Introduction to Cognitive Psychology

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Lecture – 01
A Brief History of Cognitive Psychology

Hello, I am Naveen Kashyap and I teach psychology at Indian institute of technology Gauwhati. One of the subjects in psychology that I teach here is cognitive psychology and so I will be teaching you this course.

This course on cognitive psychology will be covered through 8 modules. We will start with introduction to the history of psychology, cognitive psychology. Then moving on to the methods of studying cognitive psychology, we will deal with perception, the basic process of taking in information, then moving to attention, the filter or the barrier which let us information gets encoded.

From there, we will move into how, whatever information has been perceived or taken in into our system, how that is stored as memories. Further on, we will look into what are memories? What are the type of memories, which are there? How many processes operate? Things like, how processes of encoding and retrieval really work and what is the way in which information is organized in memory?

Once you are done with memory, we will move into something called thinking, which is a higher order cognitive processes and which draws on from memory. Now, thinking is a process which will lead on to something called decision making another important process in cognition, which is central to the idea of how people actually make decisions in real life or how people decide or make choices in real life.

We will also be venturing into a little bit into something called language, which is how people use signs and symbols to communicate ideas between them, because communication of ideas or whatever one thinks whatever cognition ones have sharing that cognition with other people is also central to the idea of psychology.

So, let us then move quickly into a brief history of cognitive psychology. Psychology developed from philosophy, it came out of philosophy and philosophers, where the people who actually first proposed a how knowledge is stored, how knowledge is dealt

and how knowledge is acquired and so they led to the development of the science which is psychology and so before moving on to the history of cognitive psychology, let us look at a brief history of the philosophical inputs to cognitive psychology.

So, one of the brief inputs of philosophy or one of the brief debates of philosophy, which led to the science of development of cognitive psychology was the debate on something called nativism and empiricism. What is this debate?

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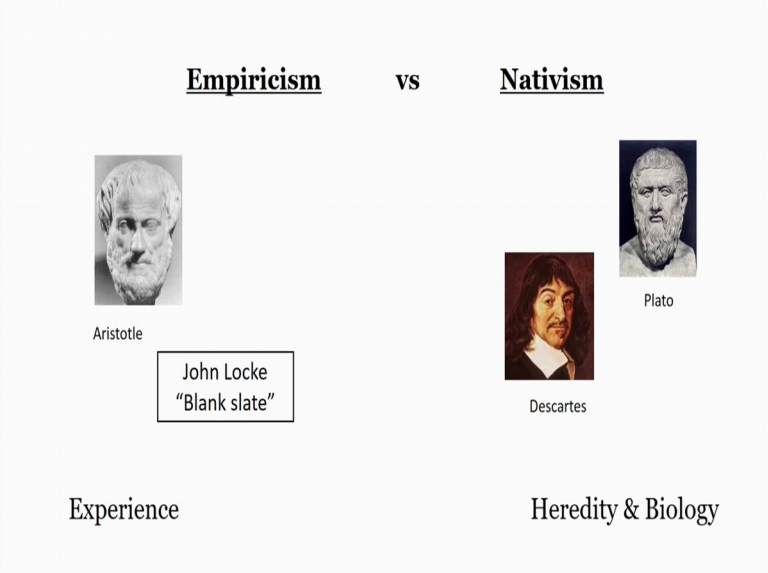

Empiricism explains that knowledge; the idea of knowledge or the idea of how knowledge gets stored, it comes from individuals experiences. So, individual so their own experience to their own interaction with people around them, with society around them or through memories or through or other kind of experiencing systems generate knowledge.

Whereas the nativist believed that, the role of heredity, the role of biology or the role of constitutional factors, are responsible for the generation of knowledge. So, what was the debate all about? On the empress's side, we have people like Aristotle and people like John Locke. Now, John Locke for one who was an English philosopher from 1632 to 1704, he talked about knowledge or the basic of cognitive psychology in terms of contents of the mind.

So, what is the content of mind and he said that mind compose of thoughts, it comprises of thoughts and these thoughts are mental images; a series of mental images, which are associated together and they are what mind is all about or knowledge is all about. Also, John Locke proposed the idea that people at the time of birth are born with a blank state of mind. So, there is nothing written in the mind itself and this debate, that this blank state or this idea that is bank state with experience or true experience, get written up and that makes knowledge or that develops knowledge or cognitions.

Similarly, Aristotle had a similar viewpoint, where he believe that personal experiences of people is the reason how this knowledge develops. On the other hand, people like Plato or people starting with Plato, other people like Rene Descartes they believed that, knowledge actually comes from heredity or it comes from the composition or biology and so they basically are the descendants or they basically progress from Darwin's point of view. They believe that knowledge is inbuilt or it comes as an inbuilt mechanism and the fact that this inbuilt mechanism is as the reason for knowledge.

Specific to cognitive psychology Rene Descartes, who was a French philosopher he gave this idea of mind and body. Plato believed that memory is the first use of Plato, where that memories were actually writings which were on a wax tablet and he believed that this mind that people have is actually a wax tablet and the writings on this tablet is what our memories and so what he goes ahead and says is that these memories, the way these memories are written, the way these writings are the wax tablet, the strength of these writings, actually explain or actually tell you how strong or weak a memory is. Also, the content of this, what is written on this wax tablet, will tell you about the content of memories.

Now, the idea of John Locke, that this mental images; the series of mental images are actually what are the contents of mind, was contested by someone called George Berkeley. Now, what is George Berkeley say, he contested the idea that thought processes or contents of the mind cannot be mental images which are associated together.

The reasoning that he gave to this, was that abstract ideas like judgment or like truth. This cannot be conceptualized as mental images, as they cannot lead to this idea of the mental images and so these were some of the basic philosophically passions or

philosophical view points of what psychology in general and cognitive psychology in special or in particular, are actually comprised of or should comprise of.

With the coming of, someone con William Wundt in the year 1879, the first scientific school of psychology developed. William Wundt developed this school at a place in Leipzig in Germany.

