Human Behaviour
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Lecture – 06
Perception – II

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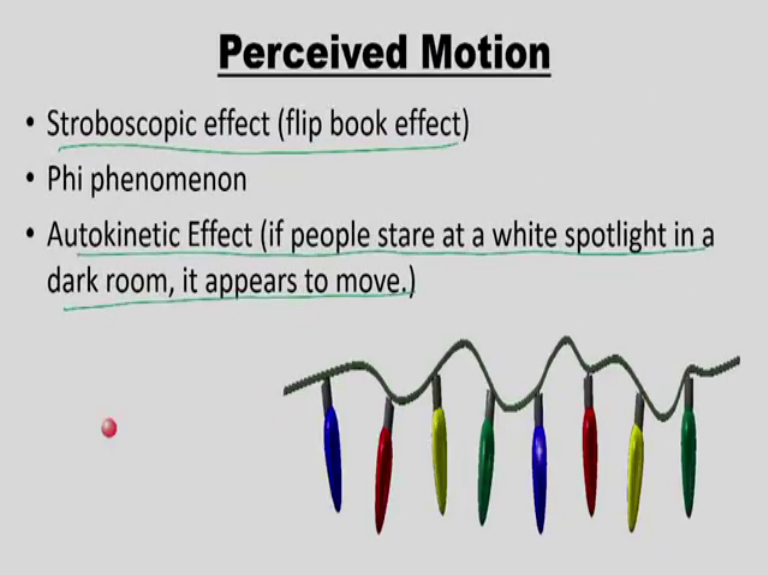

Hello friends, welcome back to this lecture number 6 on the series on Human Behaviour. Now, as I keep on doing on every lecture we will detail little bit of where we started and then after we do that, I will go back into what we did in the last lecture for the sake of continuity. So, we started off by explaining what is human behaviour and there I explained to you how human behaviour corresponds to the idea of what is psychology. And, then I kept on telling you why is the need of study of psychology and there I explained to you that psychology is to be studied because, it is a science which tells you about human beings, which tells you about why human beings do what they do.

So, basically psychology is a science of not only human behaviour, but also of mental processes which are responsible for this human behaviour that is the technical definition. After that we outline on to what is the history of psychology or the history of study of human behaviour and there, I brought to you the idea that psychology came up from philosophy and from the physical sciences. So, how these philosophers thought about what the soul was, what the mind was, what the brain was and not the brain, brain is a

recent manifestation. So, the idea of how the soul and the mind interaction and makes you do certain things or how people do certain things.

So, right from the idea of dualism to embraces and those kind of thoughts where people believe the idea that we sometimes human beings are born with certain abilities and at other times believing that they are develop these abilities from the interactions that they have in this world. So, these are the philosophically questions and then on the other hand we had physiological questions or this physiological sciences which tried to look at how human beings were composed of. And, how human beings did what they did right from the study of nerve impulses to the study of how the brains transmit information between the two hemispheres and that was what how psychology actually the hinge of psychology actually developed from philosophy and the physiology.

Then we looked at some schools of psychology and so, very quickly I will detail what of the school. So, we had schools like structuralism which were which had people coming from the basic sciences and they believed that the study of psychology can be done in terms of breaking the behaviour into its constraints part. And, these parts could be the both the physical and the psychological.

So, that is how they looked at; then we had a functionalism which believed that psychology study requires to actually evaluate the behaviour to see the behaviour when in process. So, when the behaviour is happening you look at it and only then you will understand why do human beings do what they do and how they do it that kind of a thing to primitive schools which both opposing each other.

And then we had finally, there is a style school which actually looked at psychology in terms of the whole and the part. And, what the guest style school came up with the idea that they came up with was that the psychological behaviour in totality was entirely different then the constituent parts of the behaviour. And, it was a direct opposition to what the structure listed.

These were some of the a early schools and after this a revolution took up in the whole idea of psychology, in the whole science of psychology came in the school of behaviourism which said that human behaviour has nothing to do with cognition nothing to do with the mind soul and that kind of a thing; human behaviour is a stimulus and a

response kind of an interaction. So, people do something because something makes them do that particular thing; an act is basically defined by some in environmental stimuli.

So, it is a stimulus response kind of a thing. So, it is basically mechanical in nature and so, each response can be mapped back to its particular stimulus. And so, peoples behaviour can be mapped back to certain situation events people or things like that. After behaviourism came the idea of cognitivism then which believed that human beings had the behaviour of human beings is explained by the working of the mind which in its thought process thinking decision-making and so on and so forth makes the behaviour happen. So, it is not stimulus response there is an organism in between; there is human thought process in between which makes the behaviour happen.

Then was the school of psychoanalysis they believed that human behaviour was actually coming out of unconscious drives or unconscious hidden drives and that draw the human behaviour. That is how we detailed the basic schools and further to that we explained different kinds of approaches from cognitive neuroscience to the idea of psycho linguistics and, how these schools or these areas came in to occupying the idea about psychology. Later have the lecture the introductory lecture we looked at various methods of doing psychology.

So, right on from experimentation, to the idea of what correlation is all about and detailing on two other methods like the survey method, observation and correlational study, literature review these kind of a study or these kind of methodologies or tools to study the human behaviour.

So, that was the first part. Now, after that we looked at the lecture on sensation where, we looked at how the physical environment gets converted into the psychological environment. And, our psychology physical stimulus gets converted into something which is psychological in nature. And, there we looked at concepts like absolute threshold which is basically the minimum stimulus which is required for the human systems or human receptors or human sense organs to basically record it.

And, we also looked at the concept of differential threshold which basically says that what is the minimum change, which is required for human beings to detect differences between two levels of a stimulus. And so, why these are necessary? So, we looked at the questions of sensitivity and sensory coding.

And so, why these are necessary because these are necessary because, sensation is the process through which the physical environmental stimuli gets converted into psychological stimuli. Sensation encodes physical stimulus. Now, what is the reason, why we need to study sensation because it is an interesting process, it is a very interesting process because, physical things like temperature pressure or photons in the environment they get converted into psychological factor psychological meaning. For example, the idea of cold and hot comes from the rise in fall of temperature. So, how this cold in cot is to be mapped on to degree Celsius increase in degree Celsius and decrease in degree Celsius that is what secession is all about.

So, we looked at the concepts of how these really work and in terms of Weber's law, effeteness law and in concepts like signal detection theory. So, what was the need of signal detection theory? Signal basically, what signal detection theory actually does; is it looks at how people detect or how p how good people are in detecting signals from noise. What do I mean by that? So, how people are how good people are in detecting any kind of presence of physical stimulus. And so, what is the reason for looking at that, the reason is that people are not good at detecting the presence of a physical stimulus's. One reason being that the brain itself creates a lot of noise and, in the background of that noise detecting something in the external environment becomes really difficult.

And so, the idea of single detection theory was created which basically gives us the precise sensitivity of any physical or any psychological system or any psychological organ, a sense organ for that matter. So, that that is how we looked at in that particular part of sensation. And, towards the end of that lecture we looked at we took a classic system which is the human eye and we studied the human eye of how it makes colour, how it makes perception.

I am sorry how does it how does it encodes stimulus, how does it make image, how does it encode image and how does it may encode anything which is out there in the external environment. And, how does it create things like contrast, hue, sensation. Also we looked at how the human eye is composed of and what are the various parts of it.

So, that was what sensation was all about, it was basically a section which dealt with sensory organs and how the sensory organs work. Now, once the sensory organs take in information this information is converted into a meaningful input right. So, when a

temperature goes down you call it being cooled, but when the temperature goes up you called it hot.

So, these names of hot and cold are or what sweet and bitter is or what liking and unliking is or any of these for that matter, any of these psychological constructs or psychological words how do they come about. Or, when you see a structure which is brown in colour at the base and green in colour at the top you call it a tree. So, how do you distinguish a tree from a clown, that all is composed of in perception. So, the next section we dealt with perception.

So, last class was the introductory class of perception and we looked at what is perception, what is the need of it, but why do we need perception. And so, we identified certain facts why perception is needed; one of the fact being that we human beings interact, they manipulate in the environment, they deal with the environment. And so, all kind of all kind of interactions that the human beings do with the environment that may be the reason why perception is important. And so, what is perception? It is making meaning, meaning of the external stimulus which is encoded by the sensation. So, as a sensation encode certain physical stimulus into the psychological region, how this psychological region makes meaning out of it is what is the idea of perception.

So, making meaning of physical stimulus is perception. Then we started off by looking at five different functions of perception, how does perception really start and the first step in any perception is attention. So, we focused on what is attention. So, what is attention? Attention is a process through which we decide to encode what stimulus is are processed and what stimuluses are not processed and it is a keen to the see if that we have in the house through which we filter the tea.

So, it is a kind of a filter which decide which stimulus says you will pay attention to and which stimulus is you would not pay attention to. So, that is attention and then we looked at how there are concepts of sustained attention and the concept of how attention, there is the concept and divide the attention. So, we will focused on those things.

We also looked at how attention really works in terms of reading for example, how does the eye actually read and what is the role of attention in reading. So, just as the I keeps on bouncing from one stimulus to another, in terms of sir cards and then fixations how

does that eye go on go ahead and make this reading. So, that was one part of it and then the second. So, there are 5 steps in perception.

The first part being attention, the second part was localization which is basically finding out where the external stimulus is in the environment, where exactly is the stimulus in the environment. And so, that was what we were doing and so, there what we actually did was we looked at how this localization process happens. And so, the localization process in terms of looking at localization process there are several steps to it..

Right from looking at identifying what are the backgrounds and foregrounds to using the gestalt principle which says that how things are combined together, to looking at how does the eye actually makes distance. So, how does the eye makes distance or identifies distance and it does through two processes: one being the monocular cue, the other being the minocular cue.

So, how does the eye use this type of cues and makes distances or 3D perception. So, that is what localization is all about and we further to it we also look at how does the eye create motions. So, I did not detail too much onto motion, but then the idea of having the two eye is to perceive motion. And so, how does this stereoscopic motion which is the artificial motion that you have and all other kinds of motion are actually generated and that is where we signed off in the last lecture.

