Introduction to Cognitive Psychology
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Lecture – 02
A Brief History of Cognitive Psychology

So, in the last lecture we looked at some of the basic processes of cognitive psychology. We looked at what cognitive psychology is composed of we looked at the schools, which led to the development of cognitive psychology is a field. We look at the subject matter of cognitive psychology in terms of mental representations, what are mental representations, what do they represent how do they combine together to find knowledge. And how mental representations are manipulated the way they can be expressed the way they can be understood.

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In this lecture we look at why brain is to be brought into the idea of cognitive psychology. Up till now we have been looking at mental processes, and we have been looking at mental representations, and the functions of mental representations. We are looking at how mental representations function.

But the idea of cognitive psychology in terms of what behavior is said or in terms of what cognitive is said, proposed that mental representations explain functions the process of how they combine together explain functions of a of how mental activities take place

is not enough. So, at the inception of cognitive psychology, it was all about the functional aspect of how mental representations, make up, mental activity and mental knowledge.

Now, one of the co challenges one of the main challenges of cognitive psychology is to understand what happens in the mind, and how does the mind does, what it does, the conception of the mind have been differently put by different people philosophers have given one way of what mind is psychologists have understood mind in more in terms of consciousness, understanding consciousness and the go through the cognitive revolution the understanding of the mind was put down to, or brought down to the understanding of mental representations understanding mental processes, mentally activities and so on and so forth.

Up till now till the cognitive revolution, the study of mental processes the study of mental activity the study of cognition which is basically the study of mental activities was in terms of functions. But the mind cannot work on it is own. And so, it is the idea of mind and brain as a computer hardware, and software introduces first the first-time brain as the act system on which the mind works. And so, one of the most interesting fact that has been bought or that has been thought of as by cognitive psychologists is introduction of the brain in the whole idea of study of mental processes of how mental events takes place.

The question is, why do we study the brain. What help will we get looking at the brain it is composed of different neurons neural grooves and these neural grooves have biological structure. And so, at the sight of it does not appeal, or it does not give us much information about mental processes or the functioning of the mind.

So, why should we actually look at the brain. Looking at the brain will help us identify those processes and the correct combination of processes that are required to complete a task. What does that mean? What it would mean is that since the brain leads to the mind the working of the mind the process of the mind will have a direct impact, or would directly project to the brain. And so, changes in brain structure changes in brain activity can then be correlated to the of the mind. Think of it in this way, and this is a very blow not example.

Suppose a region a of the brain, activates when a certain mental processes takes place, and it does not activate it does not show activity when a certain b mental process takes place. Then now we have an observable, a quantifiable fact or a quantifiable system on which we can look at changes. Because these brain activities the increase and decrease of brain activities will signal whether process a is working or whether process b is working.

And so, one of the reasons of including the brain or bringing up the brain into the whole idea of study of cognitive psychology is to identify, because brain helps us in identifying what mental processes are taking place. If we are able to form correlations, between mental activity and brain activity, but then there is a catch to it. What is the catch? Different information processes, they lead to the same kind of mental experience.

What I am trying to tell you here think of emotions. Now there is a correlation between a brain region which is the amygdala and the kind of emotion that people have. And so, if I am looking at an happy emotion, or if I am looking at positive emotion, what will happen is that most on most positive emotions the same or nearly same brain regions will actually activate or show activity.

So, how do I go ahead and pinpoint those brain networks which lead to the happiness or sadness factor. Also, there is no way to tell us how does the brain did use or give labels to these emotions whether this is excited this is happy and this activity leads to this kind of emotional feeling.

So, then the different sort of information processes can produce similar results or can produce similar kind of act as in in outputs is one of the basic problems by including of including the brain. So, one of the problems is that also there is a problem which is called the structure process trade off. Why does it mean? This is the same thing that I was trying to explain you a little while ago what is the structure process trade off. I try to explain this to you, in a very easy way. Saul Stenberg was trying to identify how people search mentally what is the process people use for doing mental search. And for that he gave people students volunteers experiments. So, the in the first conceptualization what Sternberg was trying to do?

