Human Behaviour
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Lecture – 12
Language – II

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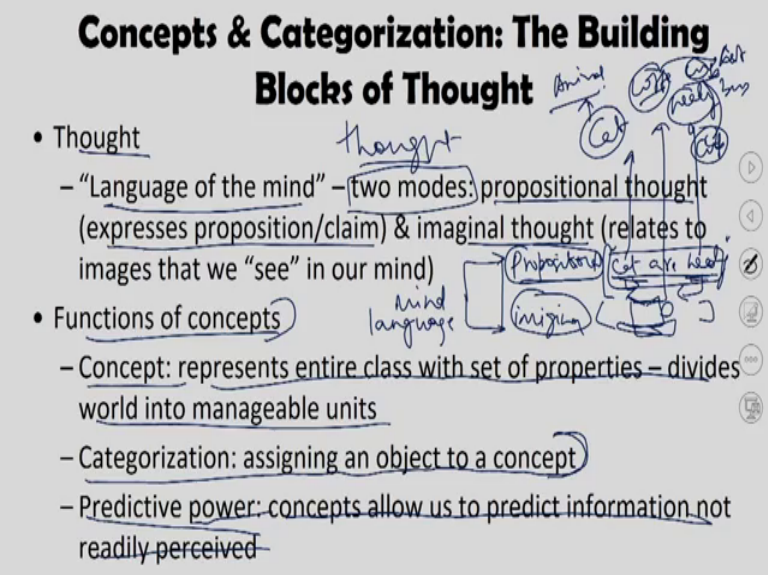

Friends, welcome back to this 12th lecture, in the series of course on Human Behavior. Now, this course I promised will actually help you to understand human behavior and the science behind doing human behavior that is psychology is what is the core of this course. Before we unwind, what is there in today's lecture, let us take a quick journey back of how we travelled through these 11 lectures.

We started off by looking at the basics of the science or psychology which is the core of human behavior; we explained the scientific routes and the philosophical routes or psychology and the various schools of the psychology. We explained some diverse schools of psychology and then we went ahead and looked at various tools of how to do psychology including experimentation, correlation, case studies, literature review and so on and so forth.

Then we moved on to the idea of sensation which is the process through which physical stimulus is encoded into the psychological domain; then we looked at the properties of

sensory systems. Two basic properties of sensitivity and sensory encoding is what we evaluated in detail.

We looked at the idea of how signal is detected from noise and what are the mechanisms on parameter of a system which detect signal from noise in terms of the human brain and then we took a model system which is the human eye and applied all these sensory characteristics on the eye and saw how it functions. Then we moved on to process which is called perception which makes meaning or which provides meaning to all sensory stimulus, which is encoded through sensation. Then we looked at the necessity of perception, the various schools of perception and the various processes in perception like attention, localization, recognition, abstraction and constancy.

Then, we moved on to another interesting concept which is the concept of learning; whatever information is encoded by sensation and organized by perception is learned by the brain and stored somewhere and so, the next two sections of learning, conditioning and memory were focused on this process. Sections on learning covered the difference between non-associative and associative form of learning; within the non-associative we looked at habituation and sensitization, and within the associative form we looked at classical conditioning, operand conditioning and observation learning. We dwelled ourselves into the associative form of learning because these are the most popular form of learning most studied forms of learning.

So, we looked at the various parameters, various factors and implications of these different kind of learning. We moved on to a section on memory which is the process which stores whatever learning has happened whatever information is learnt. We started off by defining memory as a 3 (Refer Time: 04:31) process starting with encoding going on to storage and then later literature about process. We looked at the two schools of learning which is the active differential school and the rural network school.

Then we focused on the concept of Atkinson Shiffrin and described how the short term store which were defined as a passive store in Atkinson Shiffrin was removed by a more dynamic store, the working memory store. We also define what kind of material stored in these memory systems, we dealt in detail the long term memory and described the distinction of long term memory into the declarative and procedural part. We further looked at how this declarative part is sub divided into semantic and the episodic part.

We did not dwell too much into the procedural part. We looked at too many factors of how each part of the memory is influenced, what are its implications, what are the parameters which defined what is saved, how it is retrieved and we have also looked at what is forgetting.

Next, we venture into higher order learning process or higher order cognitive process and the last section, the last lecture that we did was dealing with one of these higher order processes which is language. We started off by differentiating between communication and language and how communication and language are used to communicate ideas between people or across beings. We saw how human beings acquire language, we saw what are the properties of any language and we took a model system which is the English language, we ventured into the idea of what is phoenix which is the basic features of sound.

Then the basic word unit which is the morpheme moving on to the word unit which is the complete word and looking at the sentence level. Then we looked at what is syntax and grammar and how syntaxes are found. We described how language is used to pass one information between many beings. Then we looked at how languages are acquired, whether it is a innate thing or irate conditioned. Not only that we also looked at the neural basis of the language which is what kind of affairs he has or problems can arise in certain regions of the brain are blocked or certain regions the rain brain are not active.

Now, in today's lecture we will continue with this idea of higher cognition and discuss three more features of higher cognitive process. One is concept and concept formation thoughts, the second is in terms of reasoning and the third is in terms of problem solving. So, we start off today's lecture by looking at what is thought and how this thought is related to categorization and classification.

So, basically when human beings produce language they have to start at the level of the thought. So, even when we are producing a language or comprehending a language whichever way we are producing language it is either start with the thoughts or ends with the thoughts because it is ideas or thoughts that we express and that we want to transfer between two human beings or two entities.

Now, what is thought or thinking as you may say? Thought is called as the language of the mind similar to the languages that we use for communicating ideas in verbal or non

verbal terms the mind also communicates with its different parts through a particular kind of language and that language is called the thought. Now, generally the thought has or the language of the mind has two different modes there are two different thought processes or there are two different ways of exchanging ideas between different parts of the mind. The first is called the propositional thought which expresses propositions or claims.

So, in terms of the mind or in terms of the language of the mind there are two thought process or there are two modes; one is in terms of the propositional and the other is in terms of the imaginal. Let us look at the sentence, cats are needy. If you look at it is the propositional thought and a propositional which has two ideas combined together. One idea is that they something called the cat a concept of a cat or concept of a animal and the second idea is that it is needy and so, expressing the fact that cats are needy or the fact that cats are one of those animals which actually beg you to a food or actually are to need based to express that idea we can use a language like this.

Now, in this language or in this propositions it is said that two ideas which are combined together and the whole idea that cats are needy is passed along. We can also have the imaginal language or the imaginal thought process. For example, if I ask you to imagine a cup of coffee on a plate what you do now is not expressed thought as language rather you imagine or you start thinking in terms of the image of coffee. Now, if you remember back from the course on perception, I talk about something from Zion's and so, here when you start imagining about a cup of coffee or we start thinking about a cup of coffee you start assuming certain Zion's in a particular orientation and the very idea of a steamy coffee.

And, so, thoughts in the brain can be explained through these two formats. Now, generally most propositions are actually statements which express a claim and most imaginal thoughts are images which are thought about or images which contain certain kind of meaning. Now, as you look at the propositional thought or you look at the imaginal thought both of them pass over an idea. In this case the idea is cat; one idea is the cat, the other idea is it being needy. If we look at the concept of a cup of coffee it is passing two idea coffee and the idea of a cup. Now, what are these - cats, needy, cup, coffee these are ideas and these ideas actually represent parts of a concept.

What are concepts? Concepts represent an entire class of objects. If I call the cat, the cat is part of a concept of the animal. Similarly, if I look at coffee it is a part of a concept which is hot beverage and if I look at the cup the idea of cup it is part of a concept which is kitchenware or dishware. So, what is concept? It is a way of expressing an entire class of object.

Now, what is a need of concept? What are the functions of concept? Why it is needed at all concepts are needed because they help us in many ways. Concepts ease our world or help us ease our world and one of the first function of concept is something called maintaining cognitive economy and what is maintaining cognitive economy? Concepts help us organize the world around us.

So, concepts represent entire class with a set of properties which divides the world into manageable units. There are so many objects around us and if we start naming each and every object it is very difficult for us. So, we have managed to classify objects together to combine objects together into wholes into bunches and these bunches are what are called concepts.

