Introduction to Cognitive Psychology
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Lecture – 20
Object Transformation in Visual Memory

Hello friends, welcome back to this follow up session on mental imagery and visual imagery. So, in the last class, what we saw was what are visual images and what is imagery and we looked at what are the pitfalls of using imagery and why imagery studies were negated in the beginning of psychology.

So, several reasons for example, imagery cannot be verified, it is very personal also imagery mental imagery is equivalent to a picture and so that is one concern, we cannot see imagery and we cannot actually verify peoples imagery also the idea that there is something called visual imagery code into long term memory is also not proven to experiments and so, imagery studies were not taken seriously in the beginning of psychology, but later on with classical book bile and pavio on mental representations and using the dual code processing model talked a lot about what visual imagery and what are the different things that can be done with visual imagery.

So, one of the things that visual imagery does for us is it makes things easier for us it makes retrieval of information easier for us. So, if information is stored in the long term memory as visual code or has visual images it is much easier for us to retrieve it back the reason being that visual images are more informative and are more easily accessible. And so, we in the last class also told you a lot about a different types of visual imagery techniques which help you into remembering our retrieval of information. Now some of this techniques were method of Loci and Pegword method and also the method of interacting images; now in each of these, what we actually did was in the method of Loci we made a mental picture of space a physical space that we are very familiar with and what we did was the things that we need to learn was taken in and.

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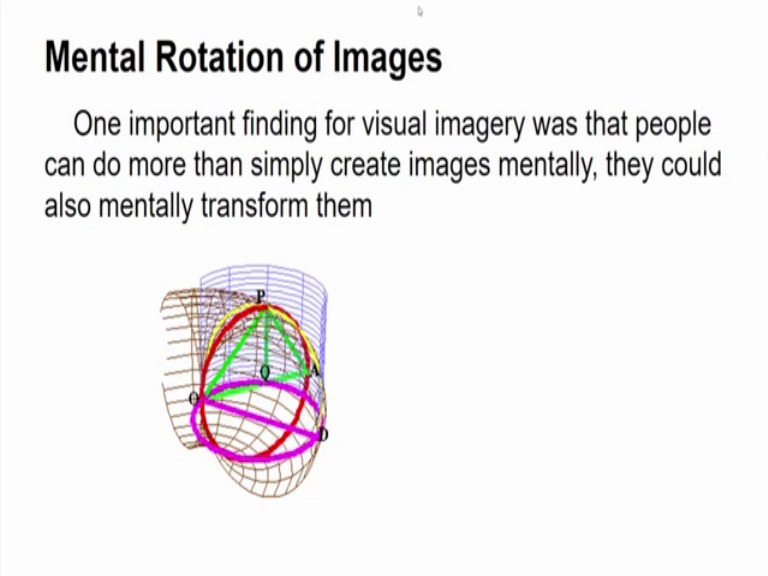

Then packed down to or packed on to certain locations of this well known space.

Now, in this way when we remember the space and certain locations in the space, those things that you wanted to retrieve came back to us. Now in the interacting images technique, what we did was we remember two bits of information as images and then we combine this two bits of information into a interactive image. For example, remembering a dog or a pipe how do you remember that? So, imagine a dog, imagine a pipe and then go ahead and combine them together by imagining a dog smoothing a pipe. Now it is funny is novel and things which are novel are remembered much better and things which are routine that is novelty is something which the brain treats as interesting or as more as as more retrievable. So, novelty is the reason why it is retrievable.

Now, in the third method the Pegword method, we specifically did not used imagery what we did was we used a technique in which kind of routine ordered list which we have wrote memorization of was used and things where then tagged on to this list and so, basically, what we could do is how these least lists are wrote memorized list it could be lists that we learned in nursery as nursery rhymes, for example, 1, 2, 3, 4, 5, 6, 7, 8 or a, b, c, d kind of a thing and then we tag on these wrote memorize list on to certain information that we want to stick into it and also that is what we did. So, 1 2; buckle my shoe, 3 4; shut the door, 5 6; pick up the stick, 7 8; lay them straight, 9 10; a big fat hen kind of a thing.

And so, there is a target and there is a queue and the queue is 1, 2, 3, 4; that is a memorize list and the target is the word that you have to remember now beside that we also saw several conceptualizations or several reasons which were given of how these mnemonic techniques. So, basically the techniques I just describe the call mnemonic techniques how do they work and so, one of the explanation which was given was that in terms of the fact that LTM has dual code a verbal code and a visual code and so, these 2 codes actually lead to more number of retrieval cues and so, they are better remembered and that is the dual coding hypothesis proposed by Allan Paivio.

We also looked at something called relational organizational hypothesis which are presented by power where he talks about the fact that if two images are if word that have to be learnt are created as image and created as a combined images, then they have better remembering because we try to create a relation between these two images and have an organizational scheme for it and so, that is the reason why we have better recall the last thing that we did in last section or the last session was looking at the evidences of visual imagery and we saw two tasks a visual task and verbal task and we saw that preferences in terms of method of retrieval was for visual it was visual was better whereas, for verbal the method of retrieval verbal was better.

Now, in today's lecture, what we do is we will continue from what we learned in the last lecture and then look at some more evidence for the existence of visual imagery. So, one existence is that the one evidence for the existence of visual imagery is the fact that certain kind of visual image when it is encoded the method retrieval preferred for it is also visual the second evidence is mental rotation. So, what is mental rotation basically what people do is when they are given some mental images when they are given some kind of a picture, they are able to mentally rotate. So, one important finding for imagery is that people can do simple rotations of images for example, and they can mentally transform them. For example, look at this now this kind of rotation that you are seeing of a basic curve of a circle can be done mentally and so, this people take in images and they can mentally rotate them.

And so, if we can test the idea or if we can provide evidence for the idea that people go ahead and transform these images or if we can come up with solutions in terms of the fact that give them if people certain instances in which ask them to rotate a mental image and give them certain instances to verify whether these images will fit into the model of

the transformation or whether the sequence give them a sequence out of their rotation and if they match, then we can say that people form mental images and they also rotate that now what I mean by that is if people certain mental image to think about and ask them to rotate into certain sequence for example, either anti clockwise or clock wise.

