Chapter I: Introduction to Cognitive Psychology

Cognitive psychology definition

The word "cognition" comes from the Latin word “cognoscere”, which means "to know" or "to come to know." As a result, cognition encompasses the activities and processes involved in the acqusition, storage, retrieval, and processing of information. In other words, it could involve the mechanisms that assist us in perceiving, attending, remembering, thinking, categorizing, reasoning, and making decisions.

As the name indicates, cognitive psychology is the field of psychology dealing with cognitive mental processes. Cognitive psychology, according to Sternberg (1999), is “the study of how people interpret, understand, remember, and think about information.” In 2005, Solso provided a new concept of cognitive psychology, stating that it is the study of the mechanisms that underpin mental events. In general, cognitive psychology is the field of psychology dealing with how people learn, store, turn, use, and communicate language.

Cognitive psychologists study the different cognitive mechanisms that make up this branch of science. These processes include attention, which is the process by which we concentrate on a stimulus; perception, which is the process by which we perceive sensory input; pattern recognition, which is the process by which we classify stimuli into known categories; and memory, which is the process by which we recall information. As a result, cognitive psychologists' research extended to a variety of fields, as seen below:

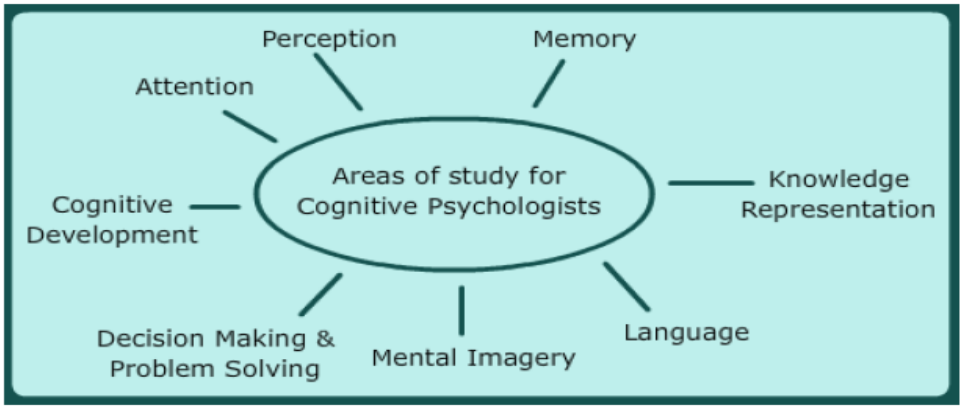

Figure (01): Research fields related to Cognitive Psychology (Sternberg, 1999)

Roots of Psychology

- **Rationalism versus Empiricism**

Where and when did the study of cognitive psychology begin? Historians of psychology usually trace the earliest roots of psychology to two approaches to understanding the human mind:

- **Philosophy** seeks to understand the general nature of many aspects of the world, in part through introspection, the examination of inner ideas and experiences (from intro-," inward, within," and -spect,"look");
- **Physiology** seeks a scientific study of life-sustaining functions in living matter, primarily through empirical (observation-based) methods.

Two Greek philosophers, Plato (ca. 428–348 B.C.) and his student Aristotle (384–322 B.C.), have profoundly affected modern thinking in psychology and many other fields. Plato and Aristotle disagreed regarding how to investigate ideas.

Plato was a rationalist. A rationalist believes that the route to knowledge is through thinking and logical analysis. That is, a rationalist does not need any experi-ments to develop new knowledge. A rationalist who is interested in cognitive pro-cesses would appeal to reason as a source of knowledge or justification.

In contrast, Aristotle (a naturalist and biologist as well as a philosopher) was an empiricist. An empiricist believes that we acquire knowledge via empirical evidence that is, we obtain evidence through experience and observation. In order to explore how the human mind works, empiricists would design experiments and conduct studies in which they could observe the behavior and processes of interest to them. Empiricism therefore leads directly to empirical investigations of psychology.

In contrast, rationalism is important in theory development. Rationalist theories without any connection to observations gained through empiricist methods may not be valid; but mountains of observational data without an organizing theoretical framework may not be meaningful. We might see the rationalist view of the world as a thesis and the empirical view as an antithesis. Most psychologists today seek a synthesis of the two. They base empirical observations on theory in order to explain what they have observed in their experiments. In

turn, they use these observations to revise their theories when they find that the theories cannot account for their real-world observations.