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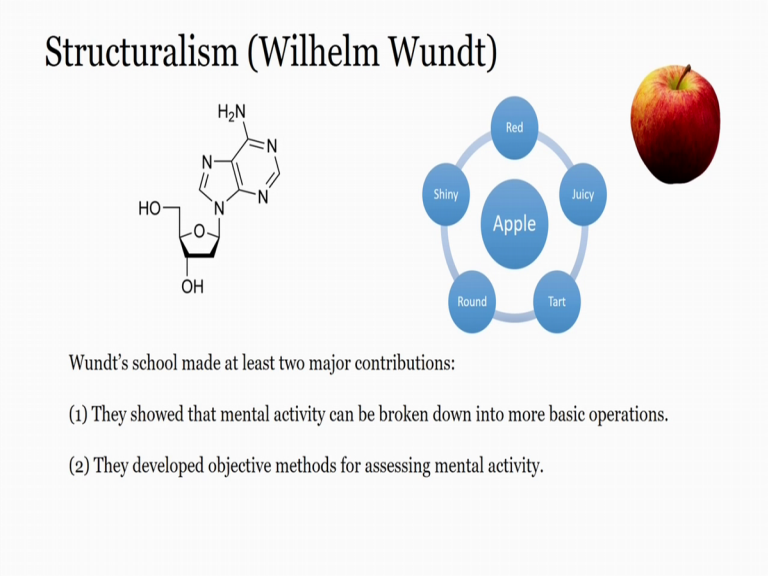

And, with his school the first structural school of psychology came into being, the basic things or the basic ideas that William Wundt actually went ahead and studied where the nature of consciousness, what is consciousness, in the nature of consciousness.

Now, consciousness as such, has been one of the basic materials or one of the basic inputs, which are the subject matter of cognitive psychology. So, what William Wundt was trying to do as a scientific school of psychology was studying, what consciousness is all about.

For the first time, William Wundt was able to explain psychology with a scientific viewpoint. Now, what was this scientific viewpoint and what was William Wundt actually trying to do. William Wundt believe, that any psychological process can actually be broken down into sub processes.

Now, this idea of breaking a mental process into his basic process is actually a hangover, which comes from the physical sciences and since William Wundt came from the basic

sciences, this breaking of the mental process into sub processes were actually hangover which he had and what did he believe. Now, William Wundt basically approached or described consciousness as 2 part system. One, he said that cons describing a consciousness will require 2 things, characterizing the basic sensations, which is, what are the sensations which characterize the mental process things like the heat, the color, the texture of the particular sensation and also characterizing the feeling. What is the feeling associated with.

Now, as you can see in this particular slide, what William Wundt would want is to study mental processes or mental ideas using the basic process of the hard sciences like chemistry and physics. On this slide, you can see that there is a structure of a organic chemical compound and as you can see this organic chemical compound, is basically composes of several parts and this chemical compound in itself can be described by the parts of our elements which comprising.

What William Wundt was attempting to do? Is to study the idea of seeing this apple, the consciousness of staying this apple and break it into processes, greatly into basic processes, of how people see this apple. As you can see on the right hand side, there is an apple and there is a process to it.

Now, the very basic idea of apple, what William Wundt said is comprised of these 5 or 6 ideas. What is the idea? For example, it can be described; the apple can be described in terms of it is color, in terms of it is taste, in terms of it is of shape, in terms of it is shine or in terms of how you feel after eating it and that is what I was talking about. So, what William Wundt did, was the idea or the consciousness or the concept of apple, the mental image of apple, the mental construct of apple he described, can be described over can be broken down into its physical features, which is the shape, color, texture and things like that and the feeling that we have, after eating an apple or how do we feel after eating a particular apple.

And the second thing is, he also wanted they also included. So, one thing was characterizing the feeling and the basic sensations and the second part of this, was to deal with the rules through which these sensations were combined together. What are the rules? Which through which, we combine the perceptions, the idea of an apple and the feeling of an apple and so he related that this could be done through perception, where in

perception we actually not only see the color, shape and size, we combine them together to see a whole apple

So, in all, what William Wundt was trying to do, is trying to explain mental processes, in terms of the sensations or the sensation and feelings and also, how these sensations and feelings combined together to give you the actual construct or the actual image of an apple. This notion of taking a mental image or taking a mental feeling and breaking it into it is part.

This led to 2 major things, one, he showed that mental activity; mental images can be broken down into basic operations. So, when I see something or when I feel something, the feeling of a particular sunrise or sunset can be broken down into it is physical part, which is the heat that I feel or the cold that I feel or the kind of feeling that I feel and also the basic factors, the basic temperature, the basic light intensity which the sun gives off at sunset. I would combine these 2 things together and then I get this mental activity or the mental feeling of what a sunset is.

And this is the second thing that William Wundt was able to do, was to develop an objective method of studying mental activity. Up till now, most philosophers are talking about mental activity as a process, as etching on a tablet or it could be in terms of consciousness,, but none of these things could actually be studied objectively, could actually be studied or could actually be measured as changes, but what William Wundt did was take a mental activity; was to take from this mental activity and divide it into it is parts, which can be measured and which are observable in nature. So, this is the contribution of William Wundt.

The problem with what William Wundt suggested was that, mental images does not gain guarantee a mental activity and so the study of mental images in no way will guarantee the study of mental activity. For example, let us say I give you different weights and ask you to compare 2 weights. One is lighter or whether one is lighter than the other or when one is heavier than the other. It is an easy task and most people will be able to do it, but the question is, do people actually realize, that they are doing this comparison or are people able to basically center on those mental activities which are required for doing this comparisons of mental weight and the answer to this is no. We do not have any idea of what is the mental activity which is going on when comparing this face.

Obviously, we will get answers on superficial terms from people of whether 2 weights are lighter or harder, but what is the actual mental activity which is acquire, which is required for doing this kind of calculation is not possible. Let us take another example, suppose I asked you to describe the ear of a cat, what is the ear of a cat look like. Most people will be able to do that, but when I ask you this question, that when I said or when I asked you, what does the ear of a cat look like. Did you, actually bring forth an image of the cat in your mind for answering this question. Not many people will be able to answer it truthfully, saying that they do actually bring up the idea or the image of a cat.