Now, once they are doing that give them a certain sequence of rotation a certain sequence of rotation from the original angle of rotation and ask them to verify whether this is a part of their mental rotation now if they could verify and the time that they took to verification will lead us to certain kind of fact that people create mental images. So, to start with the idea and this is exactly what one of the Lynn and cooper actually went ahead and did this experiment to prove that people do form mental images and rotate, but even before going that what we could see here is this kind of rotation that we are seeing here people do this kind of rotations or if you look into the other ones. So, this is called a Tesseract.

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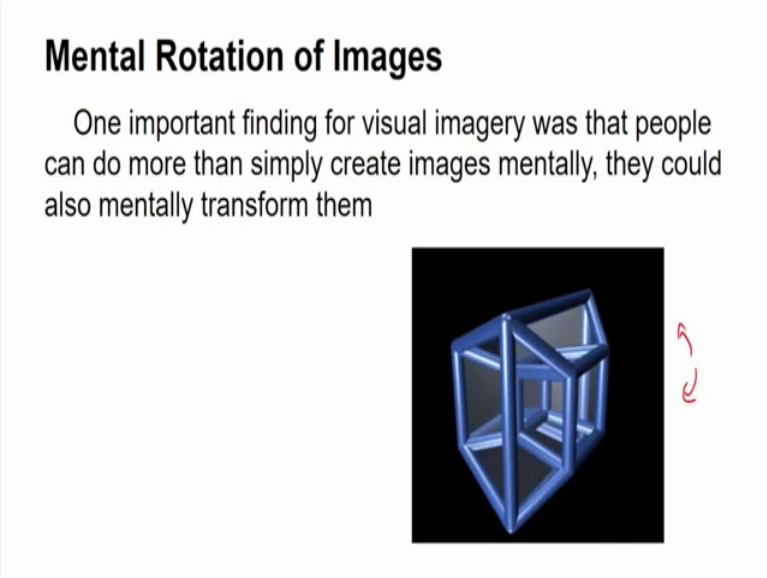

A Tesseract is basically an 4 dimensional image in a 4 dimensional image rotation. So, people can also go ahead and rotate images in multiple dimensions. And so, this is an existence or this is an evidence for the existence of mental imagery or you would have seen images like this. So, these are called in very basic games these kind of images are used and so, these images it is called Tetris.

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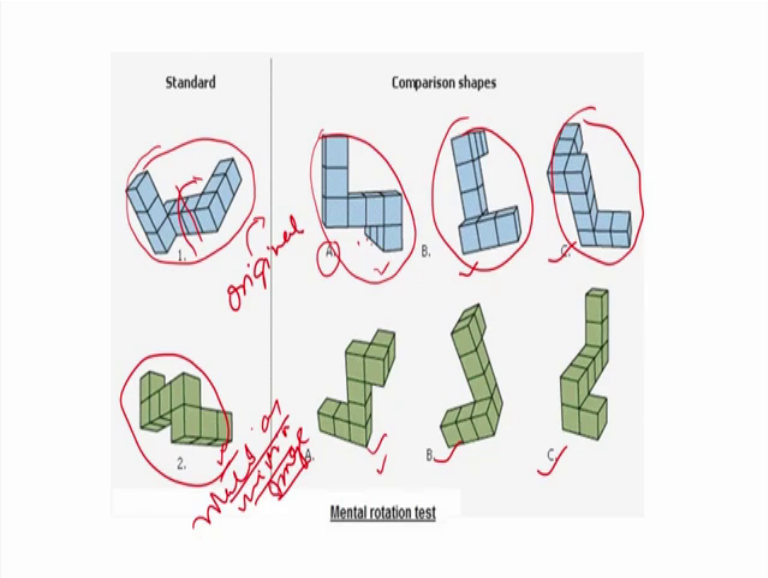

So, there is a game out there which is called Tetris and so, this kind of rotations can be done people are able to rotate. So, these are the standards and people are able to rotate the standards into these kinds of rotational sequences, they can mentally rotate there. So, these are questions which have you would have found in some of your exams some of your competitive exams.

Where you get the sequence one standard sequence and then a couple of sequences are given to you where it is ask whether this sequence what is the next sequence from this sequence and so, if you look into it what is the next sequence that you should get for this sequence; obviously, the answer is a here because this is the one sequence which can happens. So, if you rotate it by say almost 70 degree towards clockwise, this way on this axis, if you rotate it by 70 degree you will get this sequence and so, this basically the existence to the fact that you come up with an answer a by rotating this through an axis by 70 degree is the fact that people are able to do mental rotation. Similarly for this kind of image, you can do rotations like this.

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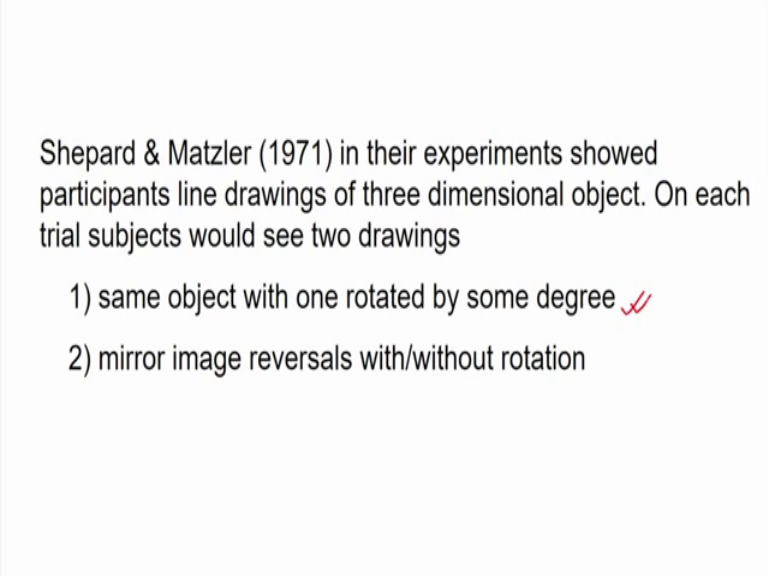

Now, this kind of test were done by Shepard and Matzler and what they found out in their experiment they showed that participants or they can rotate line drawings of three dimensional objects. So, in their in their experiment they took participants and they give them simple line drawings like this.

