

Historical and cultural factors contributing to the rise of the Cognitive Perspective.

What IS new in the latter half of the twentieth century is something called **the cognitive movement**. It is still too early to tell if it will prove to be the paradigm -- the unifying theory - - we have been waiting for. But the significance is impossible to deny. It formed in the opposition to **behaviourism**, rejecting its reductionist and anti-mentalistic S-R model. At the same time, it greatly benefited from the sophisticated and rigorous **methodology** of the behaviorist movement (e.g. Skinner).

The roots of the cognitive movement are extremely varied: It includes gestalt psychology, behaviorism, even humanism; it has absorbed the ideas of E. C. Tolman, [Albert Bandura](#), and [George Kelly](#); it includes thinkers from linguistics, neuroscience, philosophy, and engineering.

It especially involves:

1. Computer technology and the field of artificial intelligence.

Three of the greatest information processing theorists: Norbert Wiener, Alan Turing, and Ludwig von Bertalanffy.

Norbert Wiener

He began by studying the movement of particles and quantum physics, which led him to develop an interest in information transmission and control mechanisms. While working on the latter, he coined the term **cybernetics**, from the Greek word for steersman, to refer to any system that has built-in correction mechanisms, i.e. is self-steering. Appropriately, he worked on control mechanisms for the military during World War II.

In 1948, he published **Cybernetics: or Control and Communication in the Animal and the Machine**. In this book, he introduced such terms as **input**, **output**, and **feedback**!

Later, in 1964, he published the book **God and Golem, Inc.**, which he subtitled "a comment on certain points where cybernetics impinges on religion." He was concerned that someday machines may overtake us, their creators. That same year, he won the National Medal of Science.

Alan M. Turing

*The **Turing Machine** idea was introduced in a 1936 paper. It is hard now not to think of a Turing machine as a computer program, and the mechanical task of interpreting and obeying the program as what the computer itself does. Thus, the Universal Turing Machine embodies the essential principle of the computer: a single machine which can be turned to any well-defined task by being supplied with the appropriate program.*

He began working with British Intelligence on breaking the famous Enigma Code by constructing code-breaking machines. In 1944, he made his first mention of "building a brain." It should be noted that Turing was also an amateur cross-country runner, and just missed representing the UK in the 1948 Olympics!

In 1944, he became the deputy director of the computing lab at Manchester University, where they were attempting to build the first true computer. In 1950, he published a paper,

"Computing Machinery and Intelligence," in **Mind**. Today, he is considered the father of Computer Science.

Ludwig von Bertalanffy

In 1928, he published **Modern Theories of Development**, where he introduced the question of whether we could explain biology in purely physical terms. He suggested we could, if we see living things as endowed with self-organizational dynamics.

In 1960, he became professor of theoretical biology in the department of zoology and psychology at the University of Alberta. In 1967, he wrote **Robots, Men, and Minds**, and in 1968, he wrote **General Systems Theory**, which he saw as a methodology for all sciences.

2. Linguistics

Noam Chomsky

In addition to the input (no pun intended:) from the "artificial intelligence" people, there was the input from a group of scientists in a variety of fields who thought of themselves as structuralists -- not allying themselves with Wundt, but interested in the structure of their various topics -- the so-called neo-structuralists. For example, there's Claude Levi-Strauss, the famous French anthropologist. But the one everyone knows about is the linguist Noam Chomsky.

He is famous for his work on **generative grammar**. Generative grammar was based on the question "how can we create new sentences which have never been spoken before?" How, in other words, do we get so creative, so generative? While considering this questions, he familiarized himself with mathematical logic, the psychology of thought, and theories about thinking machines. He found himself, on the other hand, very critical of traditional linguistics and behavioristic psychology.

In 1957, he published his first book, **Syntactic Structures**. Besides introducing his generative grammar, he also introduced the idea of an innate ability to learn languages. We have born into us a "universal grammar" ready to absorb the details of whatever language is presented to us at an early age.

His book spoke about **surface structure** and **deep structure** and the **rules of transformation** that governed the relations between them. Surface structure is essentially language as we know it, particular languages with particular rules of phonetics and basic grammar. Deep structure is more abstract, at the level of meanings and the universal grammar.

Summing up, Chomsky was interested in the organization of language, in mental structures (e.g. deep and surface), and in mental processes (e.g. transforming or generating sentences). He postulated the existence of genetic factors, and believed that language was species-specific (human only). All these make him truly "cognitive".