The contrasting ideas of rationalism and empiricism became prominent with the French rationalist **René Descartes** (1596–1650) and the British empiricist John Locke (1632–1704). Descartes viewed the introspective, reflective method as being superior to empirical methods for finding truth. The famous expression "cogito, ergo sum" (I think, therefore I am) stems from Descartes. He maintained that the only proof of his existence is that he was thinking and doubting. Descartes felt that one could not rely on one' s senses because those very senses have often proven to be deceptive (think of optical illusions, for example). Locke, in contrast, had more enthusiasm for empirical observation (Leahey, 2003). Locke believed that humans are born without knowledge and therefore must seek knowledge through empirical ob- servation. Locke's term for this view was tabula rasa (meaning " blank slate" in Latin). The idea is that life and experience " write" knowledge on us. For Locke, then, the study of learning was the key to understanding the human mind. He believed that there are no innate ideas.

In the eighteenth century, German philosopher **Immanuel Kant** (1724-1804) dialectically synthesized the views of Descartes and Locke, arguing that both ratio-nalism and empiricism have their place. Both must work together in the quest for truth. Most psychologists today accept Kant 's synthesis

Psychological Antecedents of Cognitive Psychology

Cognitive psychology has roots in many different ideas and approaches. The approaches that will be examined include early approaches such as structuralism and functionalism, followed by a discussion of associationism, behaviorism, and Gestalt psychology.

Understanding the Structure of the Mind: Structuralism

Structuralism seeks to understand the structure (configuration of elements) of the mind and its perceptions by analyzing those perceptions into their constituent components (affection, attention, memory, sensation, etc.).

Wilhelm Wundt (1832–1920) was a German psychologist whose ideas contributed to the development of structuralism. Wundt is often viewed as the founder of structuralism in

psychology. Wundt used a variety of methods in his research. One of these methods was **introspection.** Introspection is a deliberate looking inward at pieces of information passing through consciousness. The aim of introspection is to look at the elementary components of an object or process.

The introduction of introspection as an experimental method was an important change in the field because the main emphasis in the study of the mind shifted from a rationalist approach to the empiricist approach of trying to observe behavior in order to draw conclusions about the subject of study. The method of introspection has some challenges associated with it.

- First, people may not always be able to say exactly what goes through their mind or may not be able to put it into adequate words.
- Second, what they say may not be accurate.
- Third, the fact that people are asked to pay attention to their thoughts or to speak out loud while they are working on a task may itself alter the processes that are going on.

Wundt had many followers. One was an American student, Edward Titchener (1867–1927). Titchener (1910) is sometimes viewed as the first full-fledged structuralist. In any case, he certainly helped bring structuralism to the United States. His experiments relied solely on the use of introspection, exploring psychology from the vantage point of the experiencing individual. Other early psychologists criticized both the method (introspection) and the focus (elementary structures of sensation) of structuralism. These critiques gave rise to a new movement—functionalism.

Understanding the Processes of the Mind: Functionalism

Functionalism, a counter-argument to structuralism, proposed that psychologists should concentrate on the mechanisms of thought rather than the contents of thought. Functionalism tries to figure out why people do what they do. In comparison to the structuralists, who wanted to know what the basic contents (structures) of the human mind are, this central question about processes was raised. The study of the mechanisms of how and why the mind functions as it does, according to functionalists, is the key to understanding the human mind and actions.

Functionalists were unified by the kinds of questions they asked but not necessarily by the answers they found or by the methods they used for finding those answers. Because functionalists believed in using whichever methods best answered a given researcher's questions, it seems natural for functionalism to have led to pragmatism. Pragmatists believe that knowledge is validated by its usefulness: What can you do with it? Pragmatists are concerned not only with knowing what people do; they also want to know what we can do with our knowledge of what people do. For example, pragmatists believe in the importance of the psychology of learning and memory. Why? Because it can help us improve the performance of children in school. It can also help us learn to remember the names of people we meet.

A leader in guiding functionalism toward pragmatism was William James (1842–1910). His chief functional contribution to the field of psychology was a single book: his landmark Principles of Psychology (1890/1970). Even today, cognitive psychologists frequently point to the writings of James in discussions of core topics in the field, such as attention, consciousness, and perception. John Dewey (1859–1952) was another early pragmatist who profoundly influenced contemporary thinking in cognitive psychology. Dewey is remembered primarily for his pragmatic approach to thinking and schooling. Although functionalists were interested in how people learn, they did not really specify a mechanism by which learning takes place. This task was taken up by another group, Associationists. An Integrative Synthesis: As

An Integrative Synthesis: Associationism

Associationism, like functionalism, was more of an influential way of thinking than a rigid school of psychology. Associationism examines how elements of the mind, like events or ideas, can become associated with one another in the mind to result in a form of learning. For example, associations may result from:

• contiguity (associating things that tend to occur together at about the same time);

• similarity (associating things with similar features or properties); or

• contrast (associating things that show polarities, such as hot/cold, light/dark, day/

night).

