1d | Paradigms of Cognitive Psychology

After having just looked at cognitive psychology's historical roots in the previous section of this module, we are now going to focus on cognitive psychology today. Specifically, we will talk about four major paradigms that cognitive psychologists use to frame their research. Here, a paradigm simply refers to a body of knowledge that is structured according to what its proponents consider to be important. Paradigms include the assumptions investigators make in studying a phenomena. Paradigms also specify what kinds of experimental methods and measures are appropriate for an investigation.

So the first and still quite dominant paradigm of cognitive psychology is referred to as the ***Information Processing Approach***. This approach was spawned by the human mind/computer analogy that we just talked about previously and is based on the idea that cognition can be thought of as information, that is what we see, hear, read about, think about, flowing through a system. This system is our mind.

A typical information processing system is shown in the following figure. Note first that information flows through the system from low level detectors and registers—for example, visual and auditory registers—through more temporary memory stores—for example, short-term memory—and then on to more long-term and semi-permanent memory stores—for example, long-term memory. Note also that different operations can be performed on information at each level. For example, information in long-term memory can be categorized, recoded and reorganized based on new incoming information.

There are **several key assumptions** underlying the information processing approach.

First, people's cognitive abilities can be thought of as **"systems" of interrelated capacities**. That is, cognition is built upon many interacting subskills and abilities that jointly contribute to cognition. In addition and in accordance to the computer metaphor, information processing theorist assume that people, like computers are **general purpose symbol manipulators**. In other words people, like computers, can perform impressive cognitive feats by applying only a few mental operations to symbols. These symbols may be letters, numbers, sentences, or visual images. Specifically, the same general cognitive operations, take for example the storage of information, can be applied to a wide range of stimuli. Scientists who ascribe to the information processing approach are mainly concerned with understanding the nature of the representations under study, and the nature of the processes that operate on the representations.

Early in the 1980s however, some researchers were dissatisfied with some of the assumptions of the information processing framework and they began to explore alternatives to this approach. One highly influential framework is known as ***Connectionism***. This cognitive paradigm proposed that the cognitive machinery that underlies all cognition is composed of a highly interactive network of connections among simple processing units. Because these units are sometimes compared to neurons in the brain, connectionist models are also referred to as

neural networks . The connectionist approach is quite different from the previous information processing approach that we just discussed.

First, the connectionist approach is inherently none localist. That is there is no central place where for example, word meanings are thought to be stored. Rather, information is thought to be widely distributed among what are referred to as simple neuron-like processing units. These units code patterns of information across a large population of similar units. In addition, units are connected to each other by weights that are modifiable by learning. For example, a positively weighted connection between units leads to activation and a negatively weighted connection between units leads to inhibition. Information, example a letter, a word, or a meaning, is represented by a pattern of activation distributed among a number of units.

The following figure depicts what a connectionist network that stores information about people might look like. In this example, the units of interest are the black circles at the centre of the figure with all the arrows pointing to them. Each of these units are specific people that you have stored in your memory. Each unit is connected to other units that depict certain information about the people. For example: their race, their sex, their profession, their car, their favorite cheese, and their name. The arrows between the units depict excitatory or positively weighted connections. When any unit reaches a certain level of activation, it activates all the other units to which it has positively weighted connections. In addition, other conflicting information that does not have excitatory links is inhibited. And once the activation is strong enough among the interrelated connections, a response for a specific person will come to mind. It's important to note here, that the positive and negative weighting of these connections are based on prior experience and prior learning.

The nice thing about these connectionist models is that they're extremely flexible. That is a single connectionist model can likely learn and acquire information about a variety of domains without changing the inherent structure of the model itself.

There are a **number of key differences and similarities** between the information processing and the connectionist approaches.

First, whereas information processing models assume cognition unfolds in a serial, that is step by step orderly fashion, connectionist models assume that cognitive processes occur in parallel, that is many processes occurring simultaneously. Both approaches are similar however in that they both assume that cognition will be best understood by uncovering the basic mechanisms or processes underlying cognition. In addition, they assume that the mechanisms underlying cognitive processes are stable across situations and can only be revealed under rigorously controlled experimental conditions. Therefore, in both paradigms research must be done in the lab. The final two approaches that we are going to talk about on the other hand consider the context in which cognition occurs.

For example, proponents of the ***Evolutionary approach*** argue that in order to understand cognition we need to understand the evolutionary pressures that our ancestors have faced in

the past. Here, the idea is that much like other biological systems cognition is based on a system that has evolved over many, many generations. Therefore, the human mind has had to respond and change in response to evolutionary pressures. This has resulted in us evolving special purpose cognitive mechanisms to deal with such environmental pressures.

Cosmides and Tooby, both at the University of California in Santa Barbara, are two of the foremost researchers of evolutionary psychology. They believe that some of the most significant issues our ancestors have faced involve social issues such as, the enforcement of social contracts and the detection of cheaters. To do this effectively, people must be especially good at reasoning about social situations. Therefore, evolutionary psychologists predict, that people's reasoning and decision making will be especially enhanced when they are reasoning about social situations. As you will see later on in Module 10 of this course, this is indeed the case.

A fourth and final major approach that we will discuss is referred to as the ***Ecological Approach***. The central tenet of this approach is that cognition does not occur in a context free vacuum. Rather, all cognitive activities are shaped by the culture, the context, and the situation under which they occur. This is a very important point and one which you will see in a number of remaining modules of this course. That is, the context in which cognition happens shapes the cognitive processes under investigation. Therefore, proponents of this view argue that to fully understand cognition, you must examine it in its natural context.

Following in this tradition, Daniel Smilek, here at the University of Waterloo and Allan Kingston, at the University of British Columbia, have been focussing on how attention operates in every day life. Their primary tool to investigate attention is by measuring eye movements to both real life static and dynamic displays. For example, and as is illustrated in the following photograph, in one of their studies they presented participants with pictures of art and sports scenes and monitored their eye movements while they described the pictures aloud. They found that regardless of what type of image participants were viewing, most eye fixations were committed to the eyes and faces of the people in the scene, rather than the objects people were interacting with.

I've now given you a brief overview of the major paradigms that cognitive psychologists use to guide their research. It is important to note here however, that not all cognitive research that we will cover in this course fits neatly into one of these four paradgms. Some might not fit in any, whereas others might fit more than one. However, this overview will hopefully give you a good background to understand and interpret the experiments that we will cover in the remainder of this course.