Why is that? One reason is, because we do predictions and in terms of predictions we know how a ear looks like and so how the cats ear would look like. It comes from semantic knowledge and we really do not need to imagine a cat and then look at it is head and then look at it is ear in terms of mental activities to actually come up with the idea of a ear of a cat or describing the ear texture or shape of a cats ear. So, these are some of the problems with his theory or with his structuralism, which was a solution to that was attempted through something called a new school which was functionalism.

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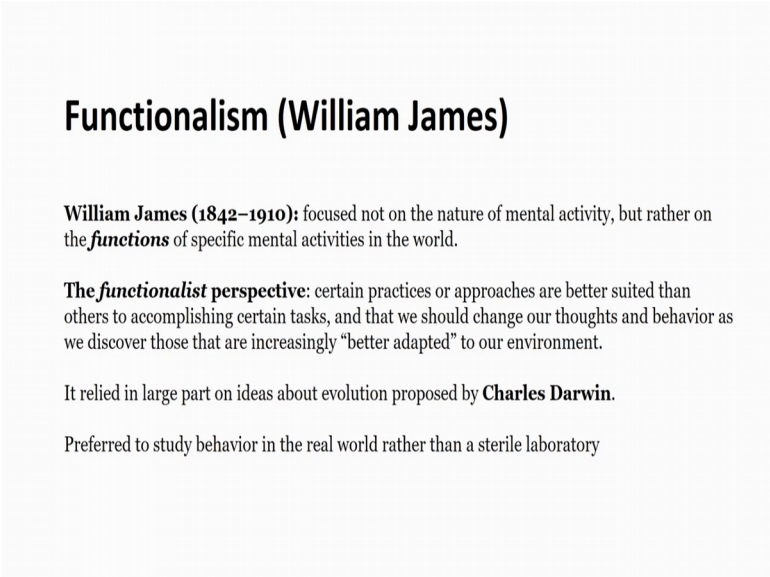

So, the school of functionalism was started by someone called William James and so William James was off the idea that the nature of mental activity is not the only solution to studying cognition, but rather the functions of specific mental activities are what require or what is required, what do I mean by this.

The functionalist perspective, suggest that the components of a mental activity are not important, but how those that mental activity actually functions or actually is described in a process is what is of interest.

For example, let us assume that we go to a lecture. Now, in a lecture for some people writing a lecture down, making note out of a lecture down, works, that is how they learn and for some other people, listening to a lecture when a lecture is being delivered, is what is the key to understanding of the contents of the lecture, now the people for whom listening a lecture or hearing a lecture is the key for them to learn. What these people can do, is find out what aspects of listening in a lecture, not writing the lecture down actually helps them in understanding the subject.

And, let us suppose that they find out or the reasons why they subscribe to listening a lecture is because, when they go into a lecture a listen to a lecture they get a chance to ask questions or they get a chance to see visual aids and learn things. These might be the reasons why listening to a lecture is beneficial, what they could do, is in future if they subscribe to a lecture, if they want to attend a lecture what they can do is basically look at those lectures which gives you opportunity to ask questions, they can look at teachers which give you opportunities to ask more number of questions and then select that particular lecture and learn for a while.

So, basically the functionalist approach says that it is not the nature of mental activity that is important. What is important is, how the function of this is? When this nature activity actually takes place or when this nature activities are actually taking place, in the real sense how does this really go ahead and explain mental process. So, mental process is not just components of mental images it is in terms of, how this mental process or how this, the acting out of this mental process actually let us you gain knowledge.

Functionalism derives a lot from someone called Charles Darwin, who proposed that evolution is the reason or the idea behind the gaining of knowledge. So, basically the then, the difference between functionalism and structuralism in terms of explaining the history of cognitive psychology is that structuralism basically thought of mental processes, thoughts of mental images or prescribe the idea that mental images are there and these mental images can be broken down and then can be studied and that is how a cognition or knowledge is generated.

Whereas, functionalism talks about are not these mental processes but rather, how this mental process operates the operation of these mental processes is actually, the way how people generate knowledge.

A third school which led or a third school which led to the formation of cognitive psychology was the Gestalt school.

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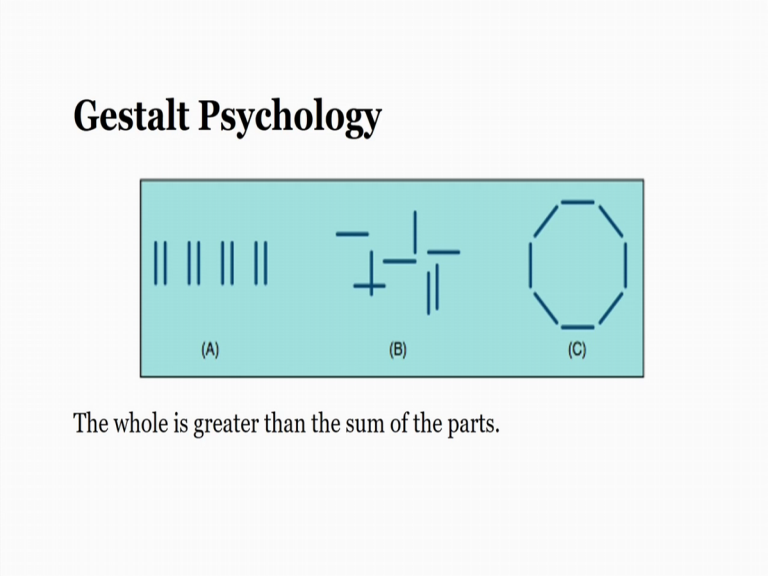

Now, this is a very simple school and this school proposed 2 rules. One, that the whole is always more than the sum of it is part, what does it really mean. It subscribes to the idea, that if we see something as a whole and if you see a part, the same thing as parts they may not give us the combined experience think of it in terms of a movie. When we go to a movie, we not only see the pictures, but we also see the sounds the which is coming from the pictures, the whole movie experiences combined together to give you the idea of what a movie is. Well, as you take the movie apart the picture, the music, the sound, the other effects, everything taken apart from it and then show them one by one to you. Will you have the same experience? No, you will have entirely different experience.