So, these kind of line drawings are given to people and they were asked in these subjects were asked into basically verify whether which one of these line drawings can actually be the next occurrence or the next sequence from this one. So, this is what your Shepard and Matzler actually experiment from all about and if we are able to prove that people can exactly go ahead and find an answer which basically means that people are rotating mentally rotating images and that lead to the fact that people are able to create mental imagery or the evidence of mental imagery is established.

So, they gave people this kind of line drawings and they ask people to rotate this in three dimensional accesses now in each trial the subjects would see two type of drawings. So, two type of drawings were shown to people in the first the same object with one rotated to some degree. So, you either have. So, the first one as you see here is basically the same object which is rotated to some degree of rotation. So, as I said if you rotate it 70 degree you will find this is 70 degree and so, same images there and it is been rotated and here in this case what has happened is the original image is being rotated as mirror image. So, the mirror image of this is being.

So, here the original is being rotated and here the mirror image of this diagram is being rotated to certain degree certain degree. So, what Shepard Matzler did was they took this kind of simple three dimensional line drawings and gave people to verify certain sequences by mentally rotating this image and so, one of these was the same object with. So, one of these experiments had rotations of the same object which had been rotated to some degrees and in the other case, the mirror image in the other case mirror image or reversal with or without rotation was used.

So, the same image image was taken a mirror image of this image was the original image was taken and that was rotated to certain degrees. So, either a mirror image was there or the mirror image rotated to certain degree was there and people were asked to verify whether which of these sequences fit to the original sequence through rotation. Now the result of the experiment what it showed is that the amount of time that participants actually took in deciding whether the same object has been rotated or a mirror image reversal was there was directly proportional to the angle of rotation between the drawings.

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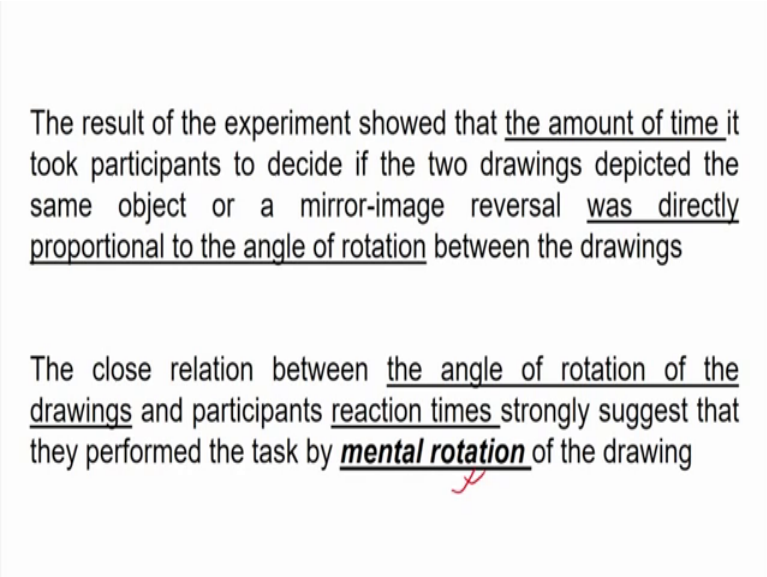

So, more the angle of rotation or higher the angle of rotation the higher the time people required because the more the angle of rotation the more kind of rotational dynamics, you have to use in your in your mentally and then more time will be able to required, if simple angles of rotation of 90, 180 or 360 are used, then it is easier for you to rotate it,

but if angle of let say 60 degree or 75 degree is used. Now that type of rotation takes a long time because these 45, 90, 180, 270 or 360 are huge angles that we see around us and so, kind of perpendicular angles or popular angles is easier for us and so, what people from what Metzler found from the experimentation.

What Metzler found from the experiment is that people were able to verify, but then the time period for verification depended on how much the angle of rotation is also, there is a close relation between the angle of rotation of the drawings and the participants reaction time strongly suggesting that people from mental rotation. So, that is what we were doing or that is what I was actually trying to tell you that people were actually mentally rotating and so, this evidence or this experiment basically provides evidence the fact that people use mental imagery that people go ahead and form mental image and not only form mental images they also go ahead and rotate these mental images and so, that is what fact is or the evidence for mental imagery is.

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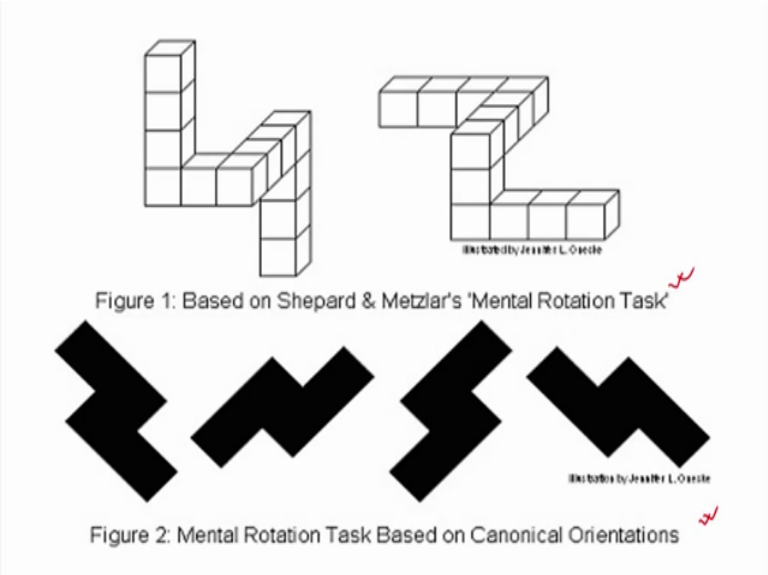

And so, these kinds of images were also use. So, these are the ones which are used by Shephard and Metzler and this is mental rotation task based on canonical rotation. So, basically images in mirror image kind of a things.

So, these are three dimensional line drawings and these are two dimensional line.

