us to quickly pattern match an object or a situation with something similar that we have experienced before. A schema provides a stored template onto which observed evidence can be automatically compared to permit correct classification.

This helps us in other important ways. In particular, it allows us to use past experience of a similar object or situation to know what to expect, and particularly how to behave without the need for careful analysis and planning. Our own personal schemas can also influence how we perceive the world around us, our beliefs and our attitudes, as we will see in later weeks.

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Although it is assumed that most schema develop through experience, something that Aristotle and the empiricists would be happy to agree with, they appear to be such powerful and useful structures that some appear to be innate and emerged very early in development. So Plato and the rationalists can breathe a sigh of relief.

Evolution seems to have given us some very powerful schemas, particularly those associated with physical appearance that may even cross animal species' boundaries. For example, babies in many mammalian and even some bird species, share a number of facial features-- rounded faces, large eyes in proportion to the total size of the head, forehead width, and correspondingly smaller mouths.

This may be coincidence, but is more likely that this physical form has evolved to serve a function that benefits survival. The most obvious explanation is that mammalian and bird species are dependent on adult parents for their survival and protection. So the baby face may have evolved alongside the adult brain to be sensitive to it, and so encourage the parenting protective response.

Indeed, evidence suggests that we may have a baby face schema hardwired into our brains. At the most superficial, perceptual level, when we all see these images, we identify them as young and not as small adults. In other words, the baby face schema categorises and classifies the age of the animal automatically. However, what is more interesting is how having such a schema influences our behaviour.

There's a large body of evidence to show that we display a set of quite specific responses when presented with baby or baby-like faces, whether human or animal. The first, and most obvious, is the labelling of the face as cute, a tendency to smile, and to experience positive emotions, at least for some people. However, the strength of the response is not the same in all people and can vary within people at different times.

A study by Sprengelmeyer and colleagues in 2009 showed that such responses tended to be stronger in young women than in men, and in women, varying according to the stage in their menstrual cycles, whether they were on or off the contraceptive pill, or whether they were before or after their menopause. Such evidence suggests that our perceptions, in this case baby cuteness, is influenced

by the level of the female reproductive hormones.

Baby faces also elicit characteristic brain changes. A study in 2008 by Melanie Glocker and colleagues showed women, without babies of their own, pictures of babies that had been manipulated to make them more or less cute, in other words to fit the baby schema more or less well. Measuring brain activity in an MRI scanner, the cuter images were found to elicit a greater change than less cute images in an area of the brain called the nucleus accumbens, an area associated with reward and motivated behaviour.

This supports a hypothesis that the baby schema has evolved to support nurturing and caretaking in adults, and so, increase infant survival. Given the near universality of the baby face in mammalian species and in many bird species, it is also reasonable to assume that these other species also have baby schema, cognitive representations that serve the same function.

Let me ask you the question to think about later. Is this breaking Morgan's canon? What do you think?

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Interestingly, even young children may have the baby schema. Probably why they, as with adults, tend to like young animals, and why cuddly toys, cartoons, and advertising aimed at children typically have characters with baby-like features.

Evidence to support this comes from an interesting study from 2014 by Marta Borgi and colleagues. In one experiment, she presented 32 children between the ages of three and six years, and 32 adults with a range of images of young children and adults, as well as adult dogs and cats, puppies and kittens. The images were both natural or high in the baby schema attributes, or artificially edited to make them low in those features, and so more adult-like.

In one of the experiments, the children and adults were asked to rate how cute they found each image on a five-point scale, from not cute to very cute. They first confirmed that the children understood what cute meant and could use the scale. The results showed that the children and adults differed little. Both tended to find the young human faces cuter than the adult, in general, and the high baby schema faces cuter than the low schema faces. Thus, it seems that the cuteness schema is something that we have from a very early age, not just something that develops in adulthood.

You may want to think about what function having a baby face schema might serve the child as young as three years old. You might want to start a discussion topic on this. However, speculation is easy. How might you set about testing new ideas about the role, the schema in young children?