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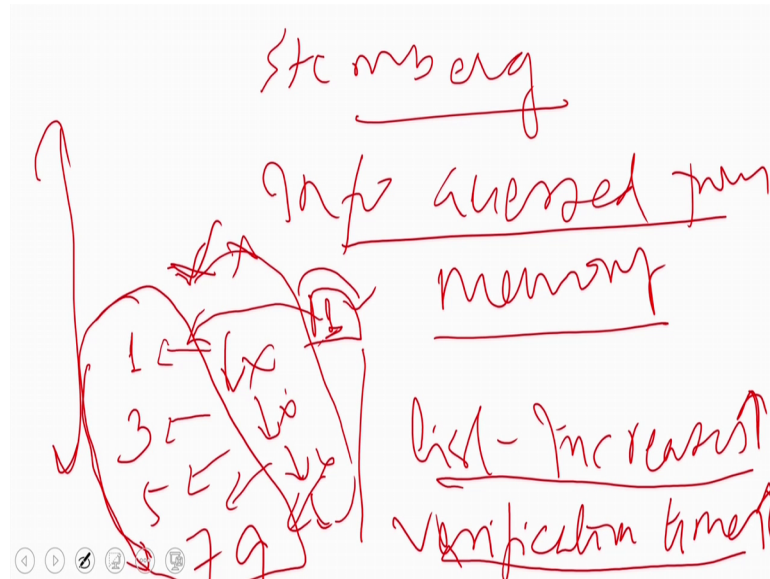
Was trying to find out how information is accessed from memory any conceptualized. So, an experiment which he gave to volunteers the experiment was like this.

Certain numbers were given to people for example, numbers 1 3 5 7 and 9. And later on these people once these numbers were shown to them. Later on these numbers were shown to them one by one and they were asked to tell with confidence whether these numbers were in the list or not. So, it is like a list recognition.

So, what happens in this experiment is, this list of number was given to people to remember to learn and once the learning was over one by one, these numbers are presented and they were asked to decide they were asked to recognize whether each of these numbers represent in the list or not. What he conceptualized is that this kind of list excess, memory excess happens through serial search. And why did he why did he propose that he found out that as the list increases the verification time also increases. So, list increases the length of the list increases the verification time also increases.

What he found out from his studies well that information excess from memory was in a serial way. So, what happens is that when once you show this list to people formed a mental image of this and then later on when you show one of these members of the list, and ask them to verify from their mental image or from the mental representation whether this is present or not we what people tend to do is match this with this. If the match of this with this results in a yes response the search is terminated.

If it is not you get a negative response here. And so, the search goes to the next item whether this and these are similar it is not. So, search goes to the third item not match, again not match, again not match, the list returns to the first item verifies it again and then gives an output saying that it was not present in the list and this is a serial search. So, what happens is one item at the same time. List 2 is matched to the list and that gives this kind of a serial search system.

And so obviously, as the number of items will increase, the verification time will increase, because this serial searches have to be more in number. This was what Saul Sternberg proposed. And this is how what he said is the reason for accessing or how information is accessing memory.

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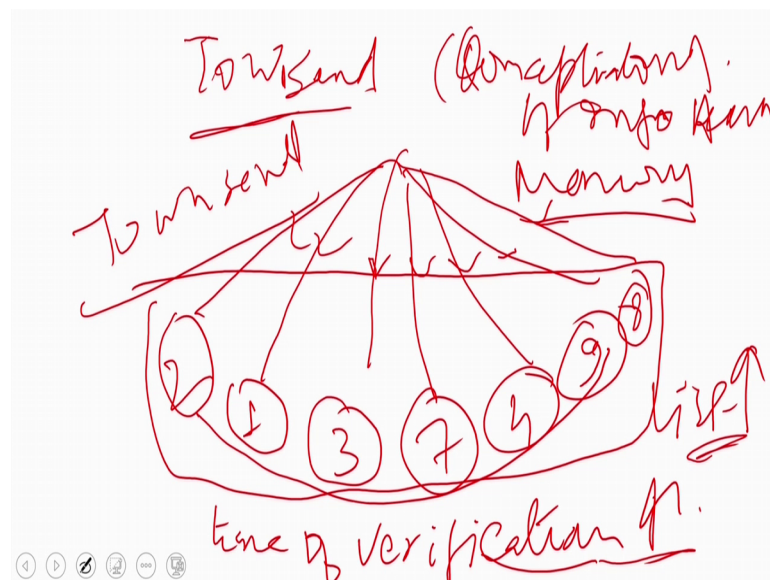
But later on, people like Townsend gave a different conceptualization of information accessing from memory. What did Townsend say? Townsend said that the same conceptualization that I have the same problem can I that I have can be thought of as balls in a plate. And So now, I have 1 3 7 4 and 9.