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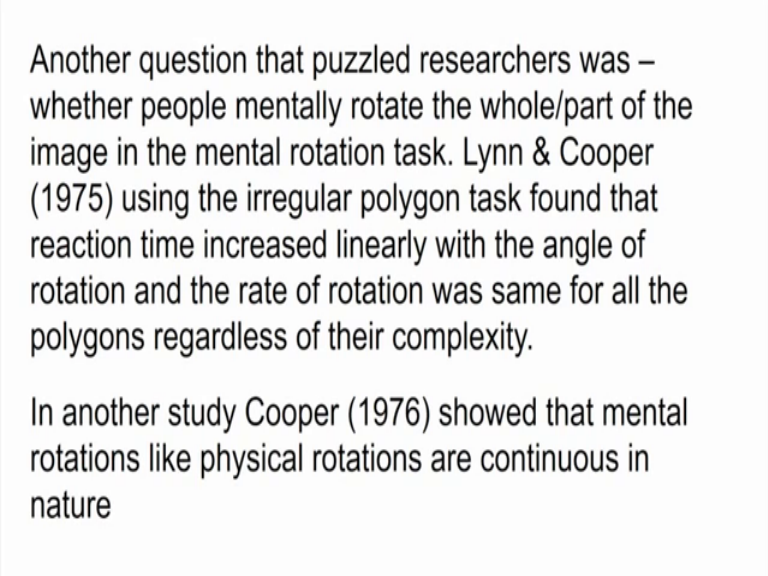

So, another question which puzzle researchers was. So, basically what we found out up till now is that Shephard Metzler; they established the fact that people were able to rotate an image mentally form image first of all and then rotate them mentally to certain degrees and that was evident from the fact that how much reaction time people were taking and that was directly proportional to the angle of rotation the first fact being that people were able to verify certain rotations, which were available or certain rotational instances, which were available and the fact that angles of rotations which were atnon so, normally not so popular angle.

They were taking more reaction times which basically means that people no way not only forming a mental image, but they were also rotating now another question that was that was worrying people or that was worrying psychologist were the fact that whether people mentally rotated the whole part of the image or part of the image. So, once doing the mental rotation task organs taking an image and mentally rotating it, what was the kind of rotation that people were doing where they taking in part of the image and rotating it or where they actually rotating the whole image. And so, Lynn and Cooper in 75, they used design and experiment to test this hypothesis. So, what they did was they took in some kind of a irregular polygon task and found that reaction time increased linearly with the angle of rotation and the rate of rotation being same for all the polygons regarding of the complexity.

So, basically the the idea that they found or the results that they found or first let us see the task that they have.

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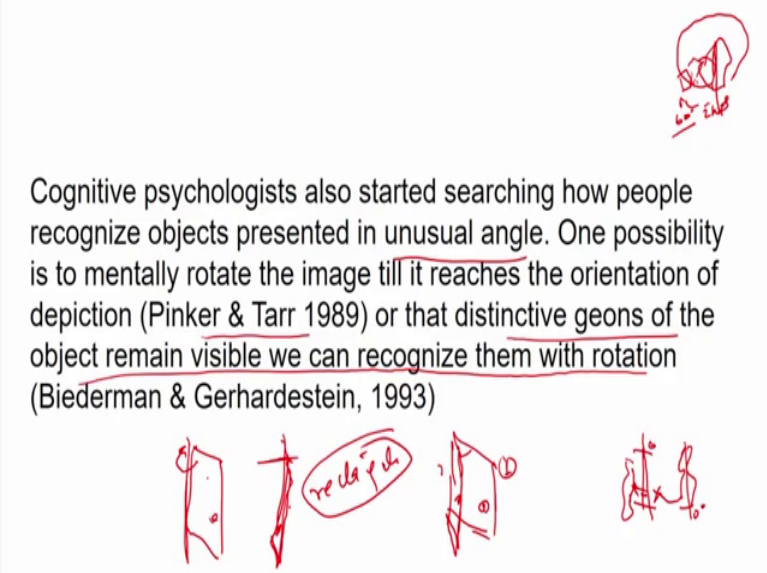

So, this is the kind of task that they have these are the irregular polygon.

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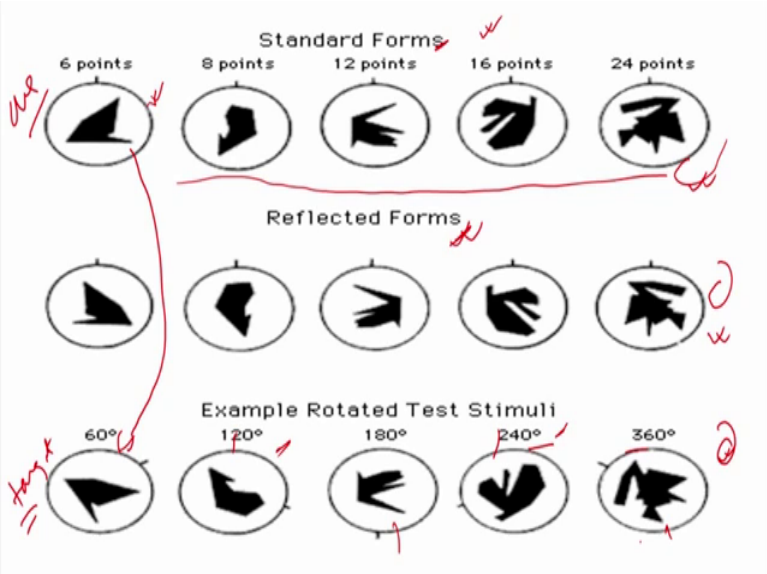

So, you have a 6 point, 8 point, 12 point, 16 point, 24 point polygon, this is the standard form of the polygon and then you have the reflected forms of the polygon these are the mirror images. So, reflected forms is basically mirror image. So, different mirror images were there and so, these mental images or these are polygons were taken in. So, this was

the standard first 6 point, 8 point polygon and certain instances were given to people to test whether this fits into the scheme whether target rotational image that was presented to them could be possible in the rotation in the kind of rotation that they are doing to the mental images. So, 3 were used a standard form was used a reflected from was used and rotated test stimuli were given to them.

So, for example, this is rotated by 60 degree and people were asked to verify this whether this is possible with this kind of a polygon with a rotation the question that stand that was being asked or that was being investigated was the fact that do people rotate the whole image or partial image and so, the results that Lynn and copper cooper got from these experiments what they found that reaction time increase linearly be the angle of rotation in the rate of rotation. So, basically the kind the speed at which the rotation people were performing and the angle that kind of angle that they were rotating it to.