Today what we will do is we will add on to what we learned in the last lecture. So, we will look at the three other processes in perception. So, the first step in perception is paying attention or what stimulus has to be encoded and what stimulus does not has to be encoded and, the second step being localization of the stimulus in the external environment or localization of the object of interest in the external environment. The third step once you are able to identify the object in the external environment, the third step starts which is called recognition.

And, recognition is a process through which people recognize or through people identify stimulus is in the external environment. So, recognition is very important. Why is it important? Suppose you are walking somewhere and a cat comes in and cross a white cat crosses your path. Now, it is very important for you to identify you have localized; first of all you have paid attention because, the cat came in quickly and it cut your path.

So, that you paid attention to it and then you did localize that there is an external object which is crossing your path. The third step has to be very important, what why it is important. If you are not able to identify the cat as a cat, but you identify the cat as a hula loop or something is which is a white colour maybe a paper or a plastic bag which is flying in front of you in the paper in front of you and it goes through it.

And, if identify it as a plastic bag you may step on it, but then if you identify it as a cat you may not step on it or you would basically take your leg back. So, basically these decisions of what to do and what not to do in the external environment or how to interact with the objects in the external environment requires you to go to the process of recognition. So, recognition is a process through which we identify or we make meaning or we understand what is the object which is in the external environment, which has been localized.

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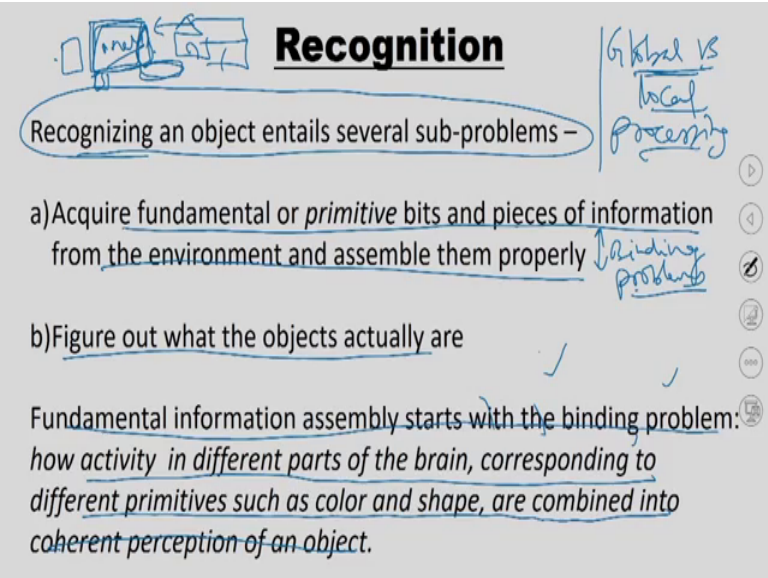

So, let us start with what is recognition. So, basically recognizing an object recognizing of an object it starts with several sub-problems right. The there are certain steps of recognizing an object, any object in the external environment and there are several style of steps to it. We will try and unfold of how recognition really happens. So, as I said its not an easy job to recognize an object, it requires you not to just to identify an object, but also compare it with a template or a prototype which has been stored into your into your head. But, let us not get in there and actually look at how does the recognition of an

object actually starts with or actually starts over. The first step into any recognizer recognition to happen is to identify the primitive bits and pieces of information..

And, the second step is how to combine these bits and pieces into a whole; what do I mean by this. Through sensation we get information like colour, like angle, like curves and this kind of informations so, basic primitive informations is what the sensory systems actually sends to the perceptual system right. So, what the sensation actually does all the sensory organs or the eye in this case a sense to the brain is informations about colour, informations about depth, informations about what is the boundary. So, where is the figure and where is the boundary that kind of thing, how many angles are there, how many curves are there, this kind of shape, orientation these are the information that the sensory organs are sending to the brain.

What the brain has to do is to take this information and combine them together to make the meaning. So, basically perception or recognition is a two-part process. The first step is to basically take this information together, collect this information for sensory organs and do a binding with it. And, the second step is to once these things are binded together how to make the whole.

So, if you have primary information how do you bind them together, how do you integrate them together. For example, you have if you have colour, if you have orientation, if you have angle, if you have certain other information. For example, height how do they combine all these information together first of all to make a hole. And, once you make that hole, once you make a picture out of it how do identify this picture to be a clown and not to be a tree or how do you identify this picture to be a tree and not to be a clown.

So, two step process: one step in recognition starts with basically taking in primary informations, primitive informations from the sensory organs and then mixing them together or combining and making a whole out of it which is called the binding problem and the second problem is to recognize this object. Now, even before we do this there is one more step to it. Recognition of object is basically is not an easy job right. And so, it happens through something called the global versus a local processing. So, recognition starts by global versus local processing. What is the meaning of it? Any object which is recognized has to be in some context right and for example, look at this I have made a

shape here not very good shape, but this is what the shape looks like. So, what is this? What is this shape looks like?

Now, given the fact that if this shape is in the background of a house, if this is my house and if this shape is in the background of a house it looks like more or less like a mailbox. So, if it this shape falls in the foreground of a house it looks like a mailbox. But, the same shape when it falls in front of a kitchen like thing in the front of a background which looks appears to be like a kitchen this appears to be a bread.

So, the idea that the same shape can be both a mailbox and a bread depends on the context and this is what is global versus local processing. What does it mean? When making interpretations of what object the important thing is that the first step is that human beings not only use the global information which is the scene in which this information is they also use something called local information. So, before interpreting what this object is human beings actually look at the scene in which this object is.

And the scene provides a lot of information about what the object has to be or what the object tends to be. So, this is basically a combination of two processes which is called top down processing and bottom-up processing. Context which is varies object is will provide us an clue or answer to what the object can be and this is called top-down processing. What is the meaning of top-down processing? When your memories, your past experiences help you into identifying an object this is called top-down process.

Because, what happens is your memory gives you a clue to what an object is. Bottom-up processes are processes in which you look at the object itself or parts of the object itself and from there you construct the meaning of the object. So, when you when you are making interpretations in terms of the object itself, recognizing an object based on features of the object this is called the bottom-up process.

But, when you are using your past experiences and based on that you are trying to identify what an object is this is called a top-down process. And so, it in recognition both these processes work to together. It starts with recognition of an object starts with a goal processing where, we look at where the object of interest is, where it is when on what background it is and based on the information from memory we then predict what can be the object.

So, that is what one of the things are. So, require recognizing an object until several sub problems. The first problem as I said is basically taking primitive informations of colour, shape, orientation, angles and those kind of things and how to bind them together that is the first step and the second step is to identifying the object.

So, acquiring fundamental or primitive bits and pieces of information from the environment and assembling them together is what is the first step and this is called the binding problem. The second step in recognition is figuring out what an object actually is, what is the object actually look like. Now, fundamental information assembly starts with the binding problem.

How activity in different parts of the brain corresponds to different primitives such as colour, shape, and combinations into core and perceptions of an object. As I said these colours, shape, angle, orientation these things are coded into different areas of the brain. So, once the sensory system is able to detect these things in an external object they send this information to different parts of the brain. So, there is a central area or a central processor in the brain which takes in this information from different parts of the brain and then creates a meaning out of it. And, how it makes the meaning that is what the binding problem is all about.

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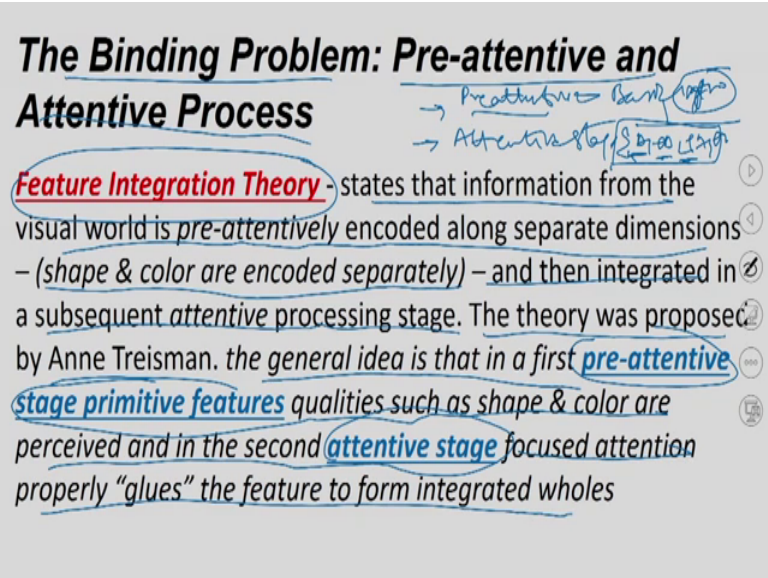

So, the binding problem: pre-attentive an attentive process. So, this is binding the idea of binding problem or the idea of how the brain takes in bits and pieces of information and

integrates them together is called the binding problem; how does it really work. At the core of it lies something called the feature detection theory. What does it say? It says that information from the world visual world is pre-attentively encoded along several dimensions which is shape, colour and encoded separately and then integrated into a subsequent attentive processing stage. The first step that happens in terms of recognition, in terms of how recognition happens is taking in this bits and pieces of information which is a been encoded by the sensory system.

Once that and this step is called the pre-attentive stage in the pre-attentive stage all information which is being encoded, all kinds of information about the stimuli which is in the external environment which is encoded by the sensory organs, these asked and which have been stored together they are first brought together. And, in the second stage these sense sensory informations, these informations about the object are then clubbed together to make a hole and that is called the attentive stages.

So, feature integration theory says that the perception of an object or the recognition of object has two parts. In the pre-attentive stages information is collected about different aspects of a stimuli and these aspects are primitive information for example: colour, shape object orientation, object direction and then object height that kind of information.