And instead of a serial search, what really happens is information is searched through parallel processes. Information access from memory is done through parallel processes. Now if that is true if parallel processes occur in the memory, then adding new items into this list for example, 2 and 8 should not increase the time of verification. As list length

increases. This is not what was found what Townsend found that as the number of balls, the number of item increases the time of verification also increases.

So, how do I confer it. For a serial search it was accounted in terms of the fact that more number of processes are there, and more structure is in. So, as the number of processes increases oh sorry, the number of searches increases the time will increase. But in this case when I have parallel searches here the same structure, in the same structure the number of items are there, but still the time of verification increases how do I confer this.

They counting further this is done in terms of the number of processes that take place. What happens is in serial search, although the process of verification is single.

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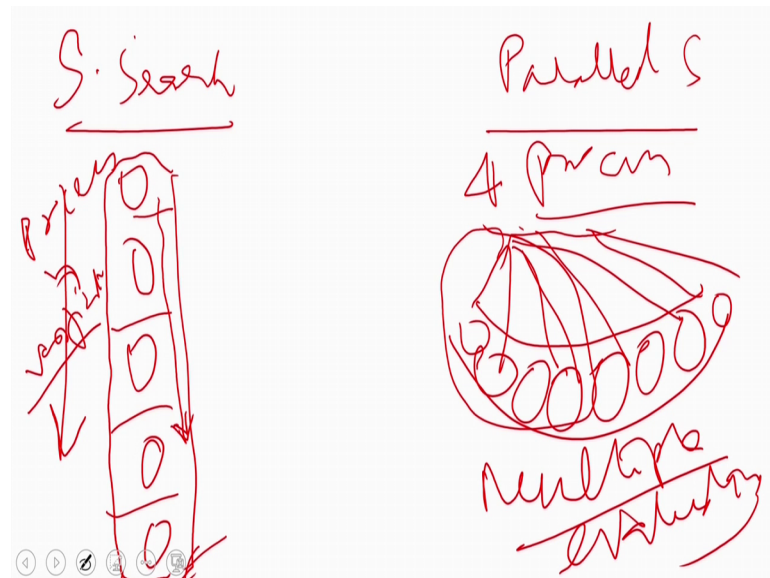
But the structure that stores this information is a bigger structure. And so, what happens is although the process is a single process since the structure is more or there is a bigger structure which stores this information the time of verification will increase, because as I add up more items into it more structure is required.

On the other hand, parallel search although the structure is same, but the number of processes that are there. The number of comparisons that have to should be done. The number of processes takes up for the or accounts for the more time. What will happen is since there are let us let us assume that there are 4 process processes which run in parallel. What will happen is these 4 processes will have to do multiple evaluations and
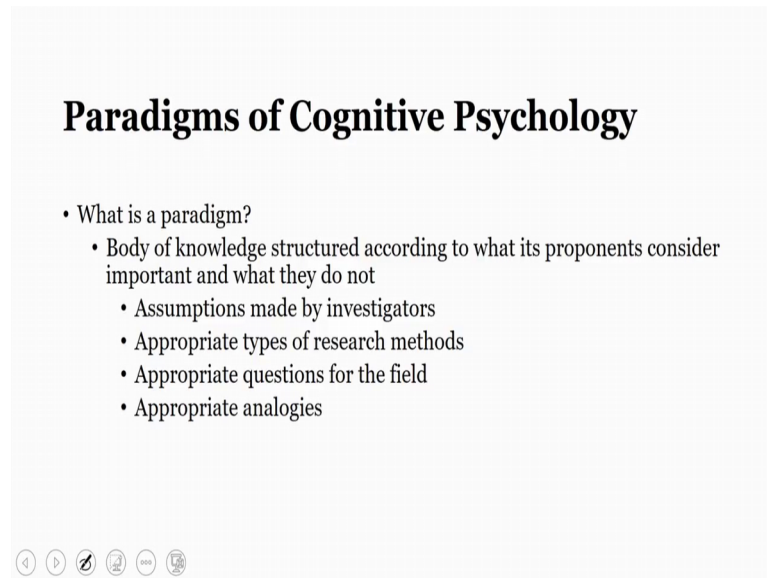
these multiple evaluations although this is much faster, but these multiple evaluations are the reason for the increase in verification time. And so, the inclusion of the brain, the inclusion of the idea of the brain gives us a chance to identify what is the reason for the mental activity or what is the reason how this mental activity is taking place.