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Before we leave baby faces, let's have a quick look at what happens when features of the cute face schema are mixed with other non-baby features, such as with these ventriloquist dolls. Some dolls are designed to be cute, but others, like these, are intended to be a bit more unsettling. They force our perceptions to hover between adult and childlike in the context of an inanimate object that can speak. No wonder many people find such dolls uncomfortable. And for some, it becomes a fully developed phobia.

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Let's look at schemas in a bit more detail and consider what role they play in the process of perception, how we bring order to our sensory world. One early cognitive model was that provided by Neisser in the theory of analysis by synthesis. Although replaced by far more developed models, it still has some important features that warrant scrutiny. It also provides us with an example of how schema may work alongside other cognitive structures and processes.

Neisser hypothesised that the process of perception, whether visual, auditory, tactile, or any sense was a cyclical process that resulted in the final conscious percept. Neisser proposed that the first

stage was a process of feature detection, the identification of different component features that made up the object. Neisser proposed that this feature analysis, performed by specific analytical modules, initially occurred automatically, unconsciously, and in parallel. That is, we do not analyse feature by feature at this stage, but build up a model of a set of features simultaneously.

This information is then mapped onto the larger set of perceptual templates, the schema, to see if there is a match. These processes are seen as largely automatic and unconscious, or preattentive. Often, more information is needed, in which case a process of active perceptual exploration occurs. This is not random, but is guided by information from the various alternative schemas that are activated following the feature analysis.

These alternatives create ambiguity, which we try to resolve by actively and consciously collecting more information. This may also include other information from the environment that provides data to help identify the object. This, in turn, could bring into play new feature analysis and so on, until stable perception is achieved.

Thus, for Neisser, perception was seen as a combination of automatic and conscious processes, with automatic processes influencing conscious ones-- so-called feed-forward or bottom-up processing-- and conscious processes influencing unconscious ones-- feedback or top-down processing. The central feature of Neisser's model and many models of perception is that they involve constructive processes. Perception is not just a simple process of automatically filtering features and matching patterns. We construct our world and schemas are assumed to have a crucial role to play in this process.

You may want to reflect how Neisser's model relates and differs to some of Titchener's structuralist studies. And Wundt's attempts, through introspection, provide a model involving a combination of both passive association and active apperception.

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Typically, these processes occur quickly and without us being fully aware, even if we are actively moving our eyes to explore the object. However, we can experience them more easily when we are presented with figures that are ambiguous that do not fit a single template and fail to resolve into a single identifiable percept.

Here are a couple of famous ambiguous figures the duck/rabbit and the old woman/young woman. Our brains struggle with such images, and the percept tends to flip from one form to another. In each instance, we can think of the two conflicting schema being equally activated, and additional exploration does not help.

However, we can resolve the ambiguity with the presentation of additional information. For example, the sound of a duck quacking will tend to cause the duck schema to become dominant. Or the sound of an old woman's laugh will immediately allow us to see and affix the old face, at least for a while.

Other perceptual studies have used hidden figures, where an object is contained within the large scene or even in a seemingly random pattern. When first shown, often, we do not notice it. This figure of black and white splotches is a famous example.

To begin with, we tend to see random black patches on a white background. It has no form because there is no schema to match the sensory experience against. However, for most people, it will suddenly resolve into a coherent shape as we explore it with our eyes. When it does, it can feel like a switch has been flicked, and we can immediately see the object in its context.

Interestingly, once we have made that switch, the figure resolves almost immediately, even many years later, when we see the figure again-- so-called one-shot learning. The schema, once formed, remains available to be activated at a later date.

The painting on the right is one of many by the artist Salvador Dali, who delighted in playing games with our brains in its effort to resolve ambiguity and construct meaningful perceptual forms from the complex evidence of our sensors. If you can't see the hidden figures, post on the discussion board for help.

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If schemas provide us with a framework or a template that allows us to readily process and categorise our world, influencing our perceptions and our attention, it's not surprising that schema that we hold will also impact on what we remember. It's possible that information from the real world becomes integrated with general schema, and also that the schema is used as a guide as we attempt to reconstruct our memory from actual events.