And in the attentive stage these informations are combined together to form a whole to form an object or to form a shape or for that matter any kind of information been. Now, the theory was proposed by Anne Treisman; the generalized idea is that the first in the pre-attentive stage primitive features qualities such as shape and colour are perceived. And, the second which is the attentive stage focuses on attention properly glues together the feature to form a integrative wholes.

So, as I said there are two steps: in the first step you have something called the pre-attentive stage where, you have basic information basic info of the external world which is recorded. And, in the attentive stage these basic informations; so, let the informations be A 1, A 2, A 3, A 4 these informations. A 1 being shape, A 2 being colour, A 3 being something else how they are integrate together to create a whole of whose meaning has to be generated.

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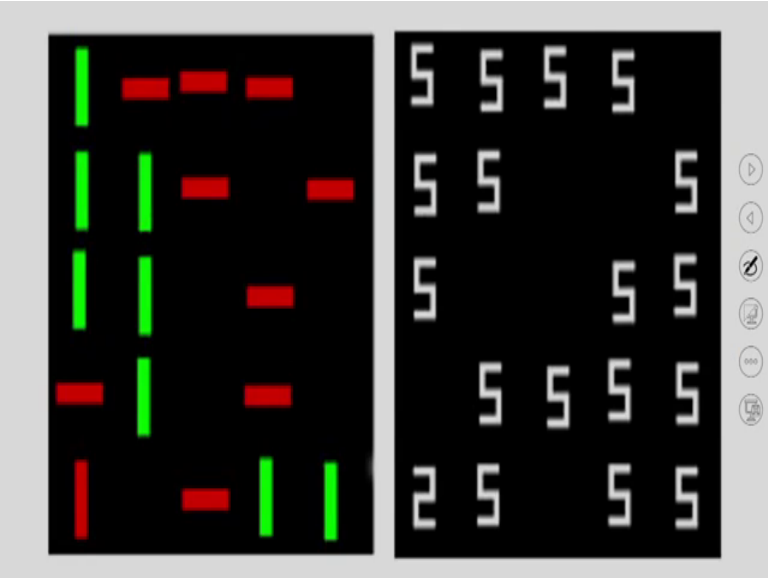

Now, whether this is correct or not to test that let us do a little bit of an experiment. Now, if I ask you to find me one problem or one deviation on my on my right or on the left of this board on the picture; on the left of board it will be very easy for you to find out. And, the answer is this one; this figure is a deviant. The reason being that most vertical bars are green in colour and now you see a red green whatever its very easy for you to find.

The reason being that it is coded this has only one bit of information that is colour. And so, as you can see colour is a primitive information, colour is a very primitive information. And so, as you scan through it a red colour vertical bar its actually excites you or it actually catches your attention. Because, it has only one-dimension that is the colour and basis the colour only it is very easy for you to identify the red colour vertical bar. Look at the one on the right.

Now, if I ask you one deviation it is difficult for you because, it has 2-bits of information here; it has colour and it has shape. Now, the one deviation that is there is this, but it takes you longer time to identify it. Because, here the shape which is different the shape which is which is an outlier here is having 2-bits of information; 1-bit being the shape, the other being be the colour.

Now, since all of them are the same colour it is difficult for you to find this information because, it is on the second dimension on the second shape is the second primitive information. Here the first primitive information itself which is colour is making you

identify or helping you identify the outlier. But, here what happens is since all of them are the same shape or same colour it becomes really difficult on in same shape, also it becomes really difficult for you to identify. Because, the deviation is happening on two-dimensions and to prove that this theory is correct or the idea the idea that we have actually looked at is correct I am going to use a kind of a demonstration.

Let us check if the demonstration really works, yes it works. And so, what we are going to do is I am going to give you a quick demonstrations, Now, in this demonstration what you are going to do is to look at the centre after this screen, there you have to look at the centre of the screen which has a plus and after that you will see 4 cars of 4 different models. All you have to do is tell me what car is was, what is the colour of the car it was and what is the model.

So, 4 coloured cars are there and 4 models are there; all you have to do is look at the centre of the screen for let us say 100 of a millisecond picture will appear in front of you which has 4 different cars on 4 different colours. And, these cars also have models; they are from a different models or different companies and the logo since the car is in the first side you can also see the logo.

So, let us see if you can identify the car colour and match it up with the car brand or the car company. Now, let us do that quickly yeah ok; what do you think let us do this one more time quick very quickly. So, here we are we start and what do you think; what will happen is most people will be able to identify correctly the colour of the car and most people will also be able to identify the model of the car.

But, the problem happens in terms of binding. Now, since colour and shape a primitive informations these it get encoded, but if you say you see a blue colour Audi or if you say you see a red colour Volkswagen; you might be wrong let us go ahead and have a look at it right.

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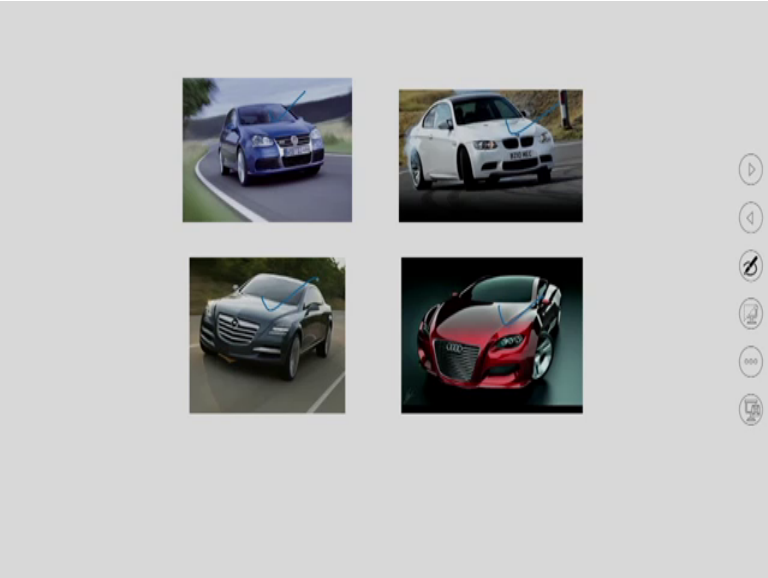

So, it is a blue colour Volkswagen, it is a white colour BMW, it is a red colour Audi and it is not a Fiat, but looks like a black colour Fiat. And so, that is what it is. So, most people are able to tell you the type of car which is here and the colour which is there, but matching the colour and car is a problem. And as just created that for you because, this is the binding problem. What happens is people are able to very easily recognize the primitive informations which is colour and shape. But when binding them to particular colours, by need to shape there is a problem and that is what the binding problem was what we were talking about.

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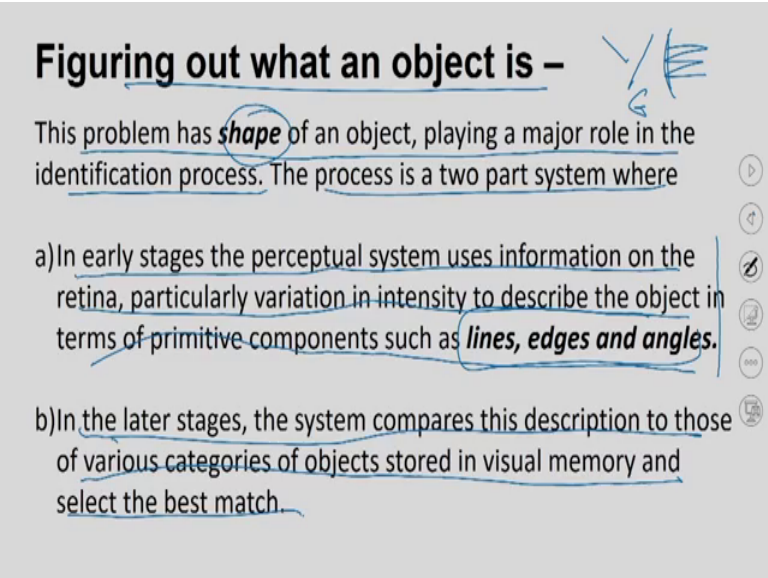

So, the first step is the binding problem, the second step is figuring out what an object is. So, how do we figure out what is object is in the recognition process. Now, this problem has shape of an object playing a major role in the identification process; the process is a two-part system. So, how to identify what an object is, what an object is in the external environment and that process starts by focusing on something called the shape. Now, there are two part process in identifying what an object is. And so, the first part is in the early stage the perception is a system uses information on the retina, particularly variations of intensity and describes the object in terms of primitive components such as lines angles and edges.

So, the first step in identifying an object starts by looking at lines, angles and and edges. So, the first step is that the retina itself, the human retina itself can pass up information in terms of what is the line, what is the orientation, what is the angle of an object in the external environment; the first step is that happens. In the second step, in the later stage the system compares the descriptions to that of the various categories of objects stored in the visual memory and select the best matches.

So, the retina if we are using the visual system it passes informations about line, angles, edges, orientations these kind of informations are passed on to the to the brain. And, in the second stage the brain uses this information the binded information together and compares it or recognizes it or does something called pattern matching in which it compares what it sees from the sensory organs from the binded of sensory organ information. And compares it to all those pictures, all those object identifiers which it has saved with it in some store and identifies what an object is.