For example, there is a concept of animal and so, all kind of animal fall into that. There is a concept of furniture in which all kind of furniture, for example; table, chair everything falls into that and, so, there are many concepts. And, so, concepts actually help us in managing objects, in managing the world around us. Also, concepts helps in categorizing which is assigning an object to a concept.

So, categorization is a process which actually helps in assigning an object to a particular concept. Taking similarities of following certain rules we club objects into certain concept and this process of using either certain rule based mechanism or certain similarity based mechanism and clubbing them together is what is called categorization.

What is the second function of concepts? The second function of concept is that it has predictive power. Concepts allow us to predict information not readily perceived. For example, let us say the bird robin. Now, robin is a bird or kingfisher is a bird which we do not see often in our country, but then if you want to predict something about robin or kingfisher for that matter all we need to know is the concept of the bird and from there we can have certain features which should be true for robin. And, that is what concepts actually do. It helps us in predicting what a robin would actually is have. So, if you have

ever see a picture of a robin you can easily predict, what it will have or what kind of features it will have.

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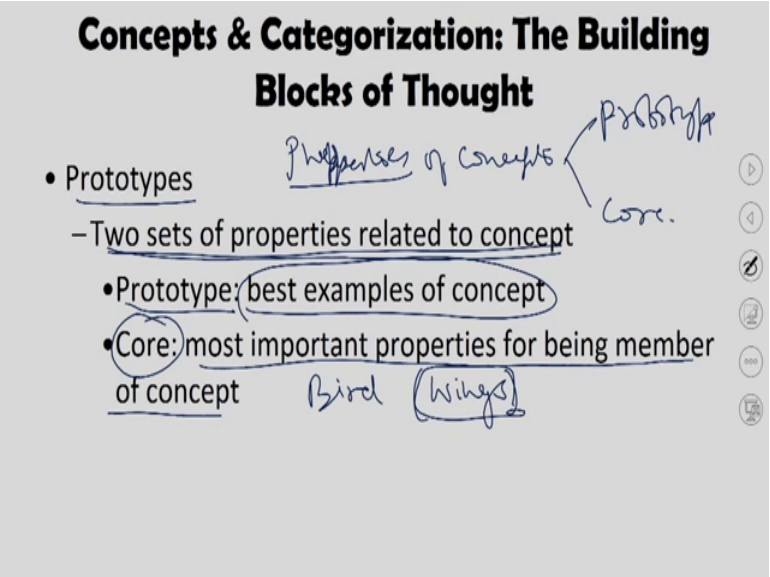

Prototypes, the properties of a concept. Any concept has two properties. How do we classify the objects into concepts on terms of properties that a concept has? Now, most concepts has two properties – one is called the prototype and the other is called the core. So, two set of properties are related to the concept.

One is called the prototype which is the best example of a concept. So, if I take the animal concept or the bird concept, the best example of the bird is the common crow or the sparrow or the sunbird in terms of our culture because these are the most visible form of the bird. If you look at the animal or mammal, they may be best examples. And, so, prototypes are the best examples of a concept.

Similarly, core is that property of the concept which should be present in all members of that concept for it to be called a part of the concept. This is the most important properties for being a member of the concept. For example, if you look at the bird the most important property is wings birds are known to fly and so, the most important property for any bird to be part of the concept of bird is that it should have wings.

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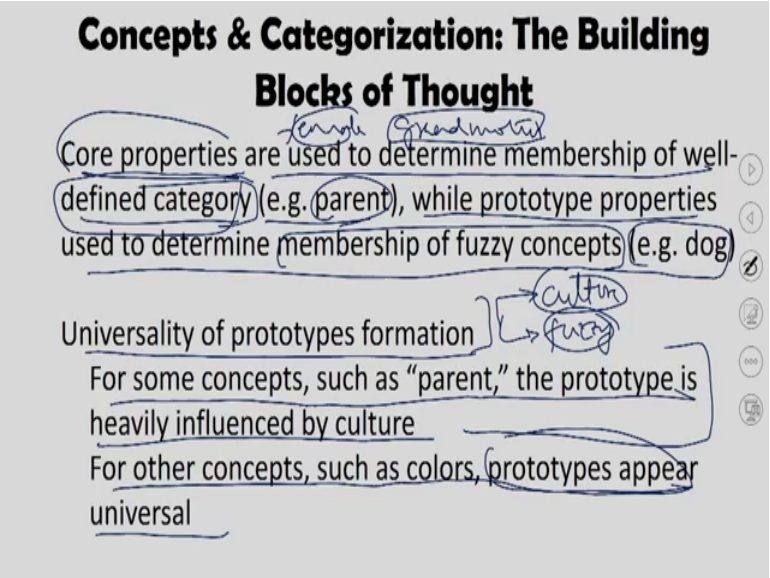

So, the core properties are used to determine memberships of well-defined category example a parent while prototype properties are used to determine membership or fuzzy concepts like a dog. So, generally when we are looking at well defined categories or well defined examples of categories, we need the core property. For example, when we are defining a parent; now, when we are defining a parent or a grandmother, for that matter now the core property is, that it should be a female because only females parent would be a grandmother. And, so, the core property here is the idea that she is female; a grandmother would be a female.

Now, what happened is this is a well defined concept prototype properties are used to determine membership of fuzzy concepts. For example, dog when a concept which is fuzzy which has no clear boundaries or which are not very clearly defined, for example, the color red now red everybody would understand, but the idea of red is different across different people because it varies in terms of hue, saturation, red varies in terms of redness dog varies in terms of his dogliness, right.

So, when we when we define dog we do not generally go for the female or the male dog or big or small dog and that kind of a thing. So, for fuzzy properties it is the prototype which is used for defining members of that concept whereas when a well defined concept is used well defined category is what is being defined as a core properties needed.

So, our prototypes universal in nature. Now, answer to the question lies in that some prototypes are dependent on culture and other prototypes are fuzzy and they are universal in nature. For some concepts such as a parent the prototype is heavily influenced by culture. Some cultures have the idea of getting married early and for them even 25 years old can be parent, other cultures the idea of parent is somebody who is old and for this kind of a concept the boundaries are well defined. So, they are cultural based. For other kind of concept, such as colors, prototype appears to be universal.

Now, here for example, color is as explain red. Now, red is something which is accepted all across the world. Everybody know what is the red color, but the idea is, what is red? The red redlines of a red or the hue, saturation those kinds of things may vary, but the idea that red is red and so, for those fuzzy concepts the prototype is the best way of explaining it.

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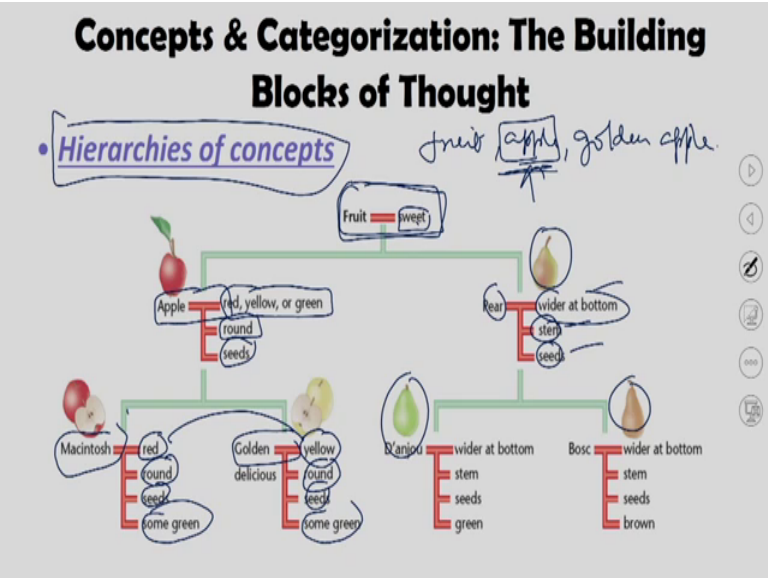

Now, concepts are expressed in terms of hierarchies. Properties of concepts and how they are related together can be defined in terms of a hierarchy. Now, most concepts actually fall in terms of hierarchies and so, any object which is classified as concept can be identified at many levels, but there is one level which is called the primary level through which our concepts is identified which is basic for classification. For example, the apple can also be a golden apple and can also be a fruit, but whenever you think of an apple you think of an apple as apple not as a golden apple neither as a fruit.