Take another example, the idea of a song. Now, song composed of lyrics it composes of music which is there it composes of special effects and so many other things into it. Now, if I take this apart, if I first make you hear the lyrics and later on add on or make you hear the instruments which play with it and later on come out show you or make you hear the basic effects or are the basic special effects, will you have the same experience

as when these combined together to form the song? No, they are different and that is what cognitive psychology or just all psychology proposes of cognitive psychology.

They say that the idea of studying cognition is that, cognitive psychology is that the experience that you get from studying a whole process is different from breaking the process apart and so this school was in direct opposition to William Wundt School, who proposed structuralism. Where they said that the mental activity; any mental activity for that matter can be broken down it is true parts studied and how knowledge is gained, how knowledge progresses can be understood.

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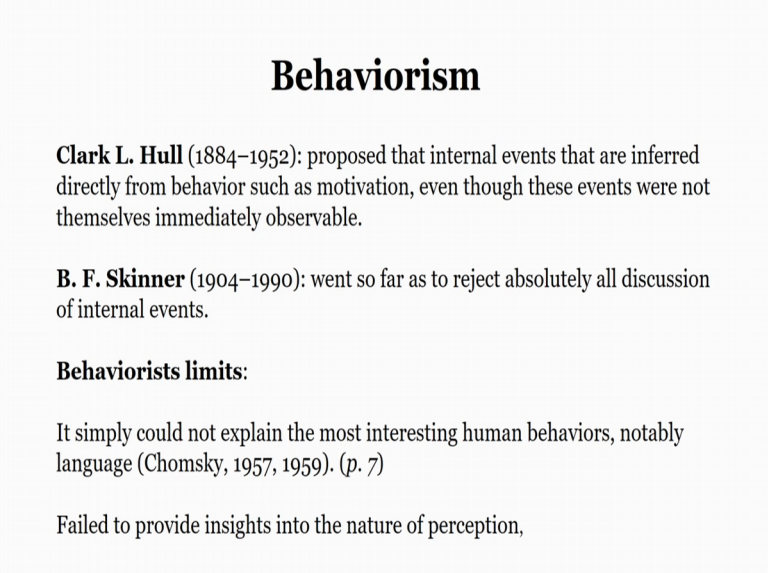

Another school which adds up or which basically goes ahead and explains some of the basic ideas about cognitive psychology or so one of the basic ideas for cognitive psychology is behaviorism. Now, behaviorism was a school which strictly proposed the idea, that there is a stimulus and there is a response and each stimulus is bound to a particular kind of a response. So, stimulus's leads to response as the moon or main, the optimal response is always adapted as the effect of a stimulus. What behaviorism reasoned did was it did not subscribe to the idea of hidden mental states. Behaviorism said, since we are not able to understand the mind, we are since we are not able to understand what is inside somebody's head. So, let us look at what is observable.

So, one of the things, one of the main propositions of behaviorism was that let us look at what is observable. So, if there is a stimulus and it creates a response which can be

observed and this response could lead to a consequence this is what it should be studied. So, study a stimulus, study a response and study a consequence to the response and this is what should be the subject matter of cognitive psychology. Cognitive psychologists should not waste it is time, on what are the mental processes, what are the mental images what is inside somebody's mind, which and how they direct the notions of knowledge gathering.

Clark hull, one of the behaviorist, he proposed that although mental events cannot be studied through behaviorism, but their existence can be deduced by their effect on behavior and so what he says is that although things like motivation, which is basically internal behavior or is an internal event, it cannot be studied, but what can be done, is that it is effect of motivation can be studied on behavior, can be studied through what people do, when they are motivated.

So, if somebody is motivated he will produce most optimal responses and based on that his efforts on doing that particular job or doing that particular act will increase and that is why this increase in the response when he gets rewarded by doing that response, basically shows the presence of motivation. Skinner, who was another behaviorist, he went so far ahead and said that look there are nothing called internal events, there are nothing called mental process and so the basic idea or the basic subject matter of cognitive psychology should be stimulus response and consequences. Studying the relationship with what stimulus says, is to what response and optimizing, understanding what is the optimal response to a particular stimulus and then studying, how these responses are strengthen or weaken and that basically happens through studying of consequences.

The problem with behaviorist or the problem why behaviorists were not successful in understanding cognition or in developing cognitive psychology was that, they could not go ahead and explain some of the most interesting behaviors or the existence are some of the most interesting behaviors.

For example, the idea of language or how 3 d perception and things like language or death perception initiates in people. This led to the fall of behaviorism as a proponent or as a school, which explains you what the subject matter of cognitive psychology is or what cognitive psychology is all about.

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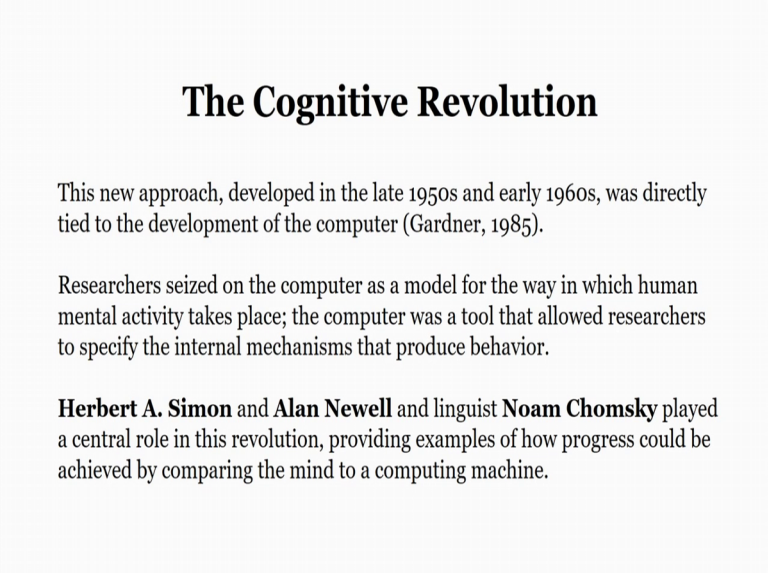

Since, most of these schools were trying to understand what should be, the subject matter of cognitive psychology or what cognitive psychology is all about. None of the schools could actually come up with a definitive answer of what is the true subject matter of cognition; behaviorism to some extent did give some very good inputs for developing of a theory of cognition, but they to fail in some ways because they were not looking at internal events. What behaviorism contributed was that, they developed some of the most rigorous idea or experimental techniques of studying cognition.