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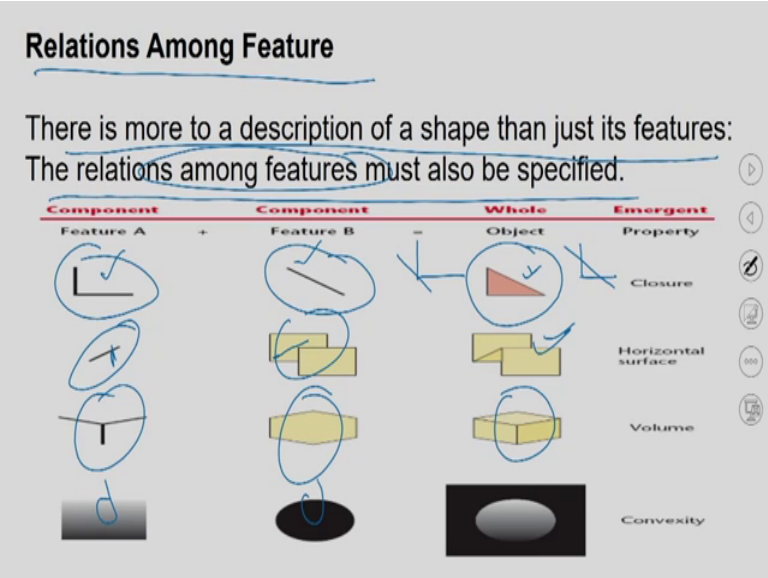

Relations among features, how does it do that. Now, there is more to the description of a shape than just its features. How do you identify a shape, what is the way in which shapes help you identify an object. So, the description of shape is more than its features. The relation among various features are also be to be specified. So, not only the shape of an object, not only how the object looks like or what is the shape of it helps you identifying what an object is or in terms of pattern recognition, how does pattern recognition starts; it starts through the identifying what the shape is.

So, shape itself is not only the reason or the idea through which objects identified in the external environment. A step to it is how these shapes are or how these objects are related to each other; for example look at this, this is a shape. So, you have a horizontal line in a vertical line and then you have shape B which is a diagonal line which is starting from the left end coming down to the right.

Now, just looking at these two shapes does not create this shape, there has to be an orientation. For example, if I take this shape and put this shape here, I will not get this or if I take the first shape and put an orientation like this I will not get this shape. So, what I am trying to emphasize is shapes are not the only way in which you can get what an object looks like or recognize what an object look like.

A certain orientation is also necessary or relationship among features is also necessary. For example, look at this and look at this; if these two are together if only this is placed

at a particular angle. For example, here will I get a shape like this any other region I move I may not. This is one feature, this is another feature integrate them together in the proper orientation I get this and similarly one feature, second feature integrate them to get together in a particular angle and I get this. So, it is not only the shapes, how the shapes are combined together, how the shapes are paste together is how you will get the feature.

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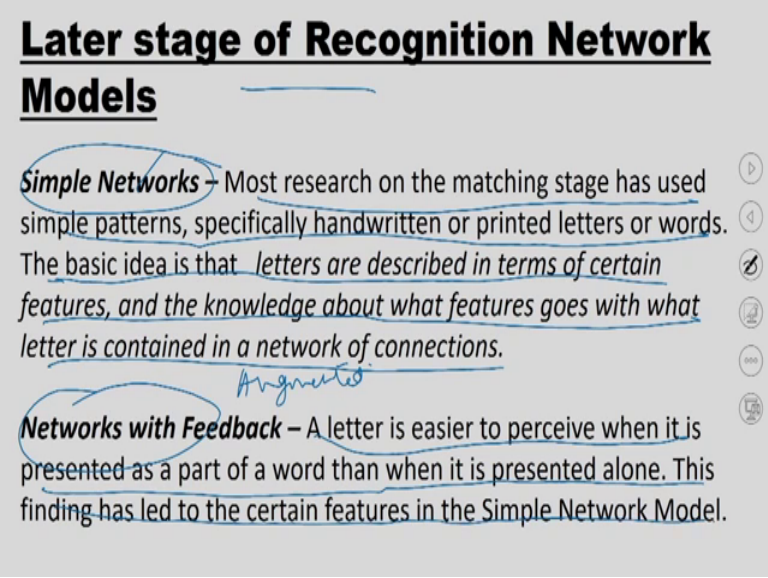

So, those were the early stages of recognition. Now, once an early idea of object is made once in our earlier idea about what an object has been constructed a later recognition model or a later recognition process starts. So, later stage of recognition networks. So, how does a recognition; so, once you are able to identify basic angles, lines that kind of thing primitive informations binded together to give you certain features. And, once these features and the relationship among features have been discussed how do we do the recognition process or how it is objective cognition probably how does original recognition progress. That happens through something called simple and complex network models. What is a simple; so, there are two types of models: one is called the simple network model and the other is called the augmented network model.

And, it borrows the augmented network model, borrows some of the concepts from global versus local processing. What it says is that the perception of an object is more helpful when it is in context of something. And so, what we will do is we to understand

the simple in the complex network models we will basically use the writing system, we will basically use letters to identify or to explain how does object recognition or recognition process goes through. So, what is the simple network? Most researchers on the matching stage has used something called simple patterns specifically handwritten or printed letters or words, now for explaining the simple network.

The basic idea is that letters are described in terms of certain features and the knowledge about what features goes with what letter is a continue as a network of connections. I will just explain to you in a minute right and network with. So, the simple network, the network with feedback or also called augmented network. How what does the model says? A letter is easier to perceive when it is presented as a part of a word, then when it is presented alone. Now, this finding has led to the certain features in a simple network model or inclusion of certain feature model.

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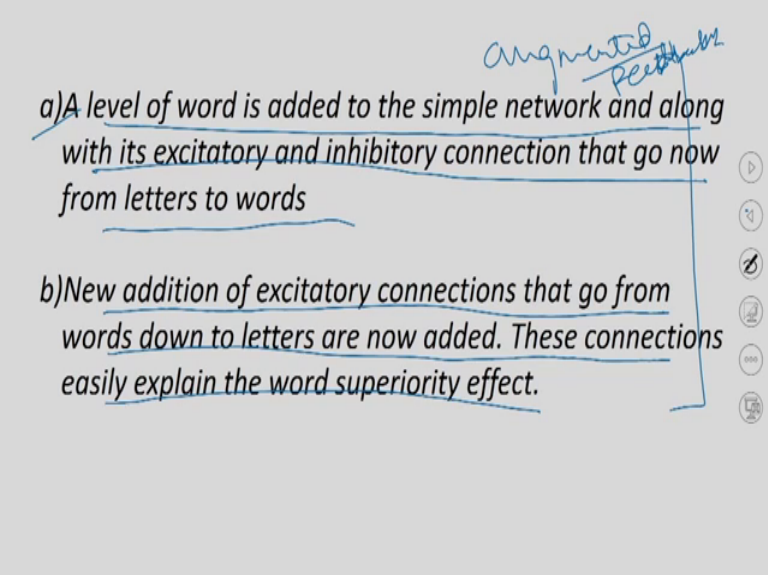

a, the level of word is added to a simple network and along with it excitatory inhibitory connections that go now from letter to words. And number 2, new additions of excitatory connections that go from words down to the letters are now added and these connections are easily explained by word superiority effect. So, these are the two additions which the augmented model or the feedback model have over the simple model. Let me explain this model to you.

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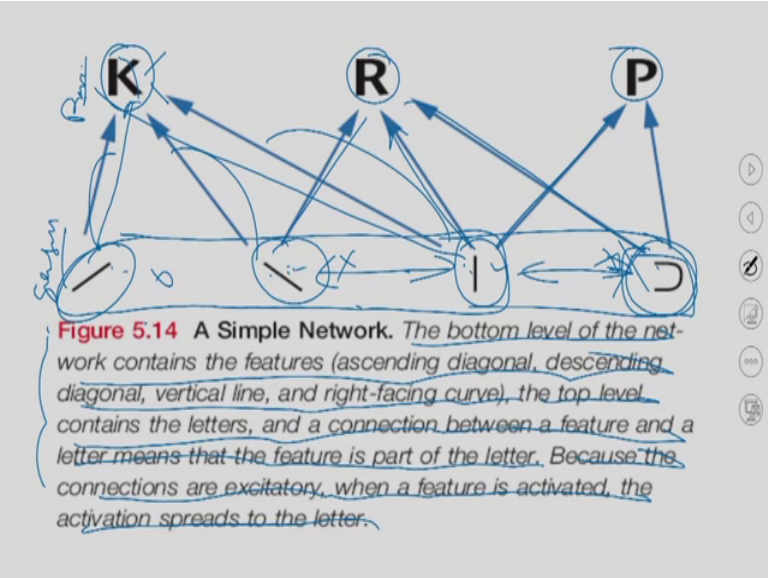

Figure 5.14 A Simple Network. The bottom level of the network contains the features (ascending diagonal, descending diagonal, vertical line, and right-facing curve); the top level contains the letters, and a connection between a feature and a letter means that the feature is part of the letter. Because the connections are excitatory, when a feature is activated, the activation spreads to the letter.

How does a simple model look like? So, suppose I have my primitive system or my sensory organ gives me the perception of this, this, this and this in the environment. It perceives that there are 3 lines: one a diagonal line which is ascending another a diagonal line which is descending and third a vertical line and forth a part of a curve. This is what the information that is sent by the primitive system to us right.

Let us say that it has only these three informations given to us. Now, if these three informations are given to us or these four information are given to us what kind of letters will be there, if that is what it is. So, if the primary systems only tell us that there are 2 diagonal lines that is the one ascending to one descending and one vertical line which it can perceive.

And, occur part of the curve which is closed on the right and open on the left what kind of letters will be there. If you look into it one possibility is K because, K has and we have to see that maximum number of these are combined together. So, what are the possibility, if you look into it one possible letter is K because, K has this diagonal line. It also has this diagonal line, look at this is the ascending line, this is the descending line and it has this also right.

And so, if I combine this, this, this the possibility is this one possibility; second possibility if I look at this, this and this then I can get a R also. So, if there is a form or shape which is a curve which is closed on one on the right side and open on the left side

the other things, that I can get or the other letters that I can get is R and P. As you can look at if I want to construct R, the presence of this is there, the presence of this, the presence of this is there and the presence of these three features are there.

So, if I combine these three features I will get R, but if I do not combine this one I will get these. So, a simple network model the bottom level of the network contains the features which is ascending diagonal, descending diagonal, vertical line in the right facing curve. Now, the top level contains the letters and connections between the features and letter means that the feature is a part of the letter.