So, most if you look at the how the hierarchy of the concepts are arranged; if you look at apple it falls under the fruit and so, the most defining property is sweet. Now, within the fruit you have the concept of an apple which has three properties red, yellow, and green, they are round and they have seeds. And, within the apple you can have different kinds of apple for example, you can have the Macintosh apple and you can have the golden apple. So, Macintosh apple it is red in color with round, seeds and some are green. Whereas the golden apple is yellow in color, round has seeds and some green and so, one distinguishing property is there.

So, when I show you a fruit which is like an apple the basic property or the basic level through which this apple is classified or through this object is classified is through the level of apple and this is called the basic level. So, most classifications, most objects which are classified has a basic level of classification. Similarly, if you look at the pear the pear is this is what the definition of pear is. So, pear is the fruit which is sweet this is the basic property wider at bottoms stems and seeds and you have the D'anjou and you have the Bosc – two types of pears. So, basically then concepts are arranged in terms of hierarchies or members of the concepts are arranged in terms of hierarchies.

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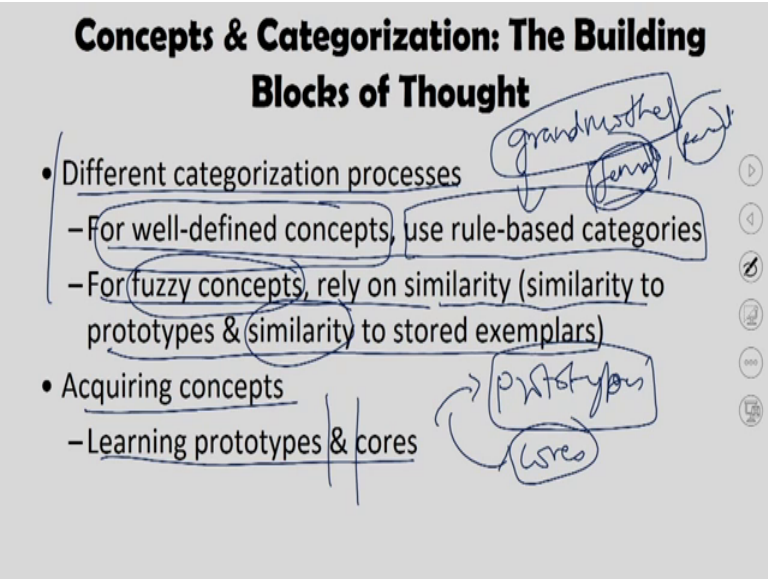

Now, there are different categorization processes which are used for making categories. For well defined concepts we use something called rule based categories. For example, if I am thinking of grandmother in this case the basic property is a female parent; now the

basic property is being female. Parent could be also be a male parent, but male parent is not a grandmother and so, for this kind of well defined concepts a basic property like this or rule based categories are used.

For fuzzy concepts the reliability is in terms of similarity, similarity to prototypes and similarity to stored exemplars for example; different kind of apples. If I try to classify them as apples, then how do they classify this different kinds of apples into apples? Based on how similar they are. So, what I am mean here is that when a category is well defined, a concept is well defined, then we use a rule based categorization in a system and these rules are followed for taking any example or taking any a member of that category and classifying it into those categories or classifying them into those well defined categories.

But, when we have a fuzzy concepts we rely on classification happens in terms of how similar members are to one another and how similar not only to one another, but to stored exemplars how similar they are and that is how we define the categorization process.

How do we acquire concepts? Now, learning of prototypes and cores. Generally we acquire concepts by learning certain prototypes of concepts which is the best examples of a concept and learning the cores of a concept and this can happen through parental teaching, through personal experience, through any kind of teaching, through conditioning and so, those are the methods through which we actually learn about concepts.

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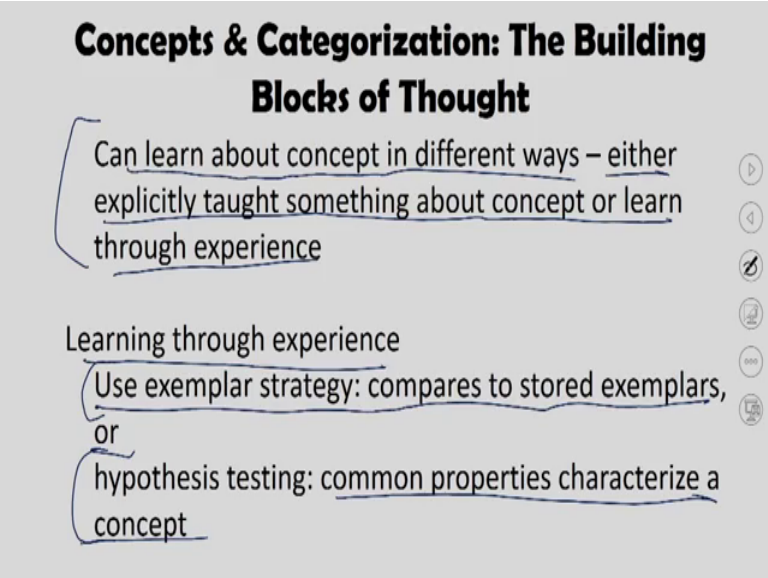

Now, we can learn about concepts in different ways either explicitly thought something about the concept or learn through experience. So, it can happen that your parents, elders or people around you could explicitly point out that this particular item falls under this concept or this particular item is an example of this category and that is how you can learn or you can also learn through experience. For example, use exemplar strategy compares to stored exemplars or hypothesis testing.

So, in exemplar strategy what we pretend to do is take a member of the concept when we encounter a member of the concept we take this concept and compare it to some stored exemplars, some stored examples of this concept and through comparison we classify the new object into the particular category. Similarly, in hypothesis testing what we do is common properties characterize a concept we look at common properties between the new item, that we want to categorize and make a hypothesis of where this new items should actually go.

So, for example, a watch which could make you do calls what would you call it you cannot call it as smart phone as of a classifying object like this we compare properties of this watch to a smart phone to a watch to so many categories and closer this watch becomes to a category the better or the more easier the classification becomes for us or more easily we can classify this watch into a particular category. We can also make certain hypothesis.

For example, if we cannot see the watch the function of the watch, but we know it can make a call. So, you make a certain hypothesis saying that since it has traps and it can be worn on hand, the hypothesis is that it is a watch. And, so, we take the hypothesis and look at all exemplars of it, all uses of this, how many people use it and how they use it. And, if we see people wearing this in hand and looking at it for time then we can say that it is a watch and hypothesis is get tested approve and we store it is a watch.

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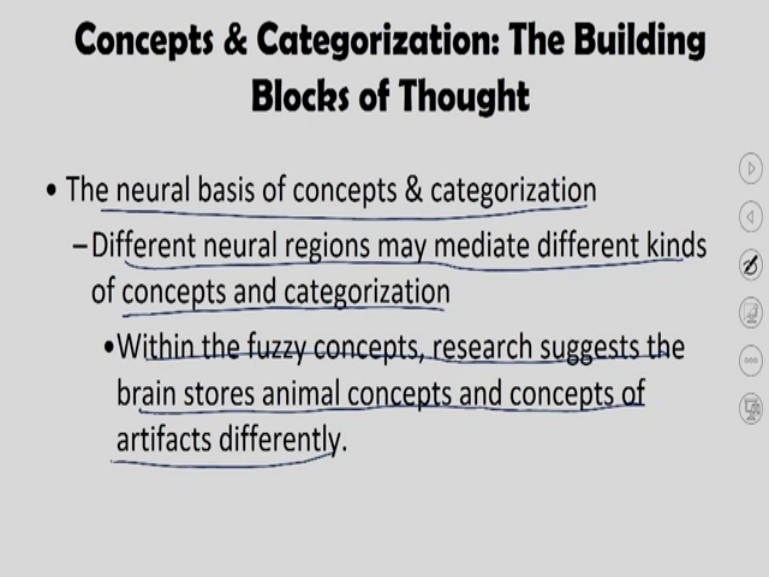

The neural basis of concepts and categorization. Now, different neural regions may mediate different kinds of concepts and categorization. Now, within the fuzzy concepts research suggests the brain stores animal concepts and concepts of artifacts differently.