Also, they for the first time went ahead and studied animal cognition and they said that studying the way animals behave could lead to understanding how people behave or how people gathered knowledge or how information or how cognition really works. So, they although did not provide with enough matter to the development of cognitive psychology, but they did provide enough impetus to the development of a new school, of how knowledge is gathered and what is mental activity questions like these.

A new school came in and they started explaining, what is the subject matter of the mind and how is knowledge gathered, and this school was called the cognitive school or the cognitive revolution. Now, up till this point of time, we have been dealing with psychology, we have been dealing with experiments in psychology, where we are dealing with people who have worked in psychology and they have been giving several definitions of what psychology is, what it should do, what cognitive psychology should

do, what should be subject matter of cognitive psychology, how knowledge is gained and those kind of things.

But the new school that came in and that explained, what is cognitive psychology or what is the basic way in which mental events or mental processes a function, was the cognitive school. This school started with the development of the first computers and this school came up or this school was proposed or came out from the ideas of people like Herbert Simon, Allen newel and Noam Chomsky.

For the first time with the development of computers psychologists got an opportunity to model the working of the human mind in terms of sets, in terms of items which take in information and process it and to understand how thought processes or how human thinking or mental processes are actually taken care of by the mind.

Now, the computer gave the cognitivist an ideal medium to study the internal mechanism of how information knowledge is grasped, is processed and is developed and is used. So, as I said before people like Herbert Simon and Newel, who gave the idea of computers, gave the idea of computer processing systems, provided a chance for the development of the field of cognitive psychology.

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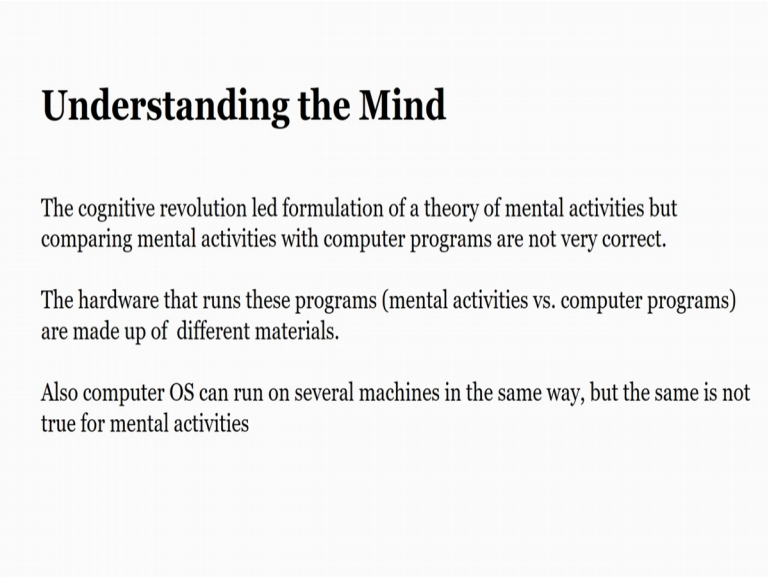

Now, the basic to understanding cognitive psychology is studying the mind. Right up till now, we have been looking at schools or we have been looking at viewpoints from

various schools of psychology and what do you think about or how they affected the development of cognitive psychology is a field.

From now on, we will be looking at what is the subject matter of cognitive psychology and how it should be studied, what are the processes and things like that. So, one of the things that led or that is the core, to understanding cognitive psychology or human cognition, is understanding the working of the human mind. Now, with the development of computers or the cognitive revolution, there was a chance to compare human mind working with the working of the computers.

But the problem was the working of the mental activities, which led to the working of the mind of how mind generated knowledge or how mind generated any activity and comparing that to a computer program is not a correct solution. The reason is, because the analog of mental activities as computer programs are wrong, is because the mind and or the brain and the computers are made up of in 2 different kind of things or 2 different kind of elements.

Whereas, the brain is made up of neurons and biological structures, the computers are made up of hardware, electronic circuits and several other things which are not comparable on any dimension. Also the mind, the analogy which says that the minds and computers are same; it proposes that the mind is the software, which runs on the hardware which is the brain. No, as I said the comparison of the mind and brain to an operating system and the computer is not correct, what are the reasons that I gave is, because they are made up of different, different kind of elements. Whereas, the brain is made up of neurons and neural structures and biologic based materials, the computers on the other hand are made up of electrical circuits.

Also, if you look at the mind and the brain, the brain the mind works on top of the brain, right, which means that, the operating system of the brain and the brain itself are one and the same thing or is a spot off of the same structure, whereas computers do not have this specificity. The idea here is that, computer programs can be run on different kind of computers, if I have an operating system no matter what computer I have, no matter what kind of hardware that I have, I can run this operating system on it and so the hardware, the operating system the mind in terms of a computer an analog can run on different, different hardware's.

Whereas, the mind that a person has, the brain which generates the mind this cannot be transported to other person, up till now, this is not possible, where Ii can take in somebody's mind and transplant it to somebody else's hardware brain and make these people similar.

Now, these are some of the, this is actually one of the most theoretical questions or I would say, thought experiments in philosophy, where it is described that if I take the mind the brain of someone, a part of brain or someone and implant it to someone else, who was having a malfunction brain as brains can function, half brains can function on their own will they be the same person. Now, that is a thought experiment in philosophy and so this is the question here.

So, if I take your mind and put this mind, let us assume that I can take your mind and put this on somebody else's hardware the brain, will 2 of you function similarly, because the brain is more or less similar in most people and so it does not, but on the other hand in terms of computers what really happens is that if I take an OS, operating system and I take it to any hardware, it keeps on functioning or it keeps on working in the same way.