Now, because the connections are excitatory when the feature is activated, the activation spreads to the letter. Now, actually this is a little bit away from the simple network because, simple networks do not talk about excitatory inhibitory connections. And what are excited to inhibitory connections? Excitatory connections are those connections or excitatory loops are those loop which says that the presence of certain features are there; inhabitory connection says this presence of certain wishes are not there..

And so, in simple network if K has to be found then this is their. So, this is excitatory this is their and this is that and this is inhibitory because this is not there. But, for the presence of R or for the recognition of R you have to have this, this and this and the presence of P is that you have to have this and this; both of them are not needed. And so, how do we perceive letters?

We perceive later in this way because, this is the information which is send out by the sensory organs and this is what the perception R or this is how the interpretation is made in terms of the brain Now, this is a very simple model because, the perception happens at only one level from down to up; it this is what the sensation gives you. So, sensory organs sense sensory organs sends you this information and perceptual systems make this meaning.

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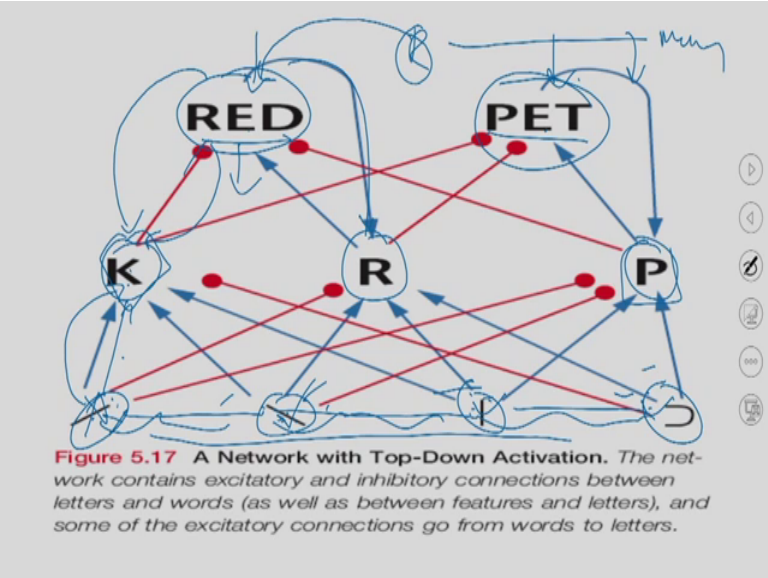

Figure 5.17 A Network with Top-Down Activation. *The network contains excitatory and inhibitory connections between letters and words (as well as between features and letters), and some of the excitatory connections go from words to letters.*

Let us take a look at how augmented networks will actually look at. Now, augmented networks as I said in global processing what happens is not only what am I processing, but top-down processing also goes through. So, it is easy to identify that this is a K or whether it is a K or not and if my sense organs sends this information, but also these words are also looked at.

So, it is very easy to say that K is not the letter which can be formed by these words right. The only letter that that can happen or the only word that can happen that can happen if this is the top word and these are the information or these are the information which might sensory organs are sending me.

So, my sensory organs send me that I am viewing these four different things right. Now, the letter has to be identified and my brain is saying that two there are two words: PET and RED right and you have to find out what is the letter which is there. So, assuming that these words are there these two possible words are there and these are the basic structures, which my sensory organs are sending to you or send a sending to the brain you have to identify whether K is possible, R is possible or P is possible.

Now, in terms of in terms of the first word the only possibility is R and that is why you are seeing, what you are seeing is that if it is R you do not need the one you need this one you need this one and you need this one. So, this are present this is a false input and that

is why when you when you look at from the top this is a inhabitory connection means which means that it cannot the K cannot be fit here because, R K D is not a word.

And, the presence of this does make K, but then K cannot be present here and the only possibility, the only letter which can happen with this and this or let us say this and this is the R word here and that is why you have the R word. And, that is why you have excitatory connection here. In case of this what happens is that in terms of PET; the only possible word that can generate that can be generated from this information which is coming from the sense organs and this information the word information which is coming from the human memory is the letter P.

Because, it can only be PET because any other thing PKT cannot be there R RET cannot be there because, these are non-words and so, identification of word. And so, what happens here is that these are called feedback and feed-forward connections; what happens is that information the one once the testing is done in terms of in term in terms of the basic information, in terms of the basic information which is gathered from the sense organs.

But, if the testing is also happening in terms of the top information or the top-down information which is coming from human memory. And, based on that when you when you look at from the sense organs we get we get the information that this particular thing is present here. But, then when you verify this in terms of the word you get a inhibitory connection we meaning that this K cannot be fit here right.

Similarly, if I look at this now in terms of K this is here, but in terms of RED K cannot be here, but R in terms of R both you can get this that A B C. So, this all included, this is the only one which is not included and the top down process also says that the word is R here and not the K here. So, this is a feed a feed forward again feedback connection or augmented connection and the other one is the simple network. Now, very simply how do we understand that, in one case what happens is that letters and angles which have been processed by the sensory organs those are used for identifying, letters for identifying alphabets.

In the other case in the argumented network what happens is that not only the information which is gathered from sensory organs, but also information word information from the human memory are taken together which is the context taken

together. And, then the letter which is presented to you is identified as what it is. So, not only information from the sensory organs are taken, information from the human memory which contains a lot of words which you have learned, how they are integrated together to form to form the idea of what word is being presented or what it could possibly mean.

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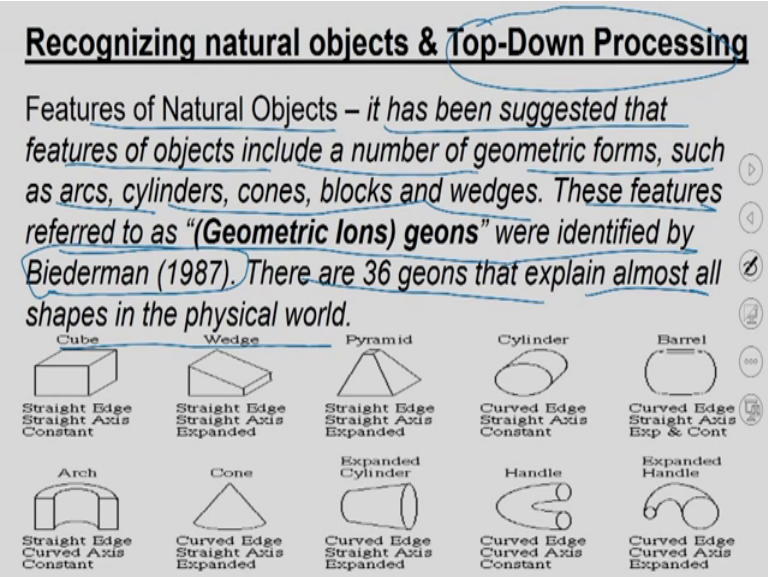

That is how recognition happens in terms of alphabets; now recognizing natural objects that is how and we recognize alphabets letters and so on and so forth. How does national object recognition happen and the top-down processing. Now features of natural objects, it has been suggested that features of objects include a number of geometric forms such as arc, cylinders, cones, blocks and wedges. Now, these features are referred to as geometric ions or geons and we are identified by someone called Biederman in 1987.

What Biederman says, is that natural objects are identified in terms of their basic geo geometric ions. Now, Biederman's proposal is that there are 36 geometric ions basic shapes and it is the combination of these shapes that you get any object or that makes any object possible. Now, there are 36 geons that explain almost all shapes in any physical world. So, let us look into this; these are the basic shapes which are there. Now, I will give you an example of how this thing really works look at these.

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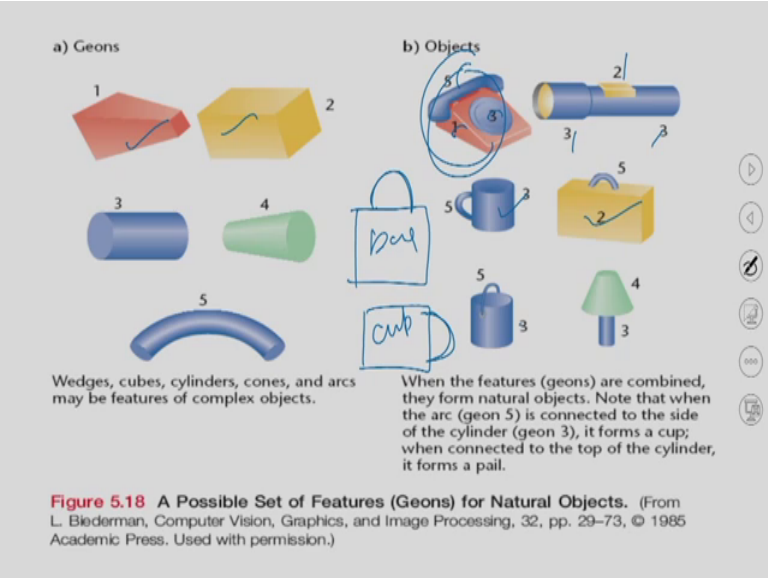

Figure 5.18 A Possible Set of Features (Geons) for Natural Objects. (From L. Biederman, Computer Vision, Graphics, and Image Processing, 32, pp. 29–73, © 1985 Academic Press. Used with permission.)

These are the basic geons and when you combine this geon. So, combine this with this 1 2 3 4 5 and if you combine this you get a remaining object geon number 5 with geon number 3 and geon number 1, you get a telephone. And, in this case combining geon 2 3 3 you get a torch light, in case of this you get a cup or you get something like this.

It is very simple take a geon like this right and this is called a square geon. And, in this square geon if I put a semicircle geon this become a shopping bag, but the same bag if we take or the same square we take and if we put the geon in this angle it becomes a cup. So, basically these orientations of geon; how these geons are related to each other in orientation makes all possible objects in the natural world.