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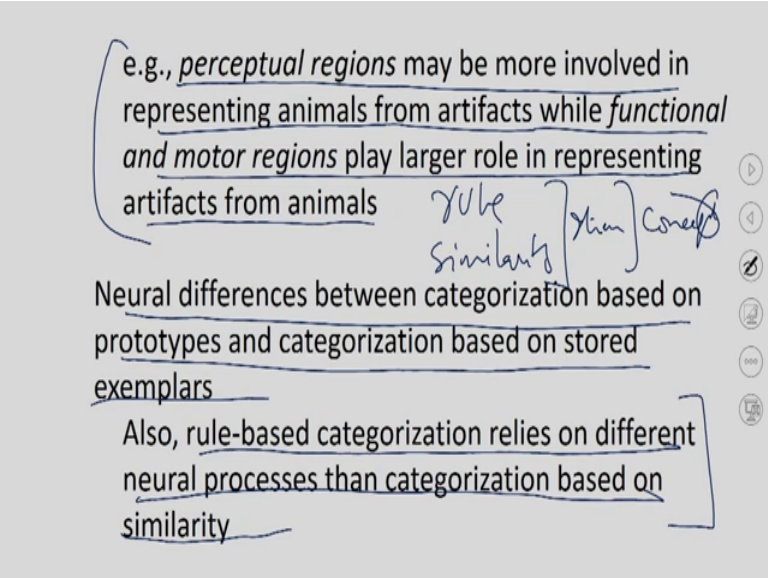

Example, perceptual regions may be more involved in representing animals from artifacts while functional and motor regions play larger role in representing artifacts from animals. So, these are the regions the perceptual and the motor regions which actually play a role in classifying concepts.

Now, neural differences between categorization based on prototypes and categorization based on stored exemplars also exist. Now, rule based categorization relies on different neural processes than categorization based on similarities. So, rule based categorization and similarity based categorization of items into different concepts takes place in different regions of the brain and that basically suggest that there are different neural signatures.

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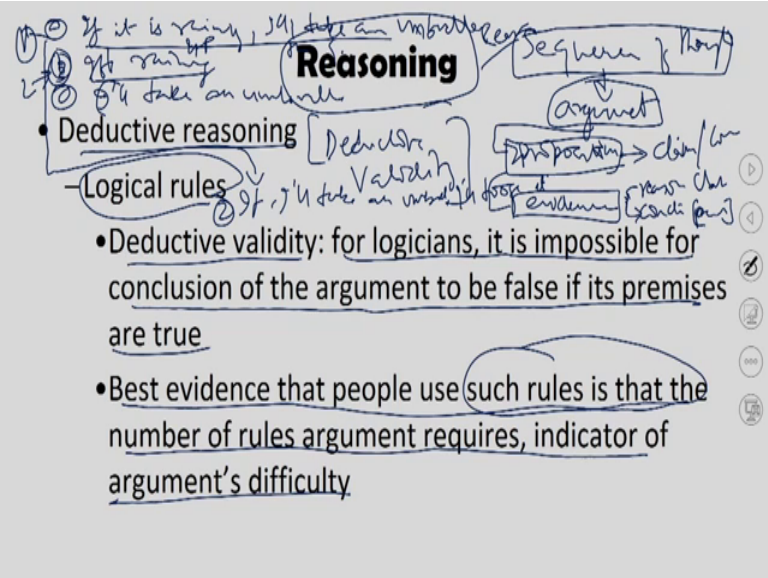

The next concept that we are looking at or that we would like to study is called reasoning. So, what is reasoning? When we start thinking in terms of propositions a sequence of thoughts is organized. So, reasoning is basically providing an answer or providing a reason and evidence for a particular thought to exist. Now, these reasonings mostly the reasonings that you have is starts with the sequence of thought and this sequence of thought actually form an argument. Now, these arguments has certain properties and they are composed of certain propositions.

So, a sequence of thought leads to arguments which are composed of many propositions. When we are reasoning a sequence of thought gets converted into arguments which has many proposers one of this proposition is the claim or conclusion and other propositions are the evidence for this claim. So, whenever we start thinking and we try to find evidence for particular thought process we provide a certain argument to that and these arguments that we provide are actually in the form of propositions. Now, these propositions or claims can be a claim or a conclusion and other propositions which are part of this argument are evidences which are or reason for the claim or premise for the conclusion.

So, this could be if it is claim then a reason for the claim and if it is the conclusion, then it is a premise for the conclusion. What do we mean by that? Wherever we have sequence of thought and we start thinking about the sequence of thought we have to

provide some kind of a evidence to support this thought or to recruit this thought and this process of providing evidences to support a recruit of a particular thought is what is the process of reasoning. Now, there are two types of reasoning that we will actually look into one is called the deductive reasoning and other is called the inductive reasoning.

So, what is deductive reasoning then? Deductive reasonings are known to something called deductive validity. In deductive reasoning what we tend to do is we tend to deduce certain conclusions from certain premises. There are certain statements which are given to us and based on the fact that, if the statements which are given to us are true the conclusion is always true, it follows like that and that is called deductive validity.

So, deductive reasoning have something called deductive validity which is for logicians it is impossible for conclusions of the arguments to be false if it is premises are true. For example, let us take this statement. This is the premise if it is raining I will take an umbrella. Premise 2 – it is raining and the conclusion which is I will take an umbrella. So, I have two premises; one is that it says it is in the form of if p then q and what says that if it is raining, I will take an umbrella. So, if p, if it is raining then q, I will take an umbrella this is one premise or one statement.

The other statement is it is raining if p then q and p is true if p is true then q is always true which is I will take an umbrella and so, given the fact that if premise 1 and premise 2 are true or any number of premise are true, then the conclusion is always true then that is called deductive validity and that is how deductive reasoning actually functions. This is the best evidence that people use such rules is that the number of rule argument requires indicator of indicates arguments validity.

Now, the fact that people use such kind of rules such kind of deductive rules for making judgments or for making reasoning valid reasoning is based on the fact that the more number of premises that I gave the more difficult in argument will be to validate and the more people will take time in validating this arguments.

For example, if I have the statements if it is raining, I will take an umbrella and I will add another statement to it if I will take an umbrella I will lose it. So, statement 1 is if it is raining I will take an umbrella; statement 2 is if I will take an umbrella I will lose it. Statement 3 is it is raining and if the conclusion is that I will lose an umbrella then it is true.

Now, how do we arrive with this conclusion or whether this conclusion is true or not let us look at the sequence? So, what we first do is we will look at a and c. If it is raining I will take an umbrella; it is raining which means that I will take an umbrella. So, from a and c I deduce the reasoning that I will take an umbrella, then I will go with b and c. The b is part of it says it says that if I take an umbrella then I am going to lose it. So, if I look at a and c statements from there, I will come to the point that it is raining and then I will validate b and d and b says that if I am going to take an umbrella I am going to lose it.

So, the conclusion d which is I will lose an umbrella is actually true and that basically says is that people use such kind of rules and the very idea that validating this rules, validating conclusions is difficult and it takes time is the evidence that people use some kind of deductive this kind of deductive reasoning or deductive rule.

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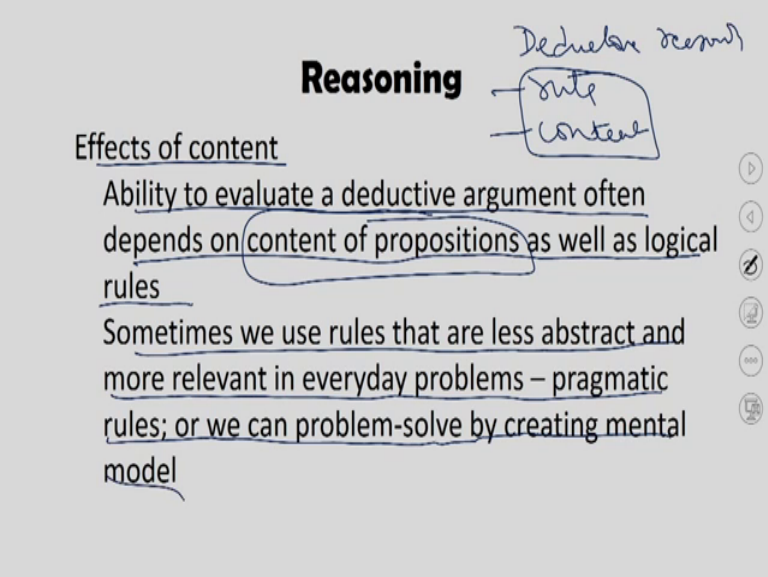

Now, there are effects of contents on deductive reasoning. The ability to evaluate a deductive argument often depends on content of the propositions as well as the logical rule. So, not only that people do deductive reasoning based on rule they also looked at the content of the statement. Any statement in reasoning examples have two things. One is called the truth value; the other one is called the validity. Each statement that I stated below, for example, if it is raining I will take an umbrella; it has one property which is called the truth value, the other property which is called validity.