So, 45, 90 degree were easier, but if an angle of 75, 80 or 95 degrees are used, then people were taking more reaction time also with the speed of rotation dependent on this thing and also the reaction time was and in this case the rate of rotation for all the polygon regardless of their complexity. So, the fact is no matter whether it is an 8 point polygon or a 12 point or a 6 point polygon people where facing difficulty all along in terms of that with the angles of rotations where at abnormal angles then people were taking more time.

Now, in another study; so, basically this proves the fact that people rotated the whole polygon instead of rotating parts of it people were actually rotating the whole polygon. So, this study demonstrates the fact that even if it was a 6 point, 8 point, 10 point or 12 point polygon, people were actually going higher and rotating it and the only answer that they getting is that the angle of rotation is the only question or the factor which decides the reaction time now all the polygons where referred to the same speed it was either clock wise or anti clock wise and so, the fact here was that as the angle of rotations of the original polygon on to the target one.

So, this is the one which is rotated. So, this is my target polygon and this is my queue polygon and so, once the angles of rotations are 360 to 40, it is easier, but it is angles of rotation at 60 degree or 120 degree, then the difficulty arises because these are abnormal angles, people do not see these angles too much.

And so, that was the result from these studies now another study cooper did in 76 showed that mental rotations like physical rotations are continuous in nature and so, what they did in this study. So, they wanted to study cooper wanted to study whether this mental rotations were continuous in nature in the sense that do people rotate in a continuous form. So, if I ask people if I ask someone to rotate take a mental image of something and rotating clockwise direction do people rotated in continuous nature and to test this they design an experiment in which they presented people with a with instances from the rotation.

So, let us say if I have an image like this and I ask people to rotate this clockwise starting from this is 0 degree and when people are rotating it, I will stop them somewhere here at some point of time, let us say 2 minutes into the rotation I will stop them and then I will show them the figure like this which is let us say 60 degree rotated to the original. So, this is the original angles. So, 60 degree rotated to the original angle. So, this is my original figure then this is at a zero degree then I rotate it by 60 degree, let us say this is 60 degree to the original angles. So, this angle is 60 degree and here is my rotated image and rotated image will be something like this and so, people were given this kind of images in between to verify whether this is there or not and this is was the experiment.

And so, they found out that people were actually able to verify that which basically means that people were continuously rotating this polygon, they were not rotating it at certain angles they were continuously rotating it and the method that they used to test this first they stop people at certain points of rotation and presented them with a instance of rotated image and ask them to verify, whether this can exist or not or this is a part of their rotation or not and so, this is very simple task and so, people were able to verify which basically means that they were people were rotating it continuously any image they were rotating it continuously, also cognitive psychologists they started searching how people recognize objects presented in unusual angle.

So, basically something is presented into an unusual angle let us see at 95 degree. So, how do you recognize that an object? So, one possibility that was available to psychologists was that the mentally rotate the image tilt reaches the orientation of depiction or that distinctive Geons of the object remain visible we can recognize them with rotation. So, basically if something is presented at an abnormal angle how do people recognize it.

So, one proposal was that people actually either rotated it to continuously to the for to the point at which the rotated image is exact matched with the original image of original image which is represented to you as target or what people were doing is they took the object took away the Geons and rotated the Geons to look into it, for example, one demonstration could be if I put a coin onto this table and let us say any coin on to this table and then I do not look at it from a top view, I come parallel to this table. So, this is my table and so, I put a coin here and so, do not look at the coin this way I looked at I look at a coin from this way now when I look at the coin from this way or from down up kind of a thing from this line of sight then what would happen. So, in these cases is this will be an original angle this will be an abnormal angle.

So, let us say if an door is like this is demonstrated in like this and then when this door comes very nearby I demonstrate it this way. So, basically when it is coming near to me it becomes larger in this way and so, these are abnormal angles which are there. So, how do I verify that? So, what people did in terms of whether this is a same door. So, this is position one and this is position two. So, in my position 1, my door is here and it is further away from me this is the hinge and in position two it is very near to me. So, this is the hinge and so, it has this is how the door looks like. So, how do I verify at this door at a irregular angle what I really do is I either that two ways to it I either I rotate this door into a clockwise direction till it matches this particular figure this is one view or that distinctive Geons of the object remain visible and we can recognize them with rotation. So, there idea here the Geon here is a rectangle.

So, a rectangle is the Geon which forms this door. So, what I do is this rectangle is still visible to us whether it is lopsided or not whether this rectangle is bigger or smaller is not the question the question here is whether the rectangle is visible to us and so, if this rectangle is visible to us we can then rotate this Geon and actually think that the door is being shut or it is being moved towards me or away from me and that is how this Steven Pinker and Tarr in 1989, they gave an explanation to the fact that how do people actually recognize object at unusual angles and so, this is the image was used by Lynn and Cooper and so, this is the original image this is the mirror image and this is the image which is tested across various angles. So, 60, 60 to 40 and 120 are angle which are abnormal angles 180 and 360 degree are. So, 180 would be basically a mirror image and 360 degree will be a complete rotational of image of it.

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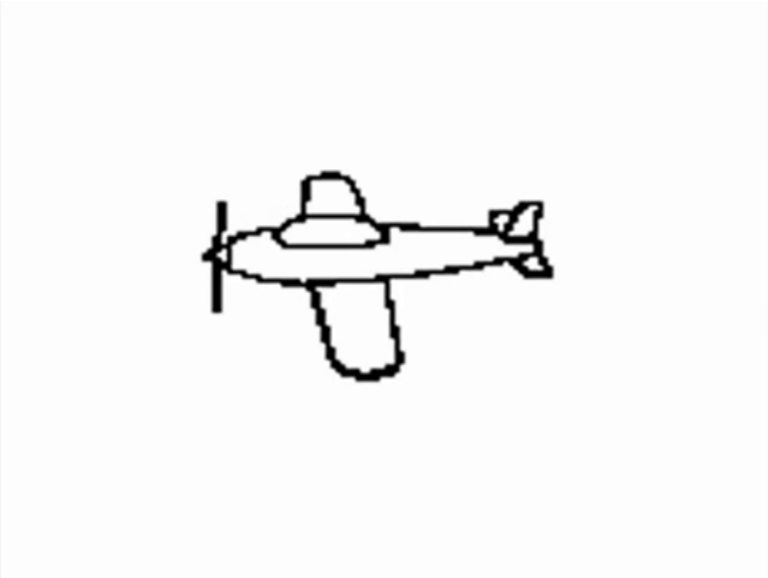

And so, this is our people actually using and so, looking at this demonstration; so basically what you are looking at is this figure being rotated in a different plane and different angles.