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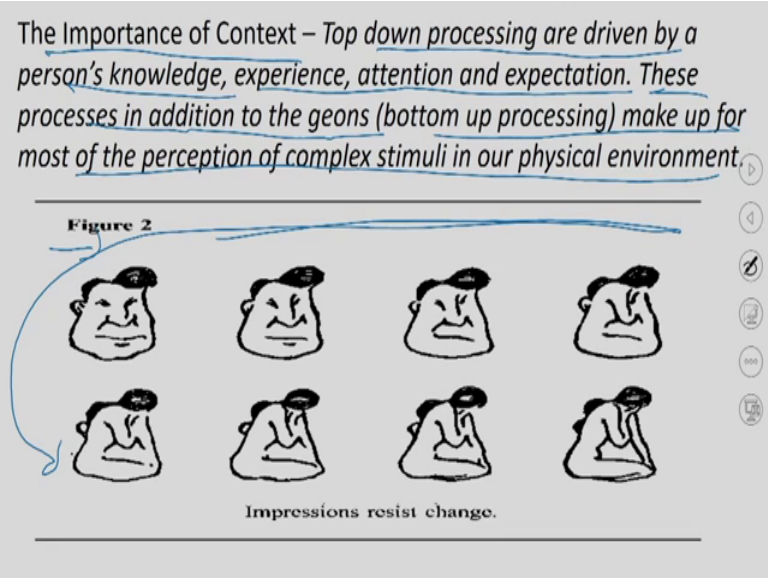

Now, the importance of context; how does context actually make you identify objects in the natural world. Now, top-down processing are driven by a person's knowledge, experience, attention and expectations. Now, these processing processes in addition to the geons bottom-up processing make up for the presence of perception in complex stimuli and physical environment. As I said the global processing or the context in which an object is the outline in which an object is makes you understand what an object is for example, look at these this figure.

Now, if you start interpreting this speaker, if you start seeing this figure in this way it will you will start seeing a human face. And then slowly if you move this way and down here and this way lastly you will see a lady. But, if you start from here somewhere down the line this lady who is crying actually becomes a human face. So, which way you start the context in which you start, the way you start seeing things will decide what you are actually perceiving.

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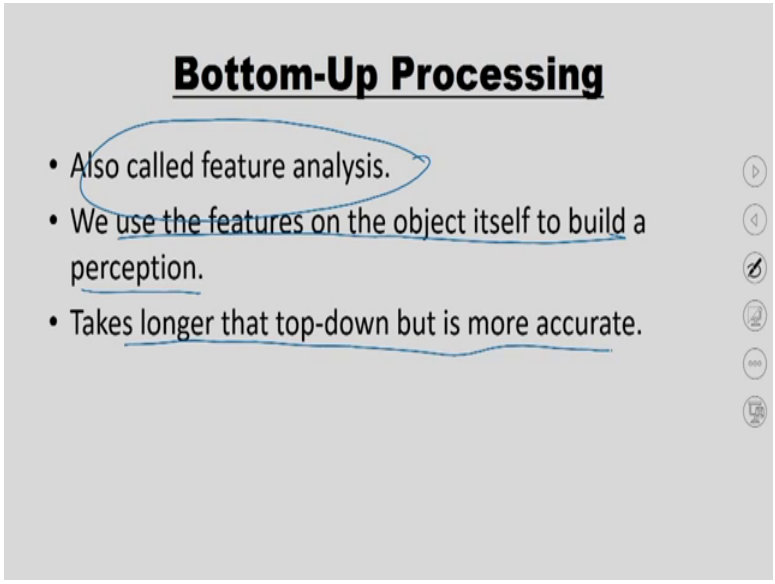

Bottom-up processing these are also called feature analysis model. Now, we use features on the objects to build a perception.

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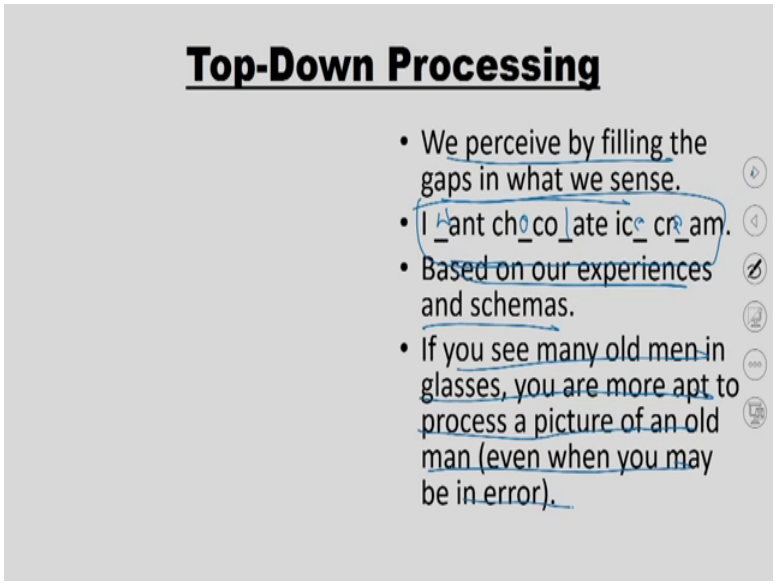

As I said bottom-up processing is basically about looking at an object. So, basically looking at lines angles and things like that to make k p idea of k p or anything for that matter, the basic geons on how they make something. Takes longer than top-down processing and is more accurate. Top-down processing we perceive by filling the gaps in what we sense. For example, if this is what we you are looking at; so, how do I fill this?

Most people will quickly say that I want chocolate ice cream right. So, bottom of processing looks like it says, I want chocolate like I ice cream and that is how you fill in.

Because, this word is there somewhere in your head or in your mind. Now, based on our experiences in schema so, there is basically your past experiences or the schemas actually make you make interpretations. And so, this is what bottom-up processing is all about. If you see many old men in glasses you are more apt to process a picture of an old man even when you may be in error.

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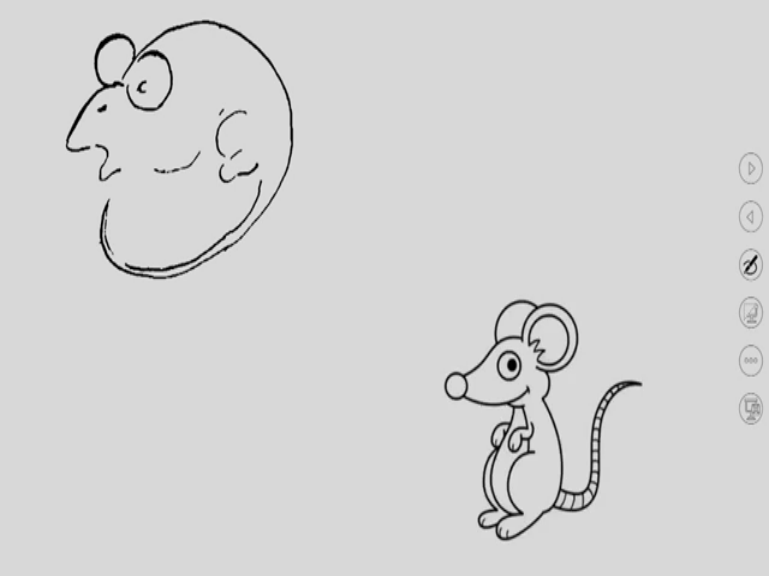

So, if this is what it is; if you have seen an old man it or you know all people there this does not become a rat because, this is seems like a rat here.

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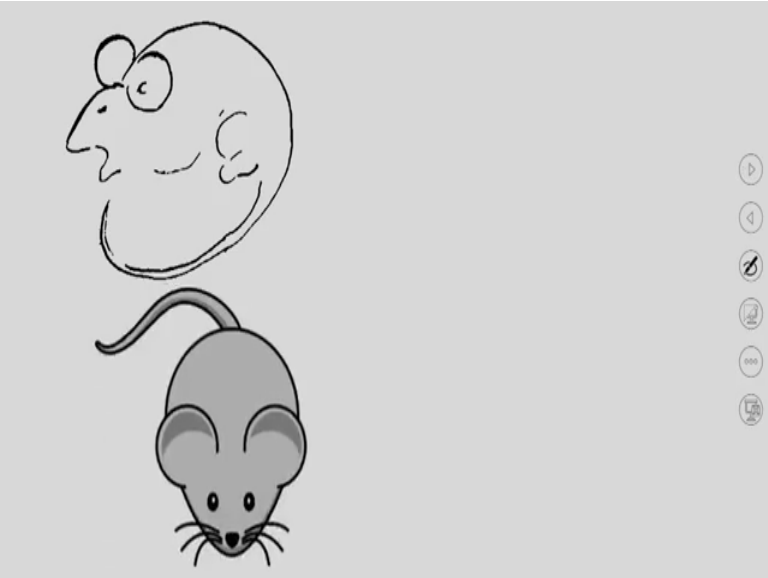

But then if you see in old men before or if you have seen too many old men it seems like a old man. So, it does not seem like a rat here; quickly moving on.

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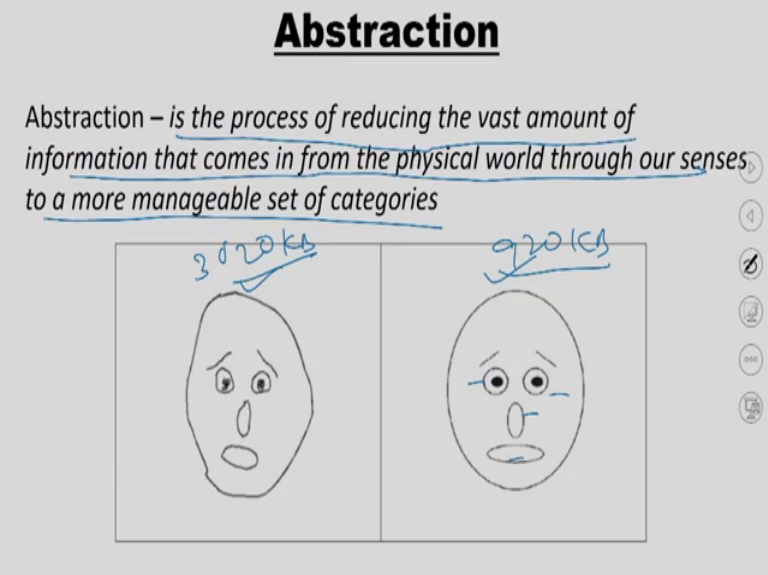

So, that is about recognition of how we recognize objects.