Now, a statement may be valid, but may not be true and on the other hand our statement may be true, but it may not be valid, but for deductive reasoning validity is what we check we do not look at the truth statement. And, there are times when people look at the content of proposition what is being said on the proposition and based on that they actually do the reasoning. So, they fall in trap in terms of reasoning problems.

So, sometimes we use rules that are less abstract and more relevant in everyday problems. For example, pragmatic rules or we can solve problem by creating mental model.

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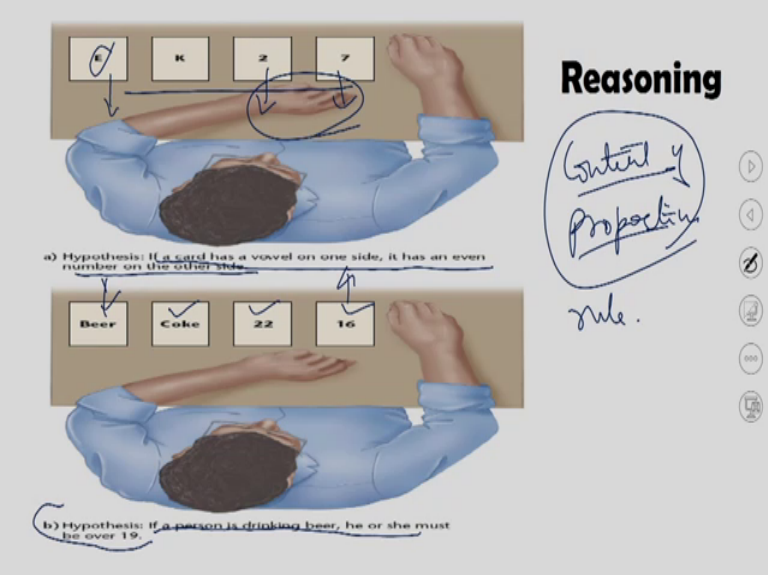

For example; so, how do we solve in those cases when a problem like that arises we either create a mental model for solving the problem or we use a pragmatic rule. Now, just to prove that content of the propositions what we said in a propositions also has a role to play in terms of reasoning and it is not just the rule that is used and experiment like this was created.

Now, a person is given four cards and he has to verify the statement if a card has a vowel on one side it has an even number on the other side and if the statements is given to you which two cards are you going to shuffle over. Now, given the fact that is this statement is given to you most people are going to shuffle over the E card and the 2 card. That is what happens, but that has not true. If you want to verify the statement which is if a card has vowel on one side and it has even number on the other side you have to actually

shuffle the E card and the 7 card. But, what we do is we shuffle the card which has the even number as well as the card which has the vowel in it to find out whether this rule holds or not.

But, given the fact that if people are given this kind of a rule to verify so, people have four cards it on one side it is one card has beer on it, the other is coke, the third one has a 22 on it and the fourth one has a 16 on it. And, the hypothesis is tested is if a person is drinking beer he or she must be over 19 years, which card would you actually turn over and in this case it has found that people use some kind of pragmatic rule, some kind of content of proposition for testing this statement and most people actually turned up the beer card and the 16 card.

Whereas in this case that is not true and so, this basically says that and why does this happens this happens because we are so familiar with we are a drinking people and age of a people drinking beer and the society loves for it that we do not fall prey to this kind of a reasoning or reasoning situation. But, here we fall prey to this kind of reasoning situation.

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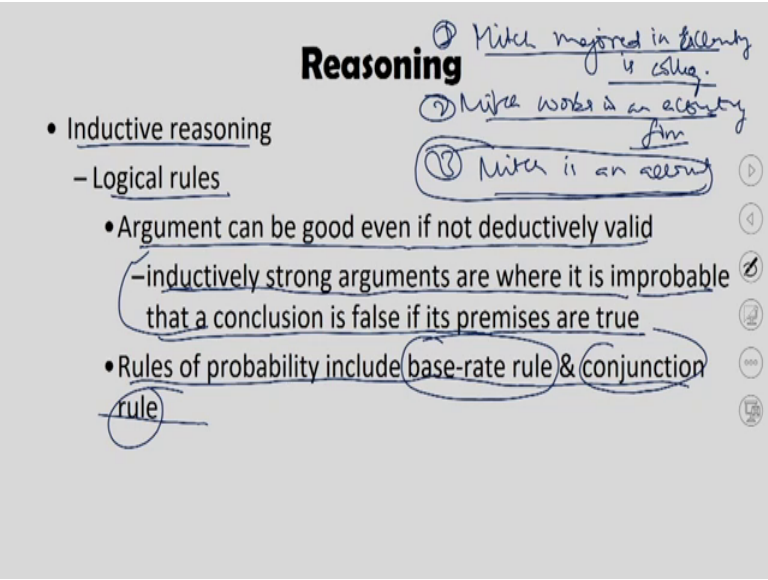

There is another kind of reasoning which is called inductive reasoning. Now, in inductive reasoning what happens is they follow sometime logical rules. So, here the arguments can be good even if not deductively valid. In inductive reasoning what happens is the conclusions are not always 100 percent valid. What happens is there is a probability that

the statement will be valid. In deductive reasoning if the premises are correct the conclusions are always 100 percent correct, but in terms of inductive reasoning the conclusions are probably true or they have a certain probability of being true.

For example, let us look at this sentences. Mitch majored in accountancy in college – statement 1. Statement 2, Mitch works in a accounting form. So, statement 1 is Mitch majored in accountancy in a college. Second is Mitch works in a accounting firm and thus the conclusion Mitch is an accountant may not be 100 percent true; the reason being that Mitch did major in accountancy and he also works in a accountancy firm. But, he may be a supervisor there, may not be any accountant.

And, so, the probability of this conclusion in inductive reasoning, because we are inducing; in deductive reasoning we actually deduce from certain clues which are there we extract an information. In inductive reasoning what we tend to do is there are multiple bits of information from which we try to create a conclusion and so, it is always probably true. So, there is a probability that he is an accountant, but the probability may not be always correct. So, arguments can be good even if not deductively valid.

Inductive inductively strong arguments are where it is improbable that a conclusion is false and if its premises are true. So, in terms of deductive reasoning the conclusion it is impossible for a conclusion to be false, but in terms of inductive reasoning it is improbable that the conclusion will be false.

Now, rules of probability include base rate rule and conjunction rule. So, the there are certain rules of probability, for example, the base rate rule. So, in doing inductive reasoning we fall into certain kind of trap for example, base rate. So, we do not look at how many items are there or what is the probability of one of the conclusion is true. So, we do not look at the base rate of the truth of the probability of a premise and we deduce the conclusion out of that and so, that creates something called base rate fallacy.

There is another thing which is called conjugation rule and so, in conjugation rule what happens is we look at two premises and we conjugate them together to get a joint probability and sometimes that leads to an error. So, if probability of a premise is 0.5 and a probability of a another premise is 0.5, we multiply them together to get a combined probability of a 0.25 as the probability of the conclusion and, so, that is problem sometimes, right.

So, details of this kind of probability testing for a inductive and deductive reasoning has been covered on my other lecture on cognitive psychology and so, if you look into reasoning there you will find in detail the explanation for this. So, now, this is a very primary class on psychology and I am just introducing the concept. So, we just introducing what is reasoning and what how does reasoning help us in understanding human behavior.