So, this is basically how people go ahead and rotate it and so, this is how mental rotation of images exist and so, this mental rotation of images, the fact that we can verify certain rotations provide enough evidence for the fact that people do form mental images and mental imagery is actually a code which can be used. So, let us then look at some other aspects of this mental imagery the question is what is the nature of the mental imagery that we are talking about what is the form of it.

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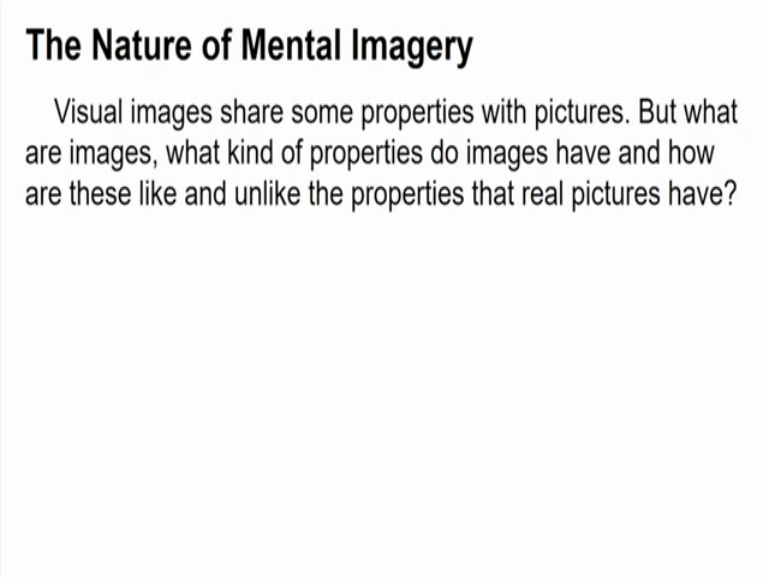

So, one other thing is that visual images, they share properties with pictures the visual images that we have they are more or less exactly like a picture, but what are images what kind of properties do images have and how these like and unlike the properties of real picture have that has to be discussed. So, what is the one to one relation between a picture and image that is what needs to be seen and what properties they share with this picture and what properties, they do not how are they like a picture how they are not like and what is what we are going to see in terms of the nature of imagery.

So, Ponald Finke in 89; 1989 he proposed some fundamental principles of visual imagery he said that visual imagery has certain fundamental properties certain fundamental features which we can discuss in which we can see and these features basically correspond to the picture thing. So, what we did was he proposes 5 different fundamental principles and they took visual imagery he took visual imagery in pictures and compared them across.

So, what are these five features of a mental image the first thing is something called implicit coding. So, what it says is that mental imagery basically in codes some information implicitly which pictures cannot for example, remember the first class that I asked you in this section in this session the earlier session on visual imagery I asked you to think about what was in the wall on your bedroom and so, there was implicit information they were things which were in your mind or they were things in the image

which you never thought about. So, you might have never thought how many cells of the window are present.

But then when I ask you this question you can mentally count it which means that the information about the number of cells which your windows have is implicitly encoded that is what this basically this principle says. So, it says that mental imagery is instrument in retrieving information about physical properties or objects or about physical relationship among object that is not explicitly encoded at a previous time and that is what I was talking about the certain informations which pictures cannot have visual images can have.

So, you can have information certain information about certain facts embedded into a visual imagery or visual image which is not possible at a picture level the second thing is that perceptual equivalence, how a visual images equivalent to a picture it has perceptual equivalence for example, it has been found that imagery is functionally equivalent to perception of the extended similar mechanism to the visual systems are activated when objects are events are imagine as when the same objects or events are actually perceive.

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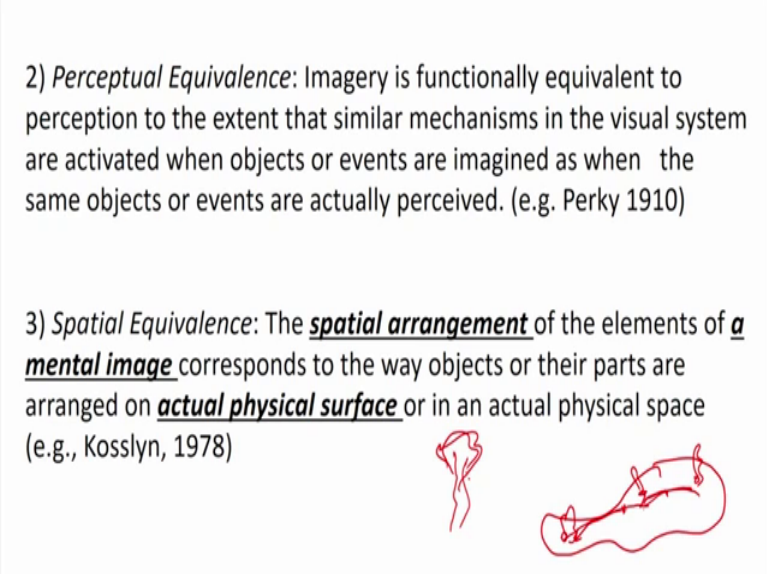

So, that there were certain there were studies which were done certain new studies which were done and it was found out that the same areas of the brain get activated except the visual eye system which takes a new information when you imagine something. So, if people asked to imagine a coffee cup and people are shown a coffee cup the way they

perceive these two things together the number of areas the kind of connections at these areas have are exactly the same the same brain regions get activated the same kind of connections are activated.

And so, what happens is that imagery is more or less same as looking at a picture or looking at something which is out there. So, it is imagine is basically same as looking the only difference being that there is no input the input system is not there the same visual cortex the same areas of the brain which verify an image which done object recognition which let us the frontal cortex know, what it is and then come out come up with the decision of what possible objects for the visual imagery be all those areas is the same and this get activated the same way, but no only the input system which is the highest not activated and so, in this way visual images are similar to and picture.