The next two processes in perception is abstraction and constancy. What is abstraction? Abstraction is the process of reducing the vast amount of information that comes in from the physical world through a census to a more manageable set of categories. Whenever information comes to us from the physical world what we are trying to do is we try to

abstract, we try to break it into manageable quantities and that is, what is a process of abstraction. For example, when we look at a human face what is it that we actually gather from it; we do not gather the whole face we just gather certain markers of the face. Because, the idea of how the human face looks like it has 2 eyes, 1 nose this is already abstracted or this is already stored in the in the in the brain.

What the brain actually captures when you see a new face is certain inequalities or certain peculiarities that the particular phase that you are looking at is having. And, that is matched up to any face which is there and based on that is how it looks like perception and that is what is abstraction. So, for example, look at this these are two set of pictures which were created and what does abstraction actually do; abstraction actually helps us in simplifying object perception.

So, if you look at two objects one is a hand-drawn picture of a face and the other is a picture which has been drawn by a computer. Now both the picture actually shows surprise a kind of a surprise which is there, but you will be amazed to know that this picture requires almost 3020 kB and this reflector requires 920 kB of disk space for saving.

Now, for the same what has happened is you are abstracted here; if you look into it what has happened is here the eyes, the nose, the mouth and the face has been abstracted with certain geometrical forms. And, these geometrical forms actually require a less mass storage, but this figure requires more.

So, abstraction is a process of through which what you tend to do is look at external information which is in front of you and from there you extract information which is required and delete information which is not required. Because, every time you see a chair you do not have to remember a chair, the brain knows what a chair looks like. And so, when you see a new chair all it has to do is to find out how this is a chair or how this chair is different from the one, different from the concept of a chair or the prototype of a chair which is so stored in your head.

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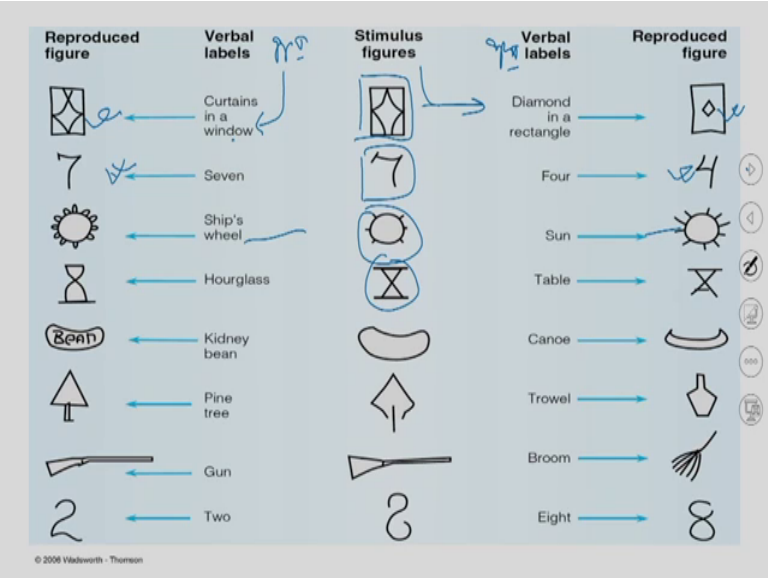

And to look at whether abstraction works or not Carmichael did a small experiment, in which what he did was he gave certain stimulus figures to two group of people. So, these are the stimulus figures that he gave to group of people; then after that once he showed these figures to people to do group of people. So, this was group I and this was my group II and what he did was, he gave these verbal labels to these figures right.

One group saw this figure and they got this verbal label or got this name curtains in a window right and this group was told that it is a diamond in a rectangle. Later on after some days these groups were called back and they were asked to draw, reproduce the figure that they saw. Now, people who saw curtains in a window they drew this, but people who saw diamond in a ring they drew this.

Similarly, people who thought that this was 7 or said this was 7 drew this, but people who said people who were said that it is 4 drew this. Similarly, people who said this is a sun drew this and ship wheel drew this, which basically see is that what label is given to you or how things are explained to you that decides, how we abstract information. People do not store images or people do not store the idea about any in image in the external information. What they do is they abstract, they take away all necessary information which helps them in identifying objects and store it away and that process is called abstraction. So, that is what abstraction is all about.

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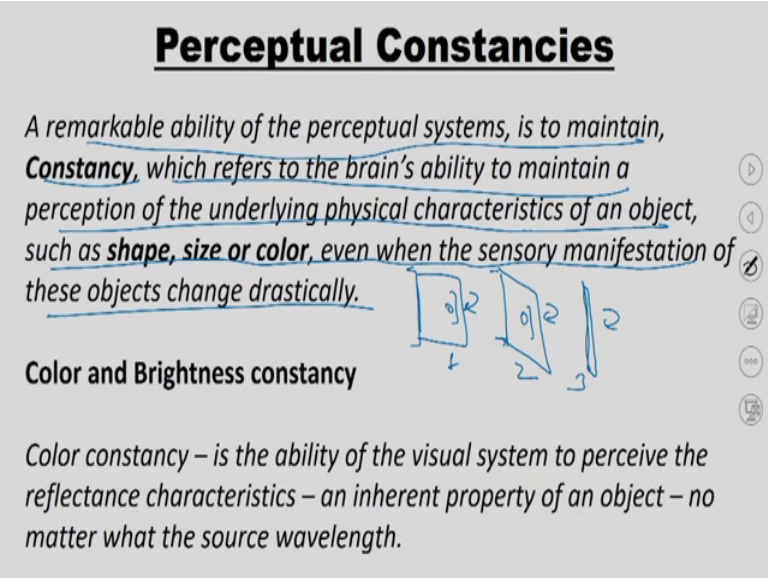

And the last step or the last step in this process is called constancy. What is constancy? Constancy is maintaining a certain a certain relationships to of objects in relation to one another. What is constancy? So, a remarkable ability or the perceptual system is to maintain something called constancy, which refers to the brains ability to maintain a perception of the underlying physical characteristics of an object such as shape, size, colour, even when the sensory manifestations of these objects change drastically. For example, think about a friend of yours who is coming from far away or who is approaching to you from a distance. Now, a friend who is approaching to you from a distance; obviously, is of a certain at a certain distance; let us say he is at a distance of 20 meters.

Now, if it is there the shape his shape which falls of the retina will be very small. Now, as he approaches closer and closer to you his shape on the retina goes on increasing bigger and bigger. But, the question is do you think your friend is changing the shape, no most people do not think that the friend is changing the shape whether is far away or whether is near to you. And this is basically what is called constancy; this is what is the idea about; what is called constancy or look at this. Assume that this is a door on a hinge, this is the handle. Now, when I take this door and when I try opening it this door becomes like this on a hinge right, this is the handle. And, when the door has totally open this is what the door looks like. So, 1 2 3 this is the direction of movement of the door and now the door looks like.

Now, this case the shape that is falling on your retina is a rectangle. This case the shape that is falling on your retina is a trapezoid and this k is the shape that is falling on your retina is a straight line. But, in all these cases the dole still appears to be a door or you maintain this constancy, maintain this idea that the door is still a door. It does not change shape, the same shape or change the fact that this is a door. There are several types of constancies that the human brain actually maintains; let us look at some of these constancies is one by one. Colour and brightness constancy, what is this; colour constancy it is the ability of the visual system to perceive the reflectance characteristics of an inherent property of an object, no matter what the source wavelength is.

Now, when let us say I have a particular colour, I have a red colour book. Now, when I take this red colour book and I go inside a room which has a incandescent bulb. Now, the incandescent bulb will have is called the source of source wave length or it produced the source wavelength source of the elimination. And the so, this is called a source of illumination and the object the red colour book which reflects or colours of light from the source has is supposed to be having something called reflectance wavelength or reflectance characteristic.

Now, when I take this book and go into a dark room weight which has incandescent bulb or a room which has an incandescent bulb, the reflectance that the book is doing off all the light particles photon particles which is coming from the bulb is different from when I take this book into a bright sunlight and then I actually see the book right. So, when I see the book in bright sunlight the reflecting characteristics or the wavelength is reflected by the book will be entirely different. But, no matter wherever I go the book appears red to me and this is called the brightness constancy or this is called the colour constancy; similar there is something called the brightness constancy.

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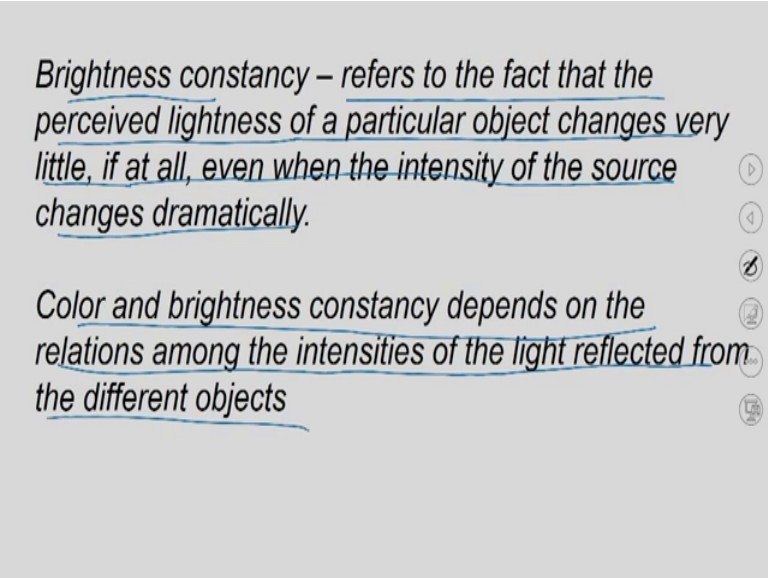

If there is a white colour cat and you see it in a dark room it is more whiter, but if it is a black colour rat or the same white colour rat in a white room will appear to be lesser or dimmer. Now, this idea the white colour act is still white whether it is in a dark room or a bright room; the idea of this is what is called the idea of colour constancy. Brightness constancy refers to the fact that the perceived lightness of a particular object changes very little, if at all even when the intensity of the source changes drastically. Colour and brightness constancies depend on the relationship among the intensities of the light reflected from the different objects.