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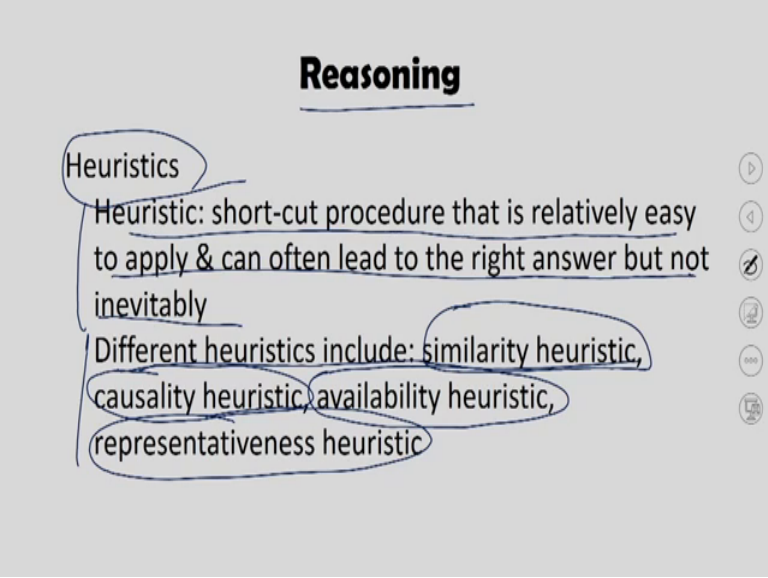

Now, we also use certain kind of heuristics in doing reasoning. Heuristics are short cut procedures that is relatively easy to apply and can often lead to the right answers, but not inevitably. Example is if you see a very tall person near a basket ball court we immediately assume that this person is a basket ball player and this is a heuristic or a fallacy, it may not be true as of this is a kind of heuristic that we use.

Now, different heuristic include similarity heuristic: people who are similar together we believe that they form in the same category. Causality heuristics if two events occur near to each other we actually provide them a correlation and believe that they happened together. So, that is called the causality heuristics. Availability heuristics availability heuristics is another heuristic that we use as the availability heuristic is the most available example of a particular kind of even leads us to believe that this event has happened and representative heuristic that is the basket ball player that we actually I explained to you and that heuristics are also used.

Again, if you want to look at details of this heuristic and how this heuristics are actually used in making inductive reasoning, please refer to my lecture on cognitive psychology the chapter on reasoning that we dealt in detail.

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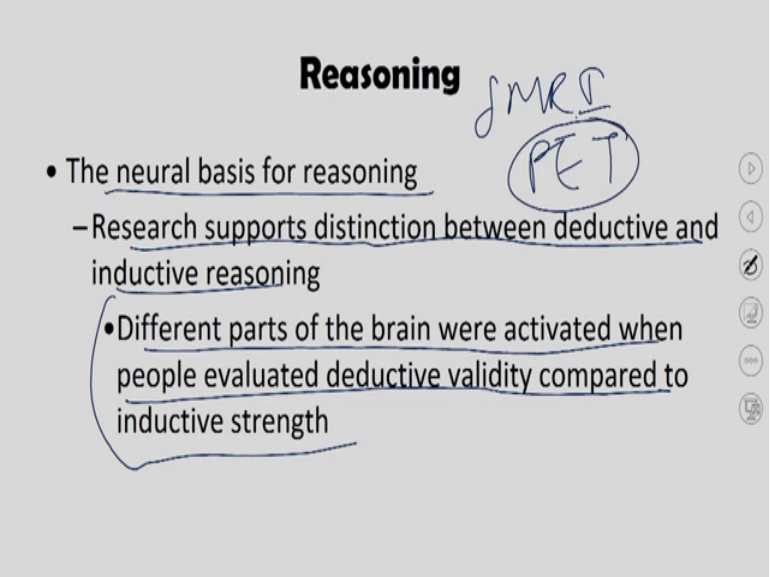

Now, the neural basis of reasoning – research supports distinction between deductive and inductive reasoning. Now, different parts of the brain were activated when people evaluated deductive validity compared to inductive strength. And, so, it has been MRI and or a fMRI has been done when a pet scan have been done. Now, these pet scan reveal that when people are doing deductive reasoning which is coming from general to specific, people use different regions of the brain, but when from specifics people conclude general statements which is inductive reasoning people use different kind of brain areas.

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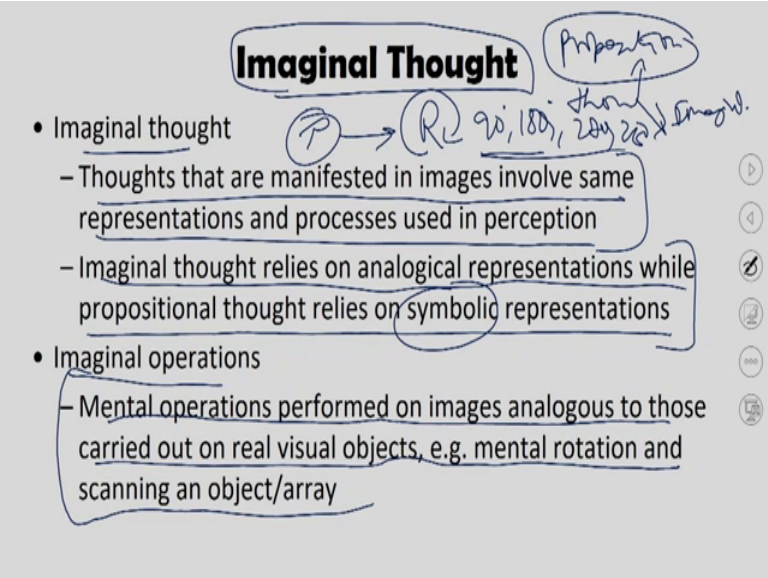

Another kind of thought so, up till we have been dealing with propositional thought now another kind of thought as I said human thought process is both propositional in nature which is in terms of claim and counter claims which can also be in terms of imaginal thought, in terms of imaginations.

So, imaginal thought – thoughts that are manifested in images involves same representations and processes using perception. When I asked you to imagine that has been found out that when I asked you to imagine a coffee cup and actually see a coffee cup the same parts of the brain or same kind of brain activity is activated, same representations are actually activated. Imaginal thought relies on analogical representations while propositional thought relies on symbolic representations. Imaginal thought works on actual pictures or actual images being transformed into the brain, whereas propositional thoughts work in terms of symbols and work in terms of logics and the manipulation of these symbols and logic.

Imaginal operations – manual operations performed on images analogous to those carried out in the real visual objects is example mental rotation and scanning of object. Now, imaginal operations to believe that people actually rotate images several type of experiments are designed and one of these experiments are letter R was taken and it was rotated anticlockwise into 90 degree, 180 degree, 270 degree, 360 degree and in between

degrees also and then it was rotated and people were also asked to rotate the or mentally rotate the letter and it was done physically.

And, mental rotation it was found out or some rotation of the letter was given to people which was not in one of these 90, 180 degree. People were able to match their imaginal thought to the actual rotation of the letter which basically meant there are many people were able to identify that rotation or identify that particular position of the letter because they were actually rotating the letter in their head.

Also, there was an experiment were an imaginal island was created and people were asked to move from one part of the island to the other part of the island now once that was done the time for people to move from one part of the island in terms of the map and in terms of the image was almost same and that basically is proposed that imaginal operations can actually happen.

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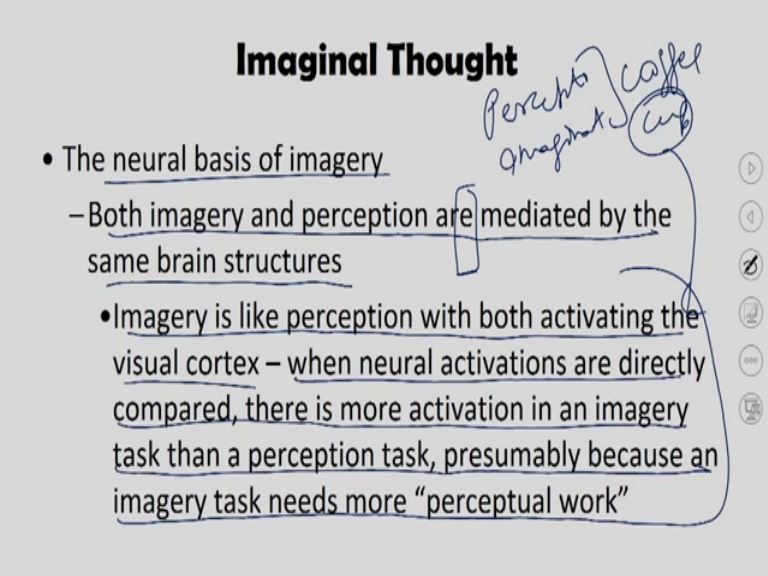

The neural basis of imagery: now, both the imagery and perception are mediated by the same brain structure. So, imagery and perceptions acquire the same brain structures and acquire the same brain processes for them to take place. Now, imagery is like perception with both activating the visual cortex. When neural activations are directly compared there is more activation in an imagery task than a perception task, presumably because an imagery task needs more perceptual work.