Another interesting thing is the idiocracy, theory is the requirement of idiocracy. What does it say? The inclusion of the brain into the understanding of mental processing or mental processes gives us this chance to understand what necessary or what adequate processes or what requirements are there for certain mental process to take place. What does this mean? It means that if 4 different processes or if 4 different answers of a particular way, a particular process through which a mental experiences felt is being proposed, given the structural constraint of the brain which of them will be the most correct. What do I mean by this?

In the first part I have explained that multiple processes will give the same result. But how do I go ahead and look at which of this is the most optimal or which of this is the most optimal theory, the best theories or best thought of theories, because there will be several theories there will be several reasons of how the mental process appear. And so, what the idiocracy laws will tell us is that given the constraints of the brain given the constraints of what the brain has or what structures of the brain are which of the theory explains the processing or the answer to a mental process or the output to a mental process.

And so, idiocracy laws says that brain inclusion of the brain will help us in pinpointing which theory works in which theory does not and what should be done for theories or what changes could be done in a theory to adjust it. So, that it explains a menl mental phenomena.

Paradigms of Cognitive Psychology

- What is a paradigm?
  - Body of knowledge structured according to what its proponents consider important and what they do not
    - Assumptions made by investigators
    - Appropriate types of research methods
    - Appropriate questions for the field
    - Appropriate analogies

Now, there are certain paradigms to the study of cognitive psychology. First of all, let us understand what a paradigm is. It is a body of knowledge structured according to what is proponents consider important and what they do not. So, it is basically what should be the basic idea behind cognitive psychology, or what is the basic matter behind cognitive psychology. And so, this these paradigms are assumptions which are made by investigators appropriate types of research methods, because these paradigms then when I use a particular paradigm when I use a particular approach to study cognitive psychology, it will not only give leaders to having a set of assumptions, which vary across paradigms. But it also gave us different methods of research of the same different processes, or the same mental process.

It will also give new questions in the field. So, the same processes same mental process or same mental activities, if it is studied by different paradigms, if it is studied by different approaches not only will it give us different types of research methods of having same process. But it would also give us new questions, and also new analog is to it or new similar problems to it of how the solutions can be generated. And so, in cognitive psychology, there are 4 basic paradigm that I wish to make you aware of here.
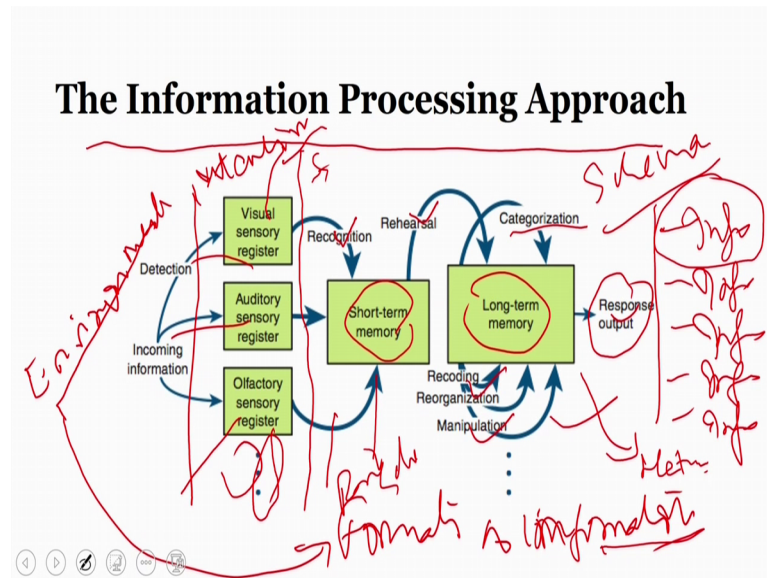
The first paradigm is called the information processing approach. And so, this approach started with the cognitive revolution. The part of this approach this approach comes from the structure list. And what this approach says is that cognition is basically information passing through a system. So, there are several systems out there seres several process systems in in the mind, and these process systems takes in information from a previous process a processing system, and passes processes it in certain way and passes it along to the next system.