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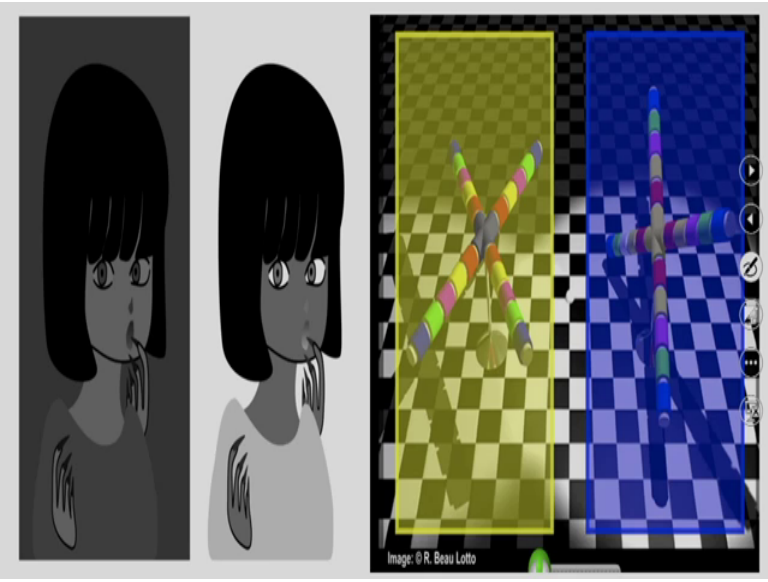

Same girl two different backgrounds. So, whether this girl looks more brighter here than this one; most people will not see this happening because a constancy is maintained. Two different the same colour object is, there at the background and two different filters are used. You will not see a difference because certain colour constancy and brightness constancy are maintained.

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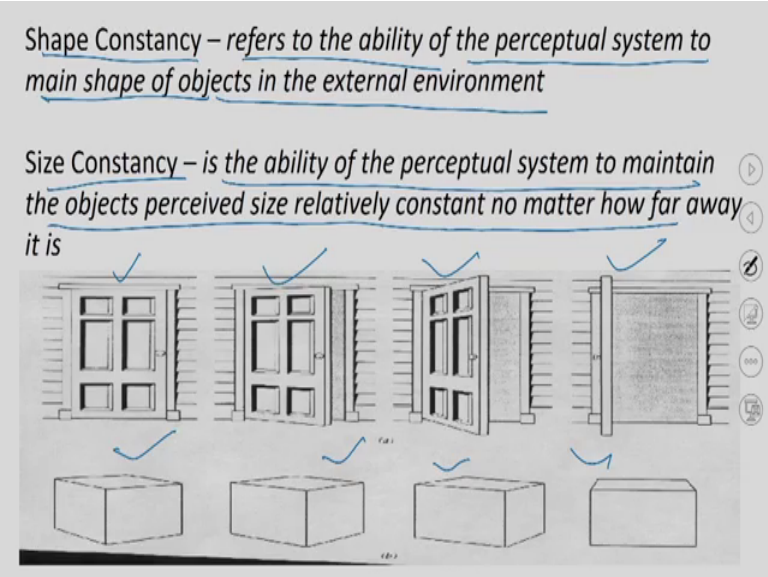

Shape constancy similar to colour and brightness constancy is the idea of shape constancy. What does it say? It refers to the ability or the perceptual system to maintain shapes of objects in external environment. Similarly, there is something call size constancy- it is the ability of the percentage system to maintain the objects perceived size relatively constant no matter how far away it is. So, door whether it is this way whether it is opening whether it is this it appears door to you.

And, similarly this is what a trapezoid is no matter how you move it is still a box right. So, here it is its not that this is more of a box and this is less of a box when you change the angle, what happens is the box still remains a box. And so, constancy is that property which is proposed or which is possessed by the brain. So, that it is able to see all orientations or it is able to see certain fixed idea about objects.

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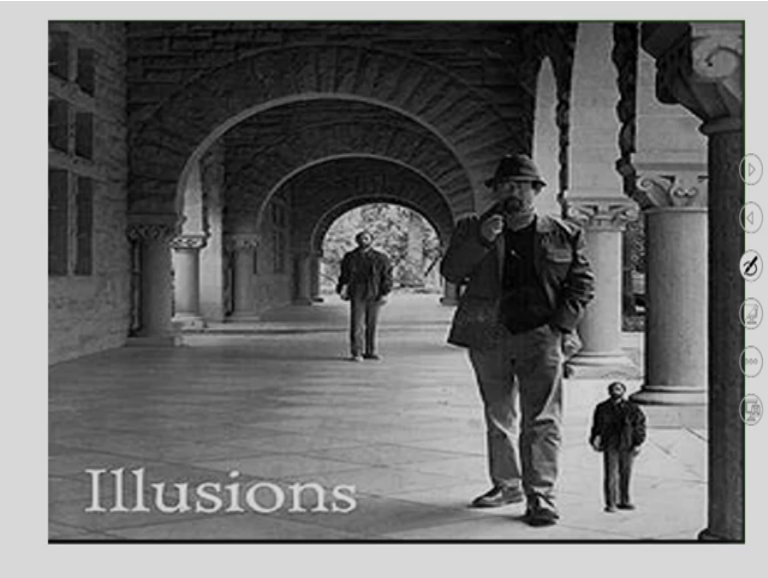

This is an illusion, now how does it sometimes these constants is also responsible for illusion. Now look at this, if you look at these two people right here and here and the idea of illusion is also another wonderful feature of this maintaining constancies. If we look at it this person looks smaller than this person although, if you measure this and this person is the same.

Now, the architecture of this room is made in such a way using binocular monocular and binocular cues that this person here appear smaller and here it appears bigger. And, the idea is that since there are lines which are going here and so, that constancy is maintained that idea is maintained in your head. And so, you believe that this person is smaller than this, is this is actually a illusion right. So, this is what we actually keep on doing and this is how the idea of constancy actually works right. So, these illusions are also part of the business of constancy.

So, what we did in todays lecture is we looked at the three different processes which we left off in the first section or in the first set of lectures. Now, perception not only starts with attention in localizing, it also has a process of something called recognition. And, as I discussed in this lecture this recognition starts with something called global versus local processing. The next step in recognition is something called the binding problem where, it has to be identified what stimulus is coming from the sense organs and how they have to be captured together or glued together.

If there is a problem on in gluing you come to note that and that is called elusive correlation. So, all those people who are able to tell the colour of the car and the shape of the car, but not the colour car which colour card is which brand they are falling prey to something called elusive correlation.

The next step is basically recognizing object and that happens in terms of recognizing the shape of an object. This is the primitive form of recognition; this is called the first stage recognition. In the second stage of combination you have later recognition models certain models which are called simple and or argumented models. Now, simple model says that and this simple and argumented models generally work in terms of letter perceptions.

And so, simple network models actually say that certain line angles and certain lines angles orientations are what are used. And, these certain line angles or orientations they integrate together to give you the perception of particular letters and shapes. The argumented model says that it is easy to perceive a shape, it is easy to perceive a letter when it when not only the basic idea of about lines angles are there; also do you know the fact that when this letter is possible or in which word this letter is possible.

So, if you have both this piece of information of what word can contain this letter and what basic forms or what basic angles and orientations is the sensory organ sending to you, these two information combined together it makes it easier for you to identify angles.

Similar to perception letters, perception of natural objects are there and the idea is that there are certain geons and these geons they combine together to give you an idea of how letters and how natural objects are perceived. So, that is about recognition or that is how about recognition really glows goes through at the process of recognition really grows through. Then we have the idea about something called abstraction. What is the process of abstraction?

When we recognize an object we abstract information or we extract information from it, those information which it has different from the prototype or the idea or the concept of anything that is as. For example, if I am seeing a face the brain already knows what a face looks like it has 2 eyes, 1 nose each time you see a face you do not have to capture this information; all you have to capture is what is the one thing which is different. And

so, it captures that and it stores it on the background of the face which is there; only the brain has to know whether it is a female and male female or male and what kind of peculiar feature that I am looking at. Takes this information, binds it to information which has already been stored in the brain and then how this is how you recognize faces.

So, this is abstraction which is basically taking in information. Then there is a process of constancy which helps in recognition or which helps in perception. Constancy says that there are certain things there are certain facts which the brain preserves. For example, heights of people do not change when they move towards or away from you, also such perception of colours do not change, perception of shapes do not change. Because, if they change then the world around us will be in interpretable and so, you have this constancies or you have these ideas of making constants into and embedded into your brain. And, that is out what the brain actually uses for making information possible or for making understanding possible.

So, in this lecture we completed what we did in the last lecture and explained the idea of how perception really works. If you are really interested there are other lectures on cognitive psychology which I have floated, which will in detail explain to you these network model disconnective models and this idea of how recognition takes place. So, if you are interested you can view those lectures or in the internet there, there are these lectures of cognitive psychology which are another course which I took.

So, you can focus on those courses which will detail to you this process. Now, since this is an introductory lecture or introduction lecture I am not focusing too much on to how these perceptions or the cognition actually happens. But, as I have been telling if you are interested you can refer back to those lectures in cognitive psychology where, the idea what perception is explained in detail. For here for introductory process this is the minimum that you need to know of how object perception or perception of any form actually takes place.

So, until we meet next it is goodbye from here you.