So, basically perception or imagination of the coffee cup requires the same brain region and same kind of mental operation, it was found that imaginations will take more rotations or more activations of the visual area of the brain.

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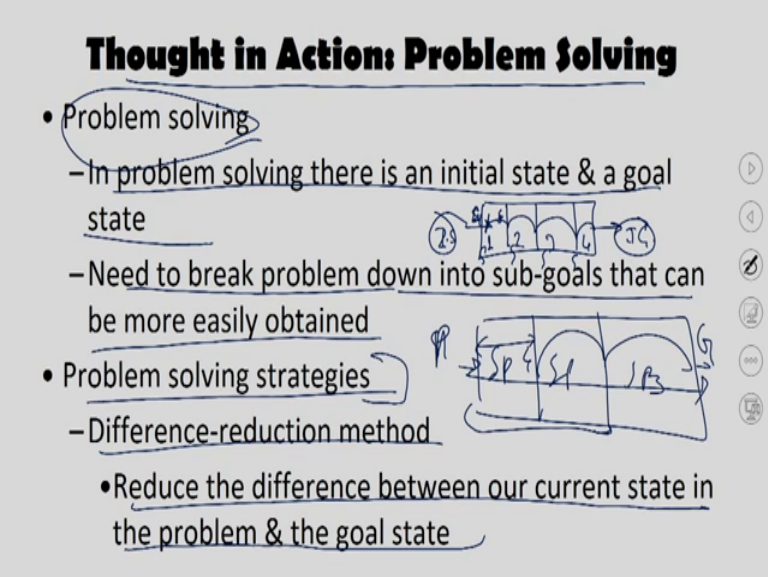

The last is the thought in action which is problem solving. Now, there is something called problem solving which is again higher order cognition and this higher order cognition helps us in understanding human behavior or understanding how humans actually function.

Now, in problem solving there is an initial state and a goal state. Most problems solving or most problems start with an initial state where you left off and a goal statement which you want to achieve. What we need to do is to break problem down into sub goals that can be more easily obtained. So, most problem solving actually start with a process of breaking the bigger problem into a smaller problems in attaining this one problems attaining the goals of this smaller problems and then looking at the bigger problems.

So, basically if this is what my problem starting point is and this is what my goal state is and these are the sub goals, what people generally do is define them into define these regions into these sub goals into many regions and so, this is my initial start and initial goal and then I put sub goal 1, sub goal 2 and sub goal 3 and sub goal 4. Now, it become sub goal one start and sub goal start of sub goal 1 and end of sub goal 2 then integrate them then integrate them then integrate them then integrate them to attain the final goal.

So, I divide the problems phase into smaller sub goals attain these sub goals and then integrate them together to end to end up at the final goal. For example, look at making tea. Now, how do we make tea if I ask you to make tea you have to at first break the problem of making tea into many parts. For example, first part is acquiring water, acquiring milk, mixing them in the right quantity, heating them on the stove, putting sugar cubes into it, putting tea leaves into it and so, this problem of making tea can be broken down into sub parts and then we integrate all these parts together then we finally, get the tea that we are looking for.

Problem solving strategies: now, there are several problem solving strategies. One is the difference reduction method where reduce the difference between our current state and the problem in the goal state. And, in this what we do is the final the if this is what my starting point or this is where my problem is and this is where I have to goal which is my goal state I divide the problem into sub problems.

So, this is sub problem 1, sub problem 2, sub problem 3 I solve the first sub problem and reach the goal from there, I solve the second problem reach the goal and so, I am much closer to the goal and third then solve the third problem and reach to the final goal, integrate the solutions together and come to the final goal. And, that is the difference reduction method where reducing the difference between the current state and the problem of the sub goal.

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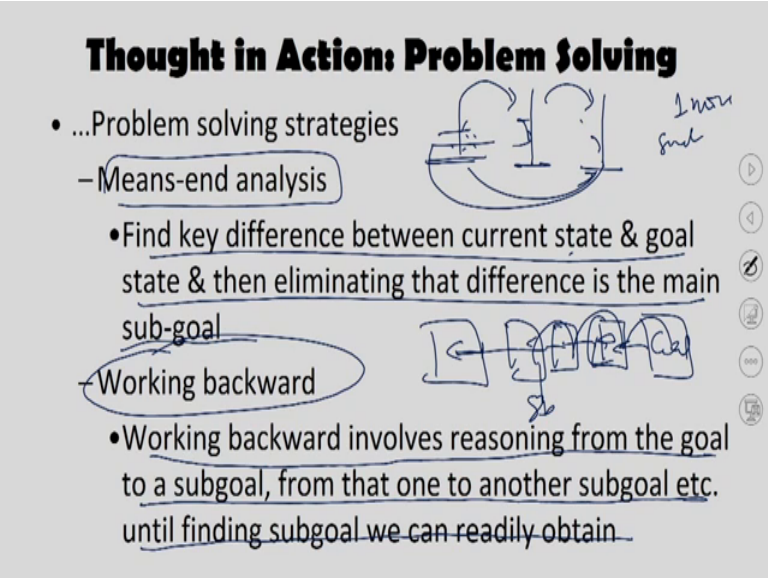

There is also something called means-end analysis. In this we find key differences between current state and goal state and then eliminate the differences in the main sub goal. So, in means-end analysis what we tend to do is for example, is one good example of means end analysis is the tower of an eye problem. So, you looked at tower of an eye and so, you have to attain this state and there are three. So, you have to move one chip at the time and then attain move all the chips from here to here these are three things. The only thing that you have to remember is it your chips can move make only one move at a time and then the smaller chip will never go on the taller chip.

And, so, what you do is, how does the solution. So, first what you do is take this two chips, the first one, move it here because this is the empty one. So, this is how it look like what you have to do is transfer this to here. So, first take these two. So, put the first one here, the second one here and so, you break this problem into sub problem and then you will finally, able to move all these chips in the same sequence here. So, find the key difference between the current state and the goal state and then eliminate that difference in the main sub goal and that is called the means-end analysis.

In the working backward method what we tend to do is work backward involves reasoning from the goal to a sub goal from that one to another sub goal etcetera until we find a sub goal that can readily be obtained. In that in the working sub goal method or working backward method we start from the goal and start towards the problem and then move to the first sub goal, right.

If from the first sub goal if you are not able to solve it we move to the second sub goal. If you were not able to solve it, we go to the third sub goal and so on and so forth until and unless we come to a sub goal which can be solved and then we move to the next one and then we move to the next one and to the goal and then how it move backward to the final problem which needs to be actually solved.

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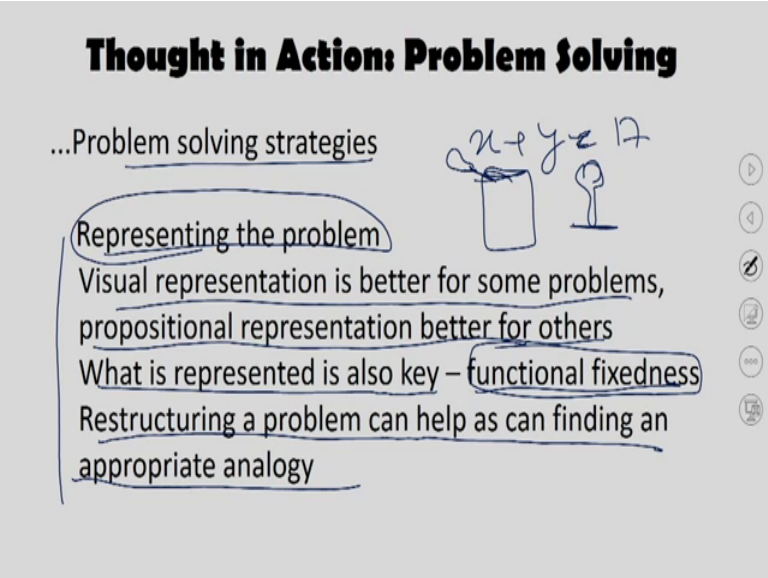

Problem solving strategies representing the problem sometimes problem cannot be solved because the representation of the problem is wrong. For example, if there is a mathematical problem the representation has to be in terms of x and y's. But, if the problem is usually in nature for example, x and y equals to 17, but if a problem is visually in nature or a problem requires visual representations then our visual representation of that problem or of a problem is visual in nature it requires a visual representations.