Now, the third principle which thing gave in terms of third property of a visual image is called spatial equivalence what does it mean it means that the special arrangement of the elements of a mental image corresponds to the way objects or their parts are arranging actual physical surface or a actual physical space. So, basically in there are some experiments done by Kosslyn and so, what they did was Kosslyn did was he created a fictitious map and in this map what he did was he made certain positions right. So, he created a map like this and in this map he created certain positions and these positions had certain kind of placeholder. So, you have certain things on this map and ask people to move from point a from point a to point b and play some hurdles here and so, he looked at the time that people took to move from point a to point b.

So, what it it was it showed them map these positions and ask them to move later on they ask people to imagine this map to think about this map think about a map of America, think about a map of India start from Kanyakumari and then move towards Bangalore or start from Kanyakumari and move towards Bombay, now do that and what you have to do is you have to then basically in this moment describe all the places that you venture into or going to and then I show you actually the map of India and then ask you to move from point a to b kind of a thing a very simple explanation.

Now, what they found out is that the time that people took right from moving from point a to b, the kind of arrangement the kind of movement that people did in terms of the actual map is the same time and the same kind of arrangement of same kind of

movement that people did in mental imagery which basically means that people when they move in terms of images in terms of real pictures in terms of real movement and in terms of mental imagery with more or less same. So, the special locations in terms of moving in spaces whether in whether through a mental imagery or through a picture for or the real motion or real movement in terms of space are more or less same.

So, people took the same time from moving from point a to b in terms of mental imagery when they imagine this map and thought of the movement then the similar to what people did in terms of making movements when they were actually moving from point a to b or another experiment was done where they were costly insured people are flower rather a tree and ask them to move from the top of the tree and start naming right. So, start naming what is at the top of the tree towards the bottom to the root start naming all the things that you find. And so, the time that people took and the number of elements that they kept on saying when they move from the top of the tree to the bottom of the tree or top of a flower to the bottom of a flower then the number of elements that they said that the flower possessed when moving from the top of a flower towards its stem or top of a tree towards its root was similar.

In terms of; both in terms of actual special movement in actual movement of a flower as compared to the movement in terms of an imagery when they were asked to imagine this flower and made to move which basically means that in a special location in terms of special locations both the image and flowers are sorry image and the pictures are same the fourth property is in terms of transformational equivalence.

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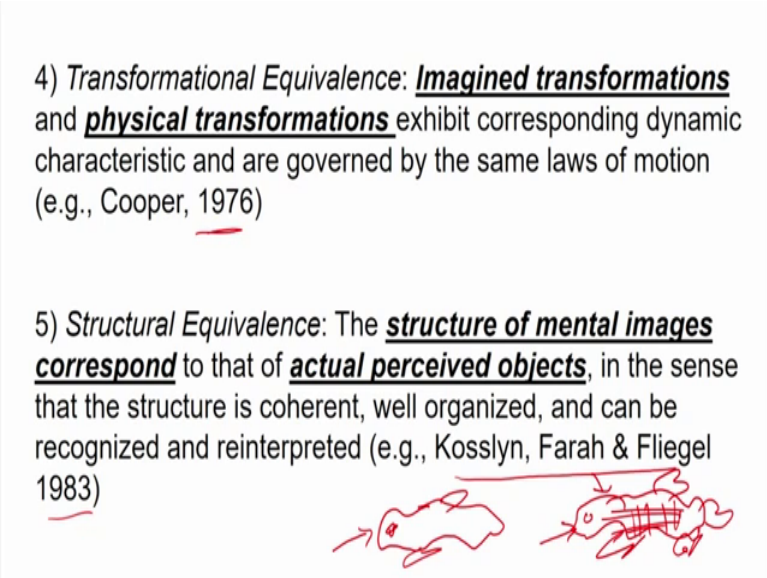

And what does it say that imagine transformation and physical transformations exhibits correspondingly dynamic characteristics in a governed by the same laws and is the same experiment which cooper did in 1976. So, what happened in this experiment where people were actually given a cube to look at and they were asked to rotate this cube through certain angles then they were asked to basically take this cube mentally imagine this cube and make the rotations and then people were tested with certain instances.

What was found out that the same amount of time or the same amount of verification was done by both or the same accuracy of verification was outputted when people were transforming mental images as where they were physically transforming an object which basically means that people while imagining may also able to transform or also able to mentally rotate images and that is what we saw in the earlier examples also.

So, visual images are not just static people also transform them and these transformations these rotations either on the axis or a cross axises or a different axises are similar to the physical transformation which is there and so, the result from cooper remember the results the experiment of cooper 76 where they made people transform certain images on to certain angles then tested certain instances with the accuracy of it the same experiment can be uses an evidence here and the fifth property of of Finke of visual images is called structural equivalence now what does it means the structure of mental images correspond to the actual perceive images.

And so, in this case, Kosslyn and Farah and Fliegel, they gave people certain structure certain images which had very leek structure and certain images which has complex structure for example, they showed people let us say the drawing of a fish I am not very good at drawing drawing of fish like this and so, it has very less detail or they showed people the drawing of a fish like this which has scales like this right and this kind of fins and other things here. So, this is a complex image because it has more details into it and this is a simple image which has lesser detail into it. So, when given people these two kinds of things and asked and then ask them to retrieve more time was taken by people to verify to actually make the structural verification or to actually perceive this one the complex picture as compared to the simple picture.

Now, in terms of imagination also when people were asked to imagine a fish like this with these many features they took longer time to imagine a fish like this or they took more time for complex image imaginations then imaginations of simple images which basically means that in terms of structure also in terms of the fact that when people imagine they imagine with complexity where they imagine complexity with more time the more complex picture is takes more time because more number of elaboration have to be done and so, this idea of more number of elaborations are also in present in visual imagery which means that the same kind of verifications in terms of complex and simple images happen both for the picture for the physical transformations as well as mental transformation.