And so, information processing approach says that cognitive psychology the subject matter of cognitive psychology should be how these systems process information. The basic information processing approach is built in this way. It says that any information, which comes out or which people encounter from the environment is first detected. So, this is the environment. And this environment provides certain signals, or certain kind of information and this information is detected by the mind or by the brain using a process called attention.

This attention then separates the different formats of information which are passed on from the environment. So, the information which is passed on from the environment could be in visual medium, it could be an auditory medium, or it could mean olfactory medium or the other 2 senses which is heptic or the taste gustatory.

Once these different formats, or this different types of information is detected by the human system through process of attention, it is passed on to something called a short-term memory. And what is short term memory? It is a system, or it is a place where information which is taken in through a process of perception using attention is thrown here or is put here for storage. Now this storage system is a temporary storage. And so, if people do not rehearse this information, do not go ahead and repeat this information, it is lost here through forgetting.

If it is rehearsed it goes back to something called long term memory. Also, information which is coming out from the environment is first recognized through perception. So, perception has certain filters and these filters are 3 these basic modules will recognize different information which is coming from the environment.

I am talking about here the content. So, based on the content the information is stored in short term memory, from the short-term memory it is rehearsed it goes to long term memory. Once the information comes into long term memory, this is basically categorized into already so existing information systems or information places in the long-term memory. So, mostly long-term memory has a very categorical structure.

Since long term memory has a lot of information to into it. So, what it does is, it categorizes information into different categories. What are these categories? These categories are generally formed through something called schema. If it is episodic knowledge, or it if it is semantic knowledge, this categorization is done through something called hierarchical tree structure. What you need to understand here is that this long-term memory takes in information from short term memory, and it binds this information which is coming from short term memory into already existing long-term memory information.

For example, the next time you see an apple you do not need to learn that this is an apple, what happens is when an apple is presented to you this apple is perceived by your perceptual system. The perceptual system identifies a scale color shape and these kind of information's texture passes on to short term memory. The short-term memory takes this information ask the long-term memory in terms of given the fact that this is the format and this is the meaning or this is the kind of information that is coming from this

structure or this mental representation what could be the long-term memory then compares this information and tells you that this is an apple.

Or if tomorrow a black apple comes in. Now when I taste it, when I see it, it looks like an apple, but the possibility of black apple is not there. So, what the brain will do is, take this black colored apple compare it with features which are existing in in the long-term memory. And so, since the black apple has most of the features, which is similar to any other apple only the color is different. So, what will happen is this black apple now gets stored up or gets included into the category of apple which are already stored in long term memory with one pointer to it or with one exception to it saying that this is a black color apple, because most apples are green and red in color. So, this is a unique feature which says that it is black in color.

So, this is what the information processing approach says. It says that any information comes in or it passes through certain stages, and these stages define how an information or mental activity defines, how an information path is processed through this system. Now the information processing approach tells us about the systems, the processes and the goals. What is the systems here? The various systems which help in the processing of information are the sensory memory here, the short-term memory here, the long-term memory here. What are the processes which help us in in understanding this mental experience or in sending mental activity our processes recognition rehearsal recording reorganization manipulation categorization and so on and so forth, and what are the goals of it the goal is the response the goal is the understanding?

So, in the apple example the processes which help us and understanding the apple is the short term memory, the long term memory, the perceptual systems those are the processes what are the sorry, those are the structures, those are the systems, the processes are the process of encoding the process of recognition the process of rehearsal the process of response manipulation the process of identification recognition these are the process through which you identify this apple, and the response the output is storage of a new kind of apple. The response output is the information the knowledge that a black apple also exists. This is the goal. Though the goal is to understand that that can only be cal can also be black is achieved, through a system of processes.
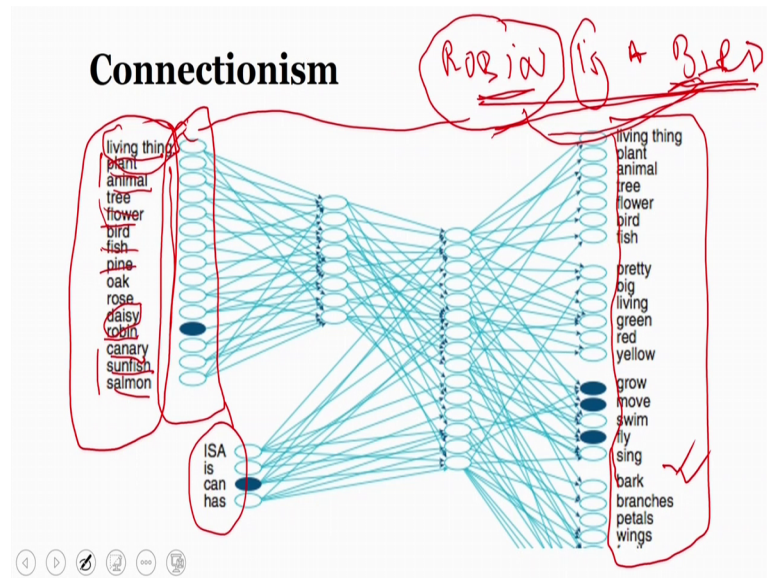
The second paradigm which has been used or which is popular in cognitive psychology is connectivism. What is connectivism? Now connectivism is also known as parallel distributed processing model. And what it says is that there are several small units, which are connected together and these connections lead to the formation of mental experience.