So, visual representation is better for some problems and propositional representation is better for other kind of problem; what is represented is also the key. Now, functional fixedness or restructuring of a problem can help us finding an appropriate analogy. Now, functional fixedness is a property of a human beings to see certain items or to see certain kind of objects to be working in a particular way, to you working to be having a particular kind of utility and that functional fixedness never allow us to manipulate to use that particular thing particular object to actually solve the problem.

For example, if we have a tin and this tin has lid on it and then we have a spoon with it. Now, the functional fixedness will allow us not to use the spin spoon to use it as a leverage here and then open the tin. Now, functional fixedness is to identify that the not to identify the fact that this spoon can be actually used as a lever to open the tin can and that is what is functional fixedness.

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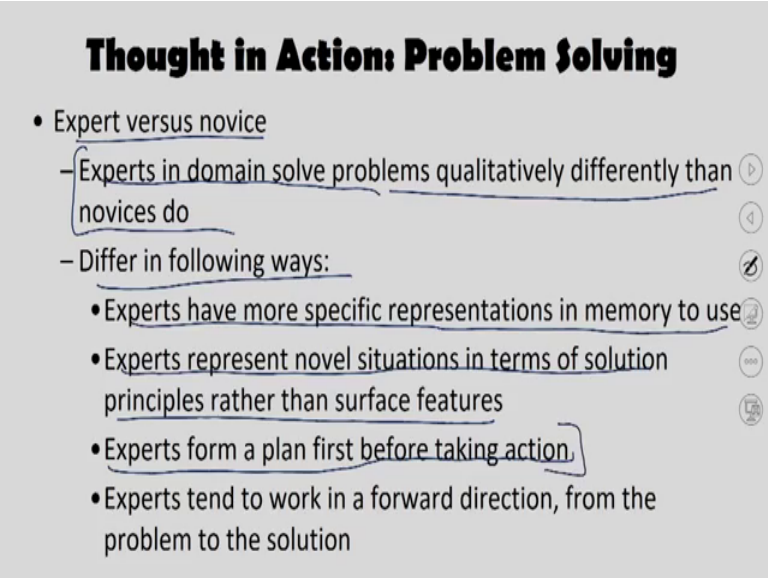

Now, how do expert solve problems an in terms novices? Experts in domain solve problems qualitatively differently than novices do. So, experts have a different problem solving strategy then what novices have. They differ in the following ways. For example, experts have more specific representations in memory to use. Experts have basic representations or they have more accurate representations in the memory which they can use to solve problems.

Expert represent novel situations in terms of solution principles rather than surface features. Experts actually dig into the problem and find out the core of a problem and try to solve it rather looking at superficial features or rather than utilizing super physic features in solving a problem. Experts form a plan first before taking into action. Experts actually never solve a problem before making a plan of how to solve it and so, they make an elaborate plan, use that plan and actually solve a problem.

Similarly, experts tend to work in a forward direction from the problem to the solution. So, experts actually never work from the solution to the problem, but they work from the problem to the solution and that is how they actually solve a problem, they never work backward because backward problem solving may not it is a heurist, but may not be the best strategy to solve a problem.

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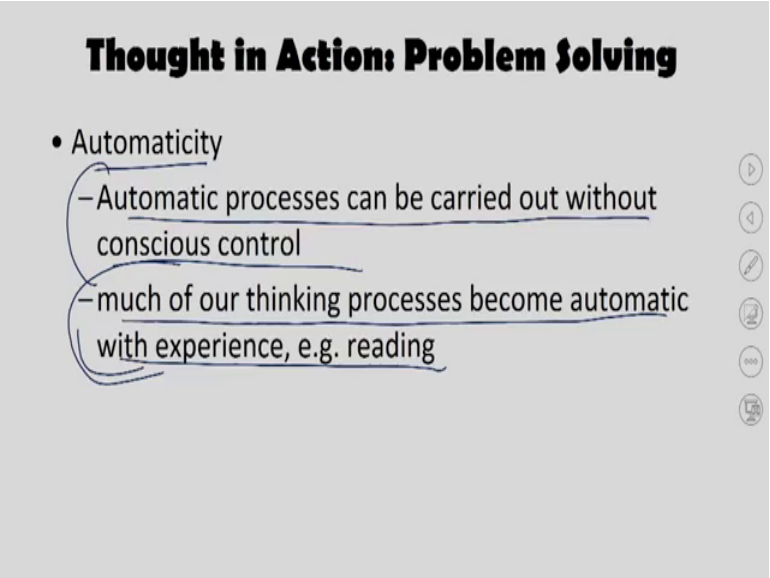

Automaticity: now, automatic processes can be carried out without conscious control. So, as you solve experts actually become automatic or they acquire the property of automaticity and that helps us solving the problems. So, certain kind of problems actually become embedded in the brain certain kinds of problem configuration get embedded in the brain and so, they can use these configurations to actually solves the problems in a automatic manner.

Much of a thinking process becomes automatic while experiencing for example, reading. Now, good example of automaticity is reading. Now, expert readers or people who are good in academies they do not actually worry about what they are reading and so, even if particular word comes in a sentence which they have no meaning about when they read the context they can easily understand the word and that is automatic and that is one way of solving problem or that is how automaticity helps you in solving a particular problem.

So, what we did in the present lecture is that we looked at two kind of thought processes. We looked at propositional thought process and we looked at imaginal thought processes and then within the propositional thought process we looked at how these propositional thought processes actually function. Then, we looked at the process of categorization of how categories are formed or how people classify items into different categories by either using a well written rule or using similarity based of rule.

Now, how why this categorization is necessary? This categorization necessary, so that we can organize a world around us into meaningful bids from which we can understand meanings, then we understood or we took a jump into what is reasoning of how propositional thoughts actually leads to arguments which actually lead to the some premises and conclusions and validity of premises and conclusion. So, we looked at something called reductive reasoning in which if the premises are always correct the conclusion are almost always correct not almost always actually every time they are correct. So, it is impossible for the conclusion be correct.

So, we looked at functions of these deductive reasoning and whereas, parameters of the deductive reasoning. Then we moved on something called inductive reasoning in which there are certain premises and given the fact that if the premises are correct the conclusion is it is improbable that the conclusions are wrong. So, basically then there are chance that they are wrong, but then they are the always possibility they are right. And, so, we looked at functions of inductive reasoning and what are the factors of the inductive reasoning.

Then we moved into something called imaginal thought which is the other kind of proposition that we use, the other kind of thinking process that we use and we look at how imaginal thought actually help in understanding problem sense solving problems and understanding other humans and passing out ideas between other human or grabbing an ideas and using that idea.

Then, we looked at problem solving which is the process through which some ideas or people solve problems in their lives. So, basically problem solving is a technique of taking a problem or taking a thought process and our thought and trying to solve that thought or trying to solve a problem which is presented to people and we looked at several means of solving problem, we use the we looked at something called means end analysis, we looked at something called backward working backward technique, we also looked at heuristic technique and so on and so forth.

Now, details of all these the reasoning, the thinking, categorization these have been covered as separate chapters in the course on cognitive psychology which is running in parallel to this course and so, what I am trying to do here is just give you a brief outlook of how these concepts they unite together to actually help us in studying human

behavior, in studying human thought process and how do they actually facilitate our understanding of human behavior.

Details of these, as I have said all these concepts are only present in my presentation cognitive and psychology and so, if you want to go into the details or if you want study them in detail do subscribe to the other course as well because there I have dealt with each of these functions or each of these property, each of these concepts in detail in my next course.

Now, upcoming lecture next lecture will be a little bit different from what we have been doing. We will be looking at another cognitive process or another higher order cognitive process when we meet in the next class. So, up till when we meet again it is good bye from here.

Thank you.