Hermann Ebbinghaus (1850–1909) was the first experimenter to apply associationist principles systematically. Another influential associationist, Edward Lee Thorndike (1874–1949), held that the role of "satisfaction" is the key to forming associations. Thorndike termed this principle the law of effect (1905). A stimulus will tend to produce a certain response over time if an organism is rewarded for that response.

Behaviorism

Behaviorism focuses only on the relation between observable behavior and environmental events or stimuli. The idea was to make physical whatever others might have called "mental" (Lycan, 2003).

The "father" of radical behaviorism is John Watson (1878–1958). Watson had no use for internal mental contents or mechanisms. He believed that psychologists should concentrate only on the study of observable behavior (Doyle, 2000). He dismissed thinking as nothing more than subvocalized speech. Behaviorism also differed from previous movements in psychology by shifting the emphasis of experimental research from human to animal participants. One problem with using nonhuman animals, however, is determining whether the research can be generalized to humans (i.e., applied more generally to humans instead of just to the kinds of nonhuman animals that were studied).

B. F. Skinner (1904–1990), an other prominent radical behaviorist, believed that virtually all forms of human behavior, not just learning, could be explained by behavior emitted in reaction to the environment and he rejected mental mechanisms. He believed instead that operant conditioning—involving the strengthening or weakening of behavior, contingent on the presence or absence of reinforcement (rewards) or punishments—could explain all forms of human behavior. Skinner applied his experimental analysis of behavior to many psychological phenomena, such as learning, language acquisition, and problem solving. Largely because of Skinner's towering presence, behaviorism dominated the discipline of psychology for several decades.

Behaviorism was challenged on many fronts like language acquisition, production, and comprehension. **First,** although it seemed to work well to account for certain kinds of learning, behaviorism did not account as well for complex mental activities such as language

learning and problem solving. **Second,** more than understanding people's behavior, some psychologists wanted to know what went on inside the head. **Third,** it often proved easier to use the techniques of behaviorism in studying nonhuman animals than in studying human ones.

The Whole Is More than the Sum of its Parts: Gestalt Psychology

Gestalt psychology states that we best understand psychological phenomena when we view them as organized, structured wholes. According to this view, we cannot fully understand behavior when we only break phenomena down into smaller parts. For example, behaviorists tended to study problem solving by looking for sub-vocal processing—they were looking for the observable behavior through which problem solving can be understood. Gestaltists, in contrast, studied insight, seeking to understand the unobservable mental event by which someone goes from having no idea about how to solve a problem to understanding it fully in what seems a mere moment of time.

The maxim "the whole is more than the sum of its parts" aptly sums up the Gestalt perspective. To understand the perception of a flower, for example, we would have to take into account the whole of the experience. We could not understand such a perception merely in terms of a description of forms, colors, sizes, and so on. Similarly, as noted in the previous paragraph, we could not understand problem solving merely by looking at minute elements of observable behavior (Köhler, 1940; Wertheimer, 1959).

Emergence of Cognitive Psychology

In the early 1950s, a movement called the "cognitive revolution" took place in response to behaviorism. Cognitivism is the belief that much of human behavior can be understood in terms of how people think. It rejects the notion that psychologists should avoid studying mental processes because they are unobservable. Cognitivism is, in part, a synthesis of earlier forms of analysis, such as behaviorism and Gestaltism. Like behaviorism, it adopts precise quantitative analysis to study how people learn and think; like Gestaltism, it emphasizes internal mental processes.

Early Role of Psychobiology

Ironically, one of Watson's former students, Karl Spencer Lashley (1890–1958), brashly challenged the behaviorist view that the human brain is a passive organ merely responding to environmental contingencies outside the individual (Gardner, 1985). Instead, Lashley considered the brain to be an active, dynamic organizer of behavior. Lashley sought to understand how the macro-organization of the human brain made possible such complex, planned activities as musical performance, game
playing, and using language. None of these activities were, in his view, readily explicable in terms of simple conditioning.