In the information processing approach, we saw certain systems interacting with certain processes to give a particular kind of a goal. In connectionism what happens is there are several small units, and these small units connect to each other through certle connect connections, and these connections later on lead to the formation of mental experience. How does this connectionism works?

The basic fundamental premise of this connectionism theory is that individual neurons in the brain they do not transmit large amounts of symbolic information. But instead they compute or they come up with the goal by being appropriately connected to large number of situational units. So, what is the meaning of this? It means that there are specialized systems. And these specialized systems are connected to each other. And these connections lead to the idea of mental process.

For example, let us understand, how this particular sentence robin is a bird. The mental experience to this is explained by connectionism. Look at robin. This is our name, it is a kind of bird. And so, if you look on this side of it falls from the category of birds. So, there are robin a canary sunfish Salomon all these are birds, and these fall under the

living things, living things have are further divided into plants and animal. Then into trees and flowers, bird fish, and so on and so forth. So, basically on this side you have a system of connections through which in which you have categorization in terms of living nonliving birds animals and so on and so forth. And so, robin forms robin goes here the name robin goes here

Is or is a is basically a connector, which defines what is the relation of robin to the word bird. And once robin which is a bird is connected to 3 to this connection of is a. We can then say that if the mental experience of robin is a bird can then conclude or can give then can give us the idea that since robin is a bird it should have wings. It should be able to fly, why? Because the idea that bird falls under the category of living things. And living things certain features of living things are there. And these live certain features should be present on any member of living things.

So, bird is a member of living things. And so, everything that is there in the living thing should be present in bird. So, robin should robin which is basically a bird should be living, should be locomoting, should be doing daily activities and certain features of the bird should also be present in them.

The basic idea and connection is that it is not big processes. It is not big systems and process the connection between big processes and systems, which leads to the formation of mental activity or mental experience, but there are several connections between several networks which are there. There as there is a network of what a bird looks like, there is a network of what if there is a bird what is the basic feature of the bird and so on and so forth and this is how connections are.

So, small units small amount of units or small units combine together to give us the mental experience. Now these units which combine with each other to give us the kind of experience that trees where that we get when we talk about robbing is a bird. It they have certain weights. And so, weight wise combination will tell us what features should robin have.

Now, we will discuss connectionism the idea of connectionism in detail in the chapter of memory, where we look into what is semantic memory and what is the parallel distributing model there, and how symbolic the hierarchy structure of symbolic memory is and those things there. But the basic difference between connectionism and

information processing approaches in information processing approach there is one system there is a set of there is a set of system and set of processes which leads to the goal, but whereas, in connectionism several units several independent units they combined together to give us the mental experience.