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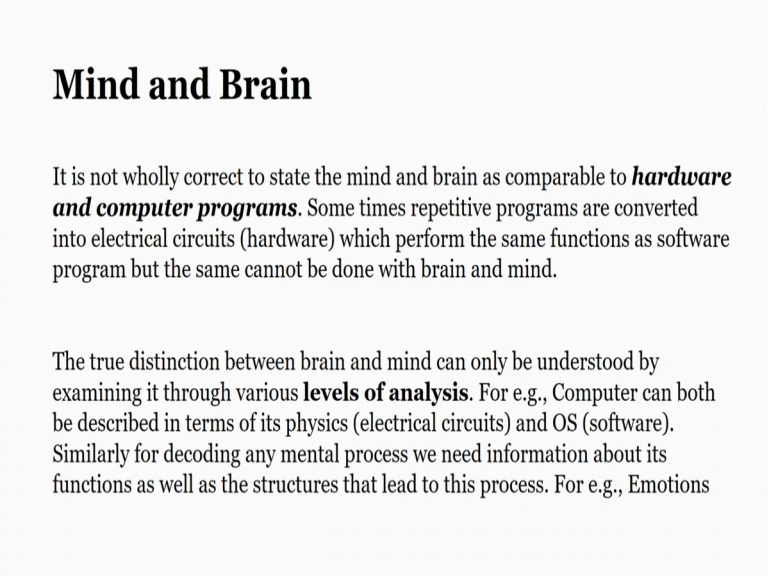

Also, some software programs are so basic, that at times we take these software programs and convert them into some kind of hardware; some kind of hardware programs. For example, the basic IC chips, which allows certain currents or certain signals, certain kind of gates which are there in electronics engineering.

So, at times simple programs, computer programs can we actually converted it into a chip and this chip can be later on used for use as an hardware, but basic human programs or basic human processes cannot be converted into a part of the brain and can be shifted. So, that is what this it says, that sometimes deputy programs can be converted into electrical circuits, whereas for humans is not possible.

So, then what is the, how do we differ between the brain in the computer or the brain and the mind. This can be understood in terms of the various levels of analysis, what does this really mean, levels of analysis actually means, the point from where you are seeing something, the point from where you are analyzing a particular feature. For example, in a computer program the 2 levels of analysis can be in terms of the basic electrical current, the basic circuits that the brain has and the physics of the computer.

So, one level of analysis will be how current flows through several hardware's in a computer and how these leads to the functioning of the computer. On a second level, on another level of analysis computers can also be understood in terms of what various programs do, how these various programs go ahead, what kind of processes they do, that they have, what kind of functions that they do and how they go ahead and actually create an output from the input given.

So, one level is the physical level in terms of computers, understanding levels of analysis could be understanding computers in terms of the physics of it, in terms of the electrical circuits that it has or in terms of the programs that run on it and that describe the computer.

Now, for understand this with a more easy example. Let us say, we are looking at a building, so what I am trying to tell you is, what are different levels of analysis? So, let us think of a building, one level of analysis of a building would be the architecture, would be the way the building is constructed, the design of the building, how it is, how it looks, what kind of rooms it has and so on and so forth. So, this is a higher level analysis.

A lower level of analysis or another level of analysis of this building, could be in terms or the bricks that is used to make this building, the cement that is used, the steel rods which are used and so in terms of the basic components which make up the building. Although both levels of analysis are talking about the same building, but they have different, different viewpoints of it and so this building can be explained with the

analysis, with the level of the architecture, architecture input or it could be understood in terms of the level of the basic building materials.

So, then this is how the distinction of the brain and the mind can be done through different levels of analysis. What this would mean is that, when we are looking at any mental process, we can look at a mental process from both a functional view as well as a structural view.

Let us look at emotions, what is the functional view of an emotion? The functional view of an emotion is, it is an arousal state, it is a state of arousal which quickly clients and gets back to normal and through which people experience feelings. This is more of functional view, but what is the structural view of looking at an emotion.

The structural view of an emotion could be expressed in terms of the brain regions, which lead to the emotion, and probably the areas which are related to amygdala or areas near to it, which leads to generation of an emotion. So, the same emotion that I am talking about, the same emotion that people have, can be expressed both on a functional level in terms of what people feel and also in terms of the structural level of which regions the brain lead to the development of this particular feeling or with this particular emotion.

Another interesting thing or another input matter; subject matter of cognitive psychology are mental representation.

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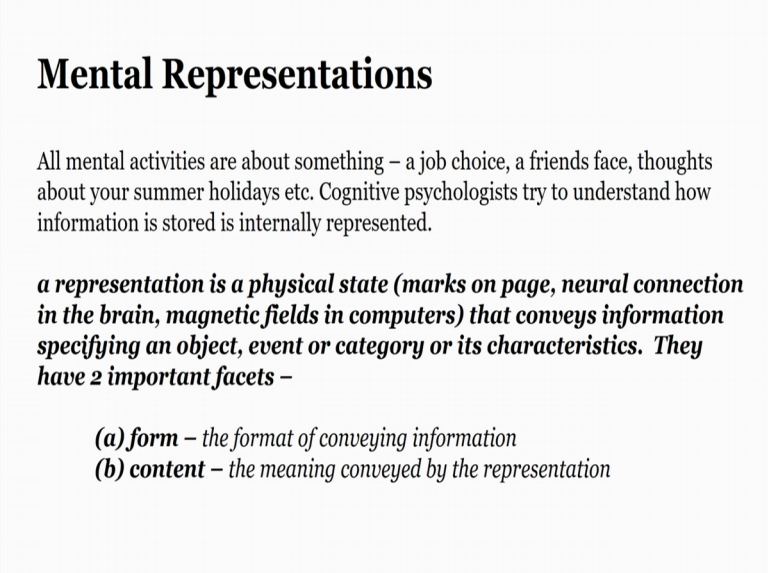

What a mental representation? Whenever we think about something, maybe it could be a job, it could be thinking about a friend, a particular vacation whenever we think about this a lot of mental activities takes place in the brain and so these mental activities actually excess or actually use something called mental representations.