3. Studies on the development of knowledge

Jean Piaget

Another neo-structuralist is Jean Piaget. Originally a biologist, he is now best remembered for his work on the development of cognition. Many would argue that he, more than anyone else,

is responsible for the creation of cognitive psychology. If the English-speaking world had only learned to read a little French, this would be true without a doubt. Unfortunately, his work was only introduced in English after 1950, and only became widely known in the 1960's -- just on time to be a part of the cognitive movement, but not of its creation.

(...)In 1925, their first daughter was born; in 1927, their second daughter was born; and in 1931, their only son was born. They immediately became the focus of intense observation by Piaget and his wife. This research became three more books!

Jean Piaget began his career as a biologist -- specifically, a malacologist! But his interest in science and the history of science soon overtook his interest in snails and clams. As he delved deeper into the thought-processes of doing science, he became interested in the nature of thought itself, especially in the development of thinking. Finding relatively little work done in the area, he had the opportunity to give it a label. He called it **genetic epistemology**, meaning the study of the development of knowledge.

He noticed, for example, that even infants have certain skills in regard to objects in their environment, which directed the way in which the infant explored his or her environment and so how they gained more knowledge of the world and more sophisticated exploratory skills. These skills he called **schemas (e.g. assimilation, accommodation)**.

4. Some famous forerunners of the Cognitive Psychology:

Hermann Ebbinghaus - his research involved the memorization of **nonsense syllables**, which consisted of a consonant, a vowel, and another consonant. He would select a dozen words, then attempt to master the list. He recorded the number of trials it took, as well as the effects of variations such as relearning old material, or the **meaningfulness** of the syllables. The results have been confirmed and are still valid today.

Tolman – cognitive maps – training rats in mazes, he showed that animals had internal representation of behaviour.

Kohler – insight learning - training apes (e.g. his ape Sultan), he showed problem solving propoert in animals.

Bartlett – using serial reproduction method, he advocated the existence of schemas and showee that mind was active in processing information.

Bandura – exploring his concept of observational learning, he showed that an organism can learn not only if directly rewarded or punished, but also by observing others subject to a reward or punishment, thereby pointing to some mental processes occurring during observation.

5. First cognitive psychologists sensu stricto.

Donald O. Hebb

Moving to the twentieth century, there are three psychologists who can be regarded as most responsible for the beginnings of the cognitive movement, and for its incredible popularity today. They are Donald Hebb, George Miller, and Ulric Neisser.

The basics of Hebb's theory can be summarized by defining three of his terms: First, there is the **Hebb synapse**. Repeated firing of a neuron causes growth or metabolic changes at the synapse that increase the efficiency of that synapse in the future. This is often called **consolidation theory**, and is the most accepted explanation for neural learning today.

Second, there is the **Hebb cell assembly**. There are groups of neurons so interconnected that, once activity begins, it persists well after the original stimulus is gone. Today, called these **neural nets**.

And third, there is the **phase sequence**. Thinking is what happens when complex sequences of these cell assemblies are activated. He humbly suggested that his theory is just a new version of **connectionism**.

George A. Miller

He wrote his most famous paper in 1956: "The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information." In it, he argued that short-term memory could only hold about seven pieces -- called **chunks** -- of information: Seven words, seven numbers, seven faces, whatever. This is still accepted as accurate.

In 1960, Miller founded the Center for Cognitive Studies at Harvard with famous cognitivist developmentalist, Jerome Bruner. In that same year, he published **Plans and the Structure of Behavior** (with Eugene Galanter and Karl Pribram, 1960), which outlined their conception of cognitive psychology. They used the computer as their model of human learning, and used such analogies as information processing, encoding, and retrieval. Miller went so far as to define psychology as the study of the mind, as it had been prior to the behaviorist redefinition of psychology as the study of behavior!

Ulric Neisser

His first teaching position was at Brandeis, where Maslow was department head. Here he was encouraged to pursue his interest in cognition. In 1967, he wrote the book that was to mark the official beginning of the cognitive movement, **Cognitive Psychology**.

He is presently at Cornell University where his research interests include memory, especially memory for life events and in natural settings; intelligence, especially individual and group differences in test scores, IQ tests and their social significance; self-concepts, especially as based on self-perception.

Conclusions?

It is impossible to tell whether cognitive psychology will prove to be THE psychology of the future. Cognitive psychology is far more sophisticated, philosophically, than behaviorism. And yet it lacks in sophistication when compared to the foundations of phenomenology and existentialism. It does, of course, have the tremendous advantage of being tied to the most rapidly developing technology we have ever seen -- the computer. But few people see the computer as ultimately being a good model for human beings, in some ways not even as good as the old white rat, which at least was alive!

I also believe that the relationship between neurological science and psychology will slowly develop, and certain perceptual, cognitive, and emotional experiences will gradually find their neurological counterparts. The two fields of study will be able to support and contribute to each other.