In an influential study by William Brewer and James Treyens in 1981, psychology undergraduates were asked to wait in a room for just 35 seconds before being called into an adjoining room to do an experiment as part of their studies. They were not told that waiting in the room before was part of the experiment. The room was set up as an office containing 61 items classified by the saliency, how noticeable they were, and schema expectancy-- how much you would expect to find them in an office. However, a number of typical office items were missing, such as a telephone, and a few items that we would not expect to see in an office were added, such as a skull.

The results showed that people tended to remember the obvious office items, those with high schema expectancy and some of the more high salient, non-schema items, such as the skull. However the most important part was that people tended to report seeing things that were not there, things that fit into the office schema and so would have expected to be seen, such as the telephone. In other words, the office schema encouraged people to fill in the gaps, constructing a memory from what would be expected rather than from what was actually there.

Another early memory study by Gordon Bower and John Black in 1979 presented people with a series of descriptions of everyday situations, such as a trip to the dentist. The description conformed to a typical dentist visit, an example of the so-called script schema, but deliberately missed out some elements, such as checking in with a receptionist on arrival.

Despite not being present in the material, people again commonly filled in these gaps when reconstructing their memory of what they had read. This tendency for schema-based expectations to alter our memories, or at least our descriptions of them, has obvious implications in areas such as eyewitness testimony.

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Schemas are used in cognitive psychology as a construct to help explain many different aspects of our behaviour-- from language, to perception, memory, and the control of action. One type of schema to consider is the event schema. This refers to the general set of behaviours that we adopt when we find ourselves in a particular situation or context.

When we enter a restaurant, for example, we know what will happen. We will sit at a table, read a menu, place an order, eat, pay, and leave. This action schema is sometimes called a script, just like the one described for the study by Bower and Black.

Importantly, event schema also guide us in what not to do. Unlike a script for having supper at a friend's house, a restaurant script does not include stacking the plates, going into the kitchen, and washing up. We don't have to think about this. The script is stored and automatically accessed to guide our behaviour. Of course, this only works if we have an appropriate schema for the situation. Without one, we have to rely on the next best match, or by consciously working out what to do, perhaps by observing others.

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Another example of the use of schemas is in cognitive social psychology-- the cognitive psychology of groups of people and their interactions. Here, the concept of role schema is often used. A role in this context relates to the set of attributes or functions that broadly define an individual to other people in a specific situation.

For example, they may be defined by a person's profession. So when we see someone identified as a doctor and dressed like we expect a doctor to be dressed, we tend to attribute that person with a range of characteristics, such as intelligent, caring, hard-working, and so on. However, when the same person is identified as an estate agent and dressed like one, our attributions about their personal characteristics are likely to be very different. This is because we have different role schema or templates for these two general roles, regardless of the individual.

We are probably more familiar with the term, "stereotype", when considering role schemas. Perhaps the most powerful role schemas that influence us on a day-to-day basis are those relating to age, gender, and race-- old or young, male or female, black or white. Role schemas tend to be based on polarised or dichotomised characteristics, such as strong or weak.

Like all schemas, stereotypes can be helpful in quickly guiding us in what to expect and how to behave when we meet people. However, they are, by definition, flawed generalisations. Problems arise when our schemas include specific negative attributes attached to a particular role, whether related to age, or gender, or race. This provides a cognitive model that can help explain prejudice, both in terms of our beliefs, attitudes, and behaviours.

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Finally, a particularly important use of the concept of the schema is in relation to mental health-- the self schema. Just as we tend to fit people that we meet into categories based on what we see or know about them, we also have one or more schemas about ourselves. Our self schemas reflect the perceptions we have of ourselves and also how we act in different situations, both consciously and unconsciously.

The type of constructs contained within the self schema include aspects of our physical appearance, things that we like or don't like, aspects of our personality, and how we act. A self schema is a bit like the profile a person might give themselves on a dating app or ad.

The self schema is often incorporated into cognitive models of mental health and symptoms. Negative self schema are proposed to have an important role in increasing a person's vulnerability to mental health problems and to serve to maintain them when they occur. Identification and modification of such unhelpful or maladaptive self schema is a common goal of psychological therapy. We will be looking at this and the evidence behind the schema model of depression in a later week.

Slide 13
This brings us to the end of our third topic and the end of the first week of the module. I hope you enjoyed it and found it interesting and informative.

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