1c | The "Cognitive Revolution"

Okay, we've already covered a lot of ground in uncovering the major precursors to the field of cognitive psychology. But we're still not quite there yet. To this point, researchers were discussing the mind, but there was no real field of psychology strongly devoted to its study. This all changed in the middle of the 20th Century to spawn what has been referred to as ***"The Cognitive Revolution"*** There were several key points in history that acted as a precursor to this revolution. We are going to discuss four of these precursors.

The first was the fact that **human factors engineering presented new problems that needed solutions**. During the time of WWII the development of complicated equipment required highly trained personal to operate them. In order to optimize their operation of this machinery the engineers and trainers needed some knowledge of how the mind worked. The focus became what was the most optimal way to design a machine for humans to use? The textbook provides an example of how they had to redesign the controls for breaking and landing gear operation to reduce errors in landing. Other examples include the development of airplane cockpit displays and radar monitoring systems, which were designed to allow the most optimum and efficient processing of a wide range of information.

Based on these interactions between humans and machines, psychologists and engineers developed the concept of the ***person-machine system***. This is the idea that machinery operated by a person must be designed to interact with the operator's physical and cognitive capacities and limitations. Along side the development of the concept of a person-machine system, psychologists began to see humans as sharing properties with the inanimate objects that engineers designed. This resulted in individuals being described as limited-capacity processors of information.

What this basically means is that psychologists were recognizing the limits of the human mind and that peoples' cognitive apparatuses are not built to do too many things simultaneously. We're going to cover the capacity limitations of the human mind in some detail in later modules of this course.

Human factors research is still booming today and is likely going to continue to grow. For example, cognitive psychologists are employed in major industries around the world conducting experiments to determine the most efficient means for people to interact with developing technology. Two examples that come to mind are Reseach in Motion here in Waterloo, the makers of the Blackberry, and NASA. This latter example demonstrates that you can fulfill your dream of becoming a rocket scientist with extensive training in cognitive psychology.

At about the same time as the human factors movement **developments in the field of linguistics** led by Noam Chomsky began to see the central importance of studying how people acquire, understand, and produce language. Chomsky's early work showed that Behaviorism could not adequately explain language. For example, Skinner argued that children learn language by imitation and reinforcement. Chomsky, on the other hand, questioned this

conditioning explanation of language on several grounds. For example, children say sentences they've never heard before, for example, "I hate you mommy", and they use incorrect grammar, "The boy hitted the ball", even though it is not reinforced. Chomsky instead argued that humans have an innate capacity to acquire language and that its development is not grounded by the laws of conditioning.

A third strand of the cognitive revolution came from developments in neuroscience and specifically the localization of function in the brain. We'll discuss this a fair bit more in the second module, but we'll talk about it here in terms of how it influenced the development of cognitive psychology as a science. Work by Donald Hebb, a world renowned professor at McGill University suggested that some kinds of functions, such as visual perceptions were constructed over time by building cell assemblies. Cell assemblies are simply connections among sets of cells in the brain.

Also in the 50s and 60s Nobel Prize winning neuropsychologist David Hubel and Torsten Weisel demonstrated that specific cells in the visual cortex of cats were in fact specialized to respond to specific kinds of stimuli, for example, the orientation of lines or particular shapes. They also demonstrated that early experience shaped brain development. Specifically, in perhaps their most famous experiment, they showed that kittens who were in a restricted environment with only horizontal lines would fail to develop the ability to see vertical lines.

Taken together, the work of Donald Hebb and Hubel and Weisel clearly showed that cognitive functions can be localized to specific parts of the brain. These discoveries forced the discussion of mind and that the discovery that cognition had a clear and localizable neural basis generated many new questions about how cognition arises from a biological organ.

The final piece to the cognitive revolution puzzle also dates from around WWII and it stems from the development of computers and artificial intelligence systems. This development led to what is known as "**The Computer Metaphor of the Mind**". Here, the development of computers and artificial intelligent systems led to the comparison of people's cognitive activities to an operating computer. Specifically, just as computers have to be fed data via keyboard press or the present day USB key, people have to acquire information through their senses. Both computers and people store information and must therefore have structures that process and allow such storage. Here computers have hard drives and people have their cerebral cortices. The parallels between the computer and the human mind are indeed many.

So, at the end of the day scientists refuse to accept the idea that mental representations did not exist and they came to accept the idea that mental events and states could be studied scientifically. In the next section of this module we're going to talk more about how people study cognition today.