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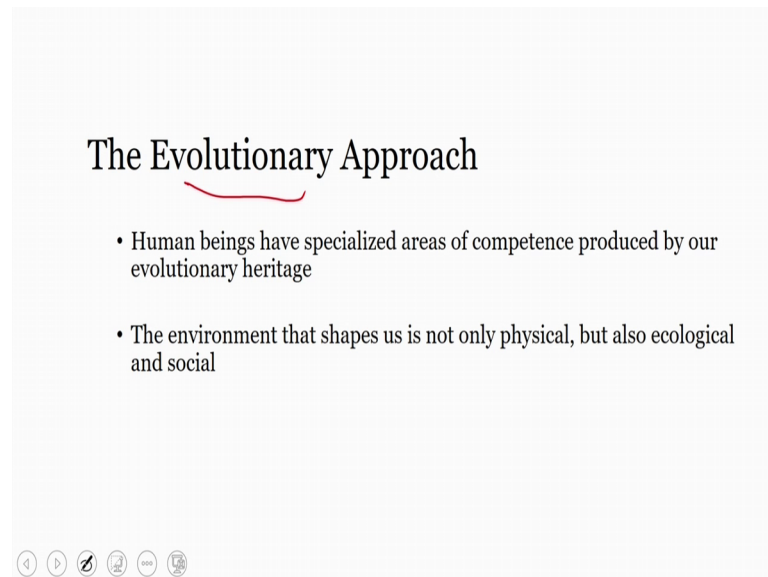
The third approach to studying of cognitive psychology is called the evolutionary approach. Now what this approach does it says that the study of mental processes through the ways in which the IP model the information processing model, and connectivism connectivist models look at they, basically do not count for evolutionary features, or evolutionary approaches, evolutionary inputs to our understanding of cognitive psychology.

So, what they say is cognitive psych subjective matter of cognitive psychology is not how mental processes are studying off mental process, how mental process a process, but there are certain specialized, competence which comes through evolutionary input. For example, basic cognitive abilities like language and 3-dimensional perception of perception of depth are present in very small children. And they do not need some kind of mental experience for them to develop that.

And. So, what evolutionary approach says that human beings they have very specialized ideas of completeness produced by our evolutionary heritage. Evolution has a role to play in cognitive psychology. So, the subject matter of cognitive psychology the view the

way of looking at what cognitive psychology should study, should not only be the study of mental processes, and thoughts it should also be how evolution has made us think in certain ways or behave in certain ways.

What they say the evolutionary approaches say is that the human mind is basically a biological system that has evolved over generations. And the development of the human mind has come through a process of natural selection. So, certain features or certain aspects certain working of the human mind or the human brain is inbuilt is evolutionary in nature and nature has given us this kind of system to process information.

So, basically then the evolutionary approach will use evolutionary as one of the reason of mental experience and one of the basic views or one of the basic ways of looking at how mental experiences are processed.

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And similar to that is the last approach which is called the ecological approach. The ecological approach goes ahead and says that mental experiences or cognition does not occur in isolation. All cognitive activities take place in certain context. And so, contexts are very important in studying cognition

So, just studying the mental processes or what is going in the brain, what is going on in the mind, how the brain or what the brain does, or what mental experiences are what kind of processes and systems make up certain kind of certain kind of mental experience,

should not be the only way of looking at cognition of how cognition happens, but one way of looking at cognition or one viewpoint of looking at cognition is also in terms of the ecology or the culture in which people live. Because culture has only a large role to play of how information is processed. Certain cultures do not allow information probe to be processed in certain ways certain, cultures allow information to be cert certain process in certain ways. And that leads to the different kind of information processing or different kind of thinking.

Think of the individualistic and the cult and the collectivist culture the kind of culture that the westerners have individualistic in nature and the kind of culture that we have here the Asian countries have is more collectivist nature. And so, the way the mental processes, the cognition of people who live in the west are entirely different from the way we live in our country, because we have a collectivist culture.

The reason is that from right on right very beginning they the westerners are taught to be individualistic taught to be alone taught to be doing things on their own. And so, they process information in an entirely different way. Whereas, the as in as Asians since we live in a collectivist culture what really happens is the way we perceive information is always in terms of how the whole society will look into it.

So, basically then the clo ecological approach says is that all collect cognitive activities are shaped by the culture and context in which they occur. And so, this brings an end to the base the first section of where we looked at the history of cognitive psychology. The subject matter of cognitive psychology, the various paradigms of cognitive psychology of what it should be the what is the subject matter what is the content what kind of things are studied into it what kind of processes are there and what is the input output kind of a system. This is the basic introduction to the history of cognitive psychology.

In upcoming lecture what we look into is how do we study cognition. Now as I said cognition is the mental process, processing of mental activities or mental representations. So, how do we study this processing how do we study this cognition in action is what we will do in next lecture. And from there on will slowly move on to other cognitive processes or basic cognitive processes such as perception, things like attention, things like memory, this decision making and so on so forth.

Thank you.