So, generally what is a mental representation? A mental representation is, basically a physical state that conveys information specifying an object, event or category or it is characteristics in terms of paper and pen. A mental representation would be the ink, which writes a particular letter; the way the particular letter is written, in terms the brain it could be the neural connections which leads to a particular kind of network connection, a particular kind of mental state disease generated or in terms of computers it could be a particular kind of magnetic field.

So, mental representation basically is a notion, is a represent, the way something is stored. Each mental representation or most mental representations have 2 things in common, one is a form of the mental representation and the second is the content of a mental representation.

What is the form of a mental representation? The form of a mental representation states, the way a particular message is conveyed, the format in which it is conveyed, the way in which it is encode and the content of a mental representation is basically the meaning, the knowledge, the idea which is being conveyed to that representation.

So, basically mental representation is, think of it is a unit of knowledge and this unit of knowledge has a form, which is in which format it has been encoded. So, it could be encoded in visual format, it could be encoded in auditory format, it could be encoded in some other format, a haptic format and the content is what is the data bytes into it, what is the knowledge into it, so mostly representations are like that.

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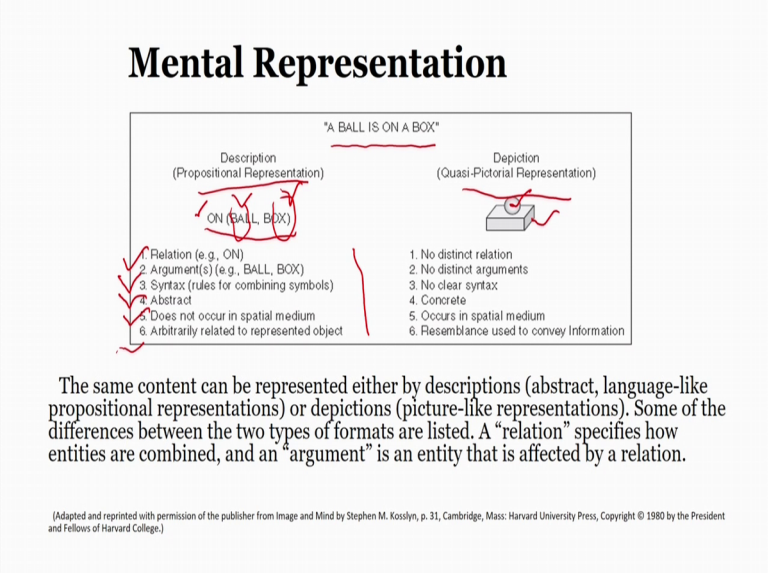

Let us understand, what mental representations are and when I say, that a mental representation is a unit of knowledge and it has a form and a particular kind of a form and a particular kind of content. Let me explain this a little bit more.

For example, I want to convey to you the following sentence. The ball is on the box, this sentence means or this idea means, that there is something on something a subject, an object and a relation between a subject an object or it represents an idea. Now, this idea has 2 parts, one is what is? Second is where? And the third is on what? So, the ball is on the box, the idea of a ball being in a box can be conveyed through 2 kinds of representations.

We can use a propositional representation and we can use a quasi pictorial representation. What is the meaning of that? Propositional representations will tell you 2 ideas and how are these ideas related together, whereas a quasi pictorial representation is going to tell you. Show you a picture of how these ideas are related together. So, when I look at the proposition of representation, looking into it, I have the ball which is on the box. So, ball

and box are 2 ideas or 2 representations, which are connected by a representation on. Which basically means that, something on something and in this case there is a ball, which is a circular in shape and which is on top of, a box which may be or rectangular in shape.

So, then what this representation proportional presentation explains is, a relationship first of all. So, the ball is in the box, if I represent it through prepositions, it could be in terms, it could have in terms of proportional disposition, it should have a relation. How the 2 ideas are connected together that undulation here is on.

Second, an argument, what representations or what ideas are connected. I have a connector on, which is connecting 2 ideas, but what are the ideas which is being connected, the ball in the box. What is the syntax of connecting? Now, if I just write on ball box, it is not going to make any meaning; there is a syntax to it, a syntax says that, 1 ball a ball it could be anything, on which is the connector a box on one thing and then the connector is. So, this ball is basically on the box. Lift up when, I am saying that I am talking about the particular ball, the particular box, then the abstract, what is the abstract, the ball in the box the shapes of the balls in the box.

Then the propositional representation, it does not happen in a spatial media, in spatial media and the reason that it does not happen in space, it does not explain you in space how these are related? So, in space you will generate the idea in your head, that there is a ball and there is a box and the ball is on the box, but you cannot see the picture of the ball on the box, although it will generate the same idea of the ball being on the box and arbitrarily related to represent objects, it can be arbitrarily related to it.

When I use a quasi pictorial representation for explaining the same idea the ball is in the box, I can draw a ball which is spherical in shape and a box. Here, I have to be very specific, I cannot draw a triangular ball neither can I draw a cubical box, hectagonal box. Obviously, it is allowed, but then most box will have rectangular or squarish surface and so I have to be very strictly to that. Also the preposition of on, suggest that the spherical shape has to be on top of the shape of the box and so in this case there is no distinct relation, there is no distinct arguments, no clear syntax, no concrete ideas but then, what happens is, it happens this can be expressed in a spatial medium.

What does these mean? What is the meaning of this? The meaning of this is, mental representations or mental ideas can not only be expressed in terms of words or in terms of prepositions, in terms of ideas and connector connecting these ideas, but it will also be expressed in terms of just images and so images are one way of conveying an idea.

Let us take another example, Ram is running, if I say the sentence Ram is running, the 2 ways of showing it. I can use running, which is a verb or I can and then I can use Ram which is the noun and then show the relation between that, running is done by Ram. This is a propositional, so making the preposition or I can draw somebody running, doing the act of running or make a cartoon of it and running and then i can show that Ram is running by that pictorially, both these representations, both these formats will actually convey the same meaning.