In the same vein, but at a different level of analysis, Donald Hebb (1949) proposed the concept of cell assemblies as the basis for learning in the brain. Cell assemblies are coordinated neural structures that develop through frequent stimulation. They develop over time as the ability of one neuron (nerve cell) to stimulate firing in a connected neuron increases. Behaviorists did not jump at the opportunity to agree with theorists like Lashley and Hebb. In fact, behaviorist B. F. Skinner (1957) wrote an entire book describing how language acquisition and usage could be explained purely in terms of environmental contingencies. This work stretched Skinner's framework too far, leaving Skinner open to attack. An attack was indeed forthcoming. Linguist Noam Chomsky (1959) wrote a scathing review of Skinner's ideas. In his article, Chomsky stressed both the biological basis and the creative potential of language. He pointed out the infinite numbers of sentences we can produce with ease. He thereby defied behaviorist notions that we learn language by reinforcement. Even young children continually are producing novel sentences for which they could not have been reinforced in the past.

Engineering, Computation, and Applied Cognitive Psychology

By the end of the 1950s, some psychologists were intrigued by the tantalizing notion that machines could be programmed to demonstrate the intelligent processing of information (Rychlak & Struckman, 2000). Turing (1950) suggested that soon it would be hard to distinguish the communication of machines from that of humans. He suggested a test, now called the "Turing test," by which a computer program would be judged as successful to the extent that its output was indistinguishable, by humans, from the output of humans

(Cummins & Cummins, 2000). In other words, suppose you communicated with a computer and you could not tell that it was a computer. The computer then passed the Turing test (Schonbein & Bechtel, 2003).

By 1956 a new phrase had entered our vocabulary: **Artificial intelligence (AI)** which is the attempt by humans to construct systems that show intelligence and, particularly, the intelligent processing of information (Merriam-Webster's Collegiate Dictionary, 2003). Chess-playing programs, which now can beat most humans, are examples of artificial intelligence. However, experts greatly underestimated how difficult it would be to develop a computer that can think like a human being. Even today, computers have trouble reading handwriting and understanding and responding to spoken language with the ease that humans do.

Many of the early cognitive psychologists became interested in cognitive psychology through applied problems. For example, during World War II, many cognitive psychologists, including one of the senior author's advisors, Wendell Garner, consulted with the military in solving practical problems of aviation and other fields that arose out of warfare against enemy forces. Information theory, which sought to understand people's behavior in terms of how they process the kinds of bits of information processed by computers (Shannon & Weaver, 1963), also grew out of problems in engineering and informatics.

Applied cognitive psychology also has had great use in advertising. John Watson, after he left Johns Hopkins University as a professor, became an extremely successful executive in an advertising firm and applied his knowledge of psychology to reach his success. Indeed, much of advertising has directly used principles from cognitive psychology to attract customers to products (Benjamin & Baker,
2004).

By the early 1960s, developments in psychobiology, linguistics, anthropology, and artificial intelligence, as well as the reactions against behaviorism by many mainstream psychologists, converged to create an atmosphere ripe for revolution.

Early cognitivists (e.g. , Galanter, & Pribram, 1960; Newell, Shaw, & Simon,
1957b) argued that traditional behaviorist accounts of behavior were inadequate precisely because they said nothing about how people think. Ulric Neisser's book Cognitive Psychology

(Neisser, 1967) was especially critical in bringing cognitivism to prominence by informing undergraduates, graduate students, and academics about the newly developing field.

Neisser defined cognitive psychology as the study of how people learn, structure, store, and use knowledge. Subsequently, Allen Newell and Herbert Simon (1972) proposed detailed models of human thinking and problem solving from the most basic levels to the most complex. By the 1970s cognitive psychology was recognized widely as a major field of psychological study with a distinctive set of research methods.

In the 1970s, Jerry Fodor (1973) popularized the concept of the modularity of mind. He argued that the mind has distinct modules, or special-purpose systems, to deal with linguistic and, possibly, other kinds of information. Modularity implies that the processes that are used in one domain of processing, such as the linguistic (Fodor, 1973) or the perceptual domain (Marr, 1982), operate independently of processes in other domains. An opposing view would be one of domain-general processing, according to which the processes that apply in one domain, such as perception or language, apply in many other domains as well. Modular approaches are useful in studying some cognitive phenomena, such as language, but have proven less useful in studying other phenomena, such as intelligence, which seems to draw upon many different areas of the brain in complex interrelationships.