So, coming back to the idea that mental representations have a particular format and a particular idea or a particular content as you can see, both these ways of representations have a format. The first one has a propositional format and the second one has the quasi representational format, which is a special format of encoding ideas. What is the content? The content of the first is, there is A, an object A which is on top of object B. Similarly, with the pictorial representations also the same idea or the same information is being conveyed that A is on top of B.

So, then these mental representations that we have can actually or how do these mental representations work?

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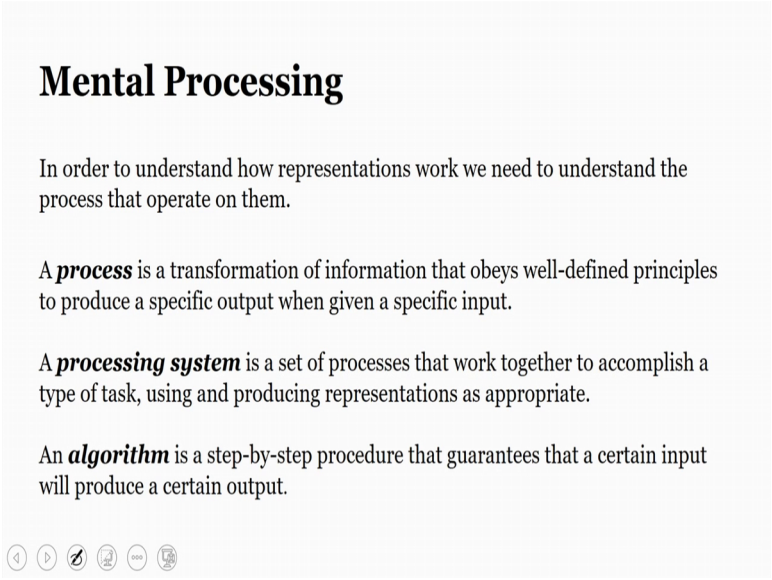

The working of these mental representations, takes place through a process, a processing system and algorithm. So, once we see something, once we form a mental representation, this mental representation is taken by the mind and then, this mind makes meaning out of it, through using a process or processing system and an algorithm.

What does the process do? The process takes in basic information and produces specific out of it. So, the process will look at the mental representation whether it is in propositional form or in special form, encode it through a system of perception, attention that kind of thing. A processing system will compose of several processes and these several processes will combine with one another to give a output, to give us the idea that A is on B or that this is, what is being conveyed.

So, a process is basically one part of a processing system. A process is basically a format or is basically a process, through which something is some information is taken and this information is transformed into specific type of output. This specific output is later on combined through or it is passed through several processes and these several processes generally are comprised in something called a processing system.

So, for example, going back to the original thing, looking at the quasi representational description, looking at this makes you understand this knowledge that a ball is on the box. Now for this, for you to understand that the ball is on the box, there are several processes responsible and there is a processing system which is processing it. 1 process,

the first process I would say which is responsible as attention, you have to pay your attention to this particular image, the special image. The process of attention will take out everything else from the vicinity of this particular picture and what it will do is it will only concentrate your mental concentration onto this box and this ball.

The process of perception will let you understand this or encode this in a visual format and then there will be process of memory, through which what will happen is there will be a comparison of the size of this the shape of this the relation between this and then there will be a process of thinking, decision making will not be a process here, but then this is how you will develop the idea that the ball is on the table.

So, the processing system comprises of several processes and these several processes one after another gives you the final output. An algorithm is basically a step by step procedure of how the processing system should function. So, any processing system should function in a particular way, in a particular direction and this algorithms tell you how to, where to start, where to go from there, what to expect out of it and then where to go from there again.

For example, in the idea of perceiving the ball on the box, the algorithm tells the mind or the brain to first look at the shapes, pay your attention to the shapes, cut out the or separate the background from the foreground, perceive this in the through the eyes in the visual format, hold it into working memory let the central executive and an episodic buffer of working memory talk to long term memory and make a comparison of what you are seeing and based on that generating this output, that this particular figure shows a ball on the table. So, this is how the algorithm says. So, it starts the algorithm says that, it starts with attention goes to perception, goes to memory, goes to this kind of memory they are retrievers and then make making the decision of how this ball is on the table or how the what this particular picture explains.

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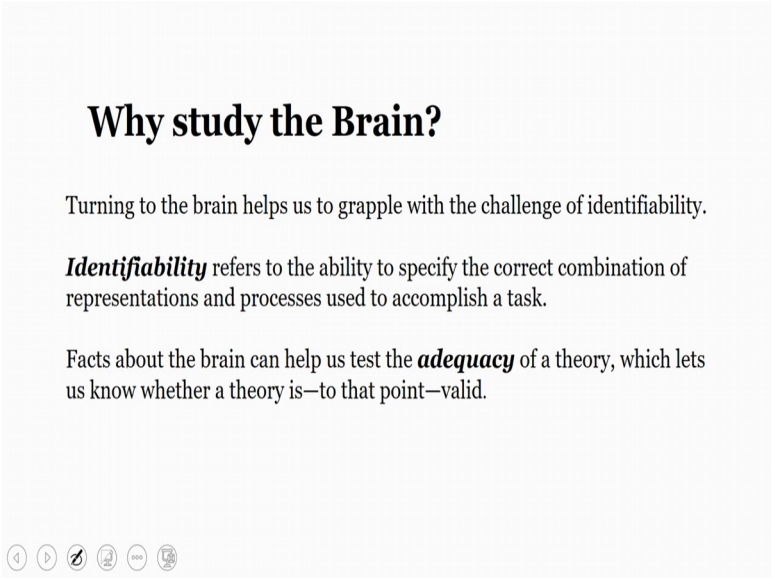

So, up till now what we have seen is, what is the history of cognitive psychology and we have looked at the schools of area schools, which gave their inputs or which led to the development of the field of cognitive psychology and we have also looked at what is the subject matter of cognitive psychology, we looked at what are mental representations, how they can be encoded, what is the format in which we can encode and things like that. We will continue our journey by understanding, why should we study the brain at all? If mind is of what is importance, why should be studying the brain and then following on, following this we will also look at the several paradigms of cognitive psychology or what are the basic bodies of knowledge of cognitive psychology.

Thank you.