So, five different kind of things to look at again reviewing quickly back into what are it is all about and so, the five things first visual images having specific coding. So, it has it specific formations into it with pictures do not then perception equivalence perceptually speaking the same areas of the brain are active when a picture is imagine and a picture is seen the third is structural the special equivalence show in terms of movement in space they are more or less the same the fourth is transformation equivalence. So, mental images can be transformed similar to what physical physical pictures could be and then the fifth is structural equivalence in terms of structure in terms of the complexity the same kind of complex it is same kind of processes exist with both the mental image as well as the actual image.

Now, there are certain critics to this mental imagery certain criticism which have been there to this mental imagery and what are this criticism.

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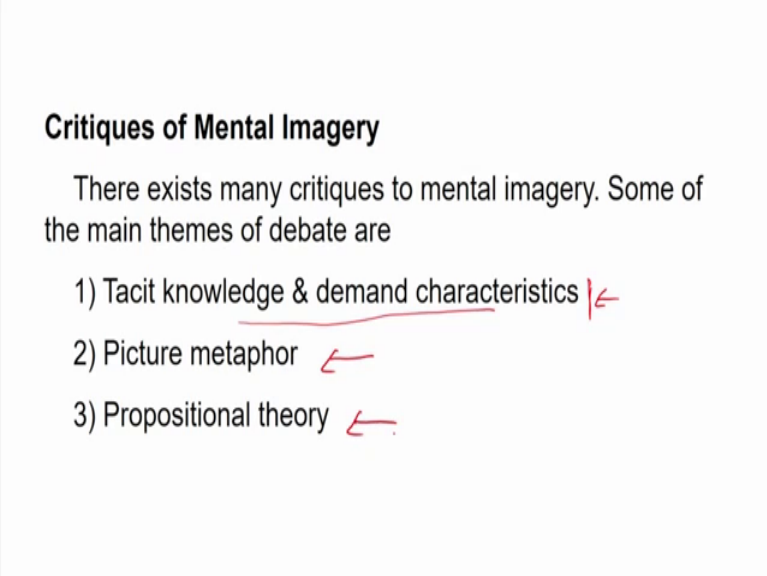

So, there are three main criticisms first is tacit knowledge and demand characteristics. So, basically mental imagery has been criticized on certain factors first is the tacit knowledge people have some kind of knowledge or people gather some kind of knowledge from experimental in terms of transformation. So, that is one thing and demand characteristics are certain task mental imagery task demand certain characteristics or demand certain kind of response from people. So, that is one thing and so, that is how it is looked at the second is the picture metaphor where comparison between picture and mental images done and the third is a propositional theory.

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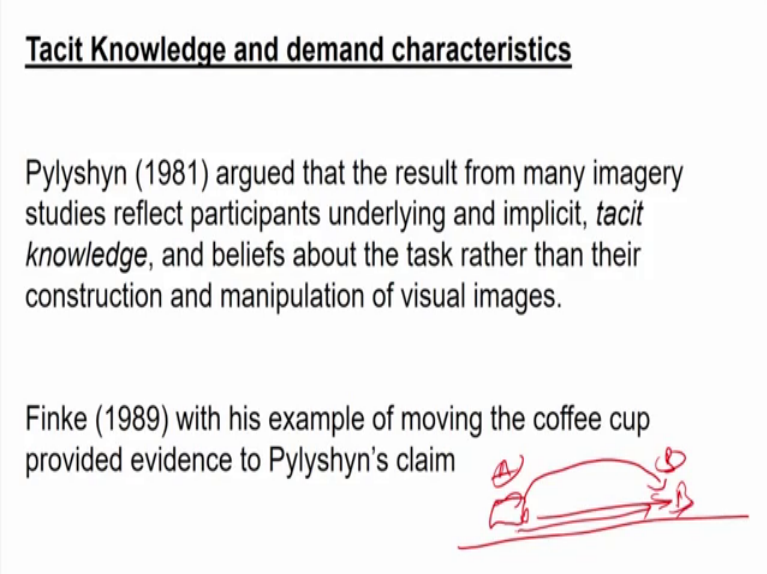

So, let us look at these critics one by one. The first is tacit knowledge and demand characteristics. So, what Pylyshyn in 1981, they argued that the results from many imagery studies they reflect participants underlying and implicit tacit knowledge and beliefs about the task rather than their construction and manipulation of visual images. So, what they found out or what they told is that people were actually what they were doing is they were they were acting up on to something called experimental effect which basically means that experiment who were asking them to do this construct this mental images they were actually providing some kind of a clue.

So, either mentally or either physically mentally or some form and so, this was the reason why people were able to create mental images or do all kind of manipulation into mental images. So, Finke with is example of moving the coffee cup provided the evidence to Pylyshyns cup. So, basically what was this coffee cup experiments, it is a very simple experiment and so, what it was that if a Kosslyn actually initiated this experiment and Finke had operated on to it. So, what the experiment was that a coffee cup was put onto a table and it was asked to move from point a to point b.

So, I have a coffee cup like this on to this is a table and this is position a and this is position b and I want to move my coffee cup from point a to point b. Now physically two ways are possible I will pick up this coffee cup from here and then move it over air to point b or I can slide the cup from point a to point b now when I do that a certain amount of time requires now when I have people were asked to imagine to move this coffee cup from a to b; what Finke found out that they could do it very quickly they actually could do it very quickly.

But then people were pausing people were taking thinking about taking the coffee cup and taking the same amount of time work rather a little bit more time when moving the coffee cup from point a to b and why was this there they were the reason that Finke gave is that the experimental were giving certain demand characteristics or certain kind of clues which ask or which made people mentally pause the coffee cup position in their head and then take that amount of time what they were is thinking is what their conclusion is that people actually thought that although this can be done quickly, but this is the amount of time it should take and should I should pause the cup mentally and so, this type of talks the task that called cognitively which basically means that these task are

open to influences from belief systems from the ad from your previous knowledge and so and so forth.

So, what people did was people although took experimentally same time in terms of movement from point a to b on a table and in terms of imagination studies also, but it was not that people were had this; this is because of imagination what really happened this that certain knowledge from previous situations or certain tools from the experimental made people actually mentally pause the cup somewhere and then take exactly the same time that the that physical movement would do and that is what their explanation is in a Pylyshyn 1981 states; states that task are that are affected by peoples belief and expectations are termed as cognitive penetrable and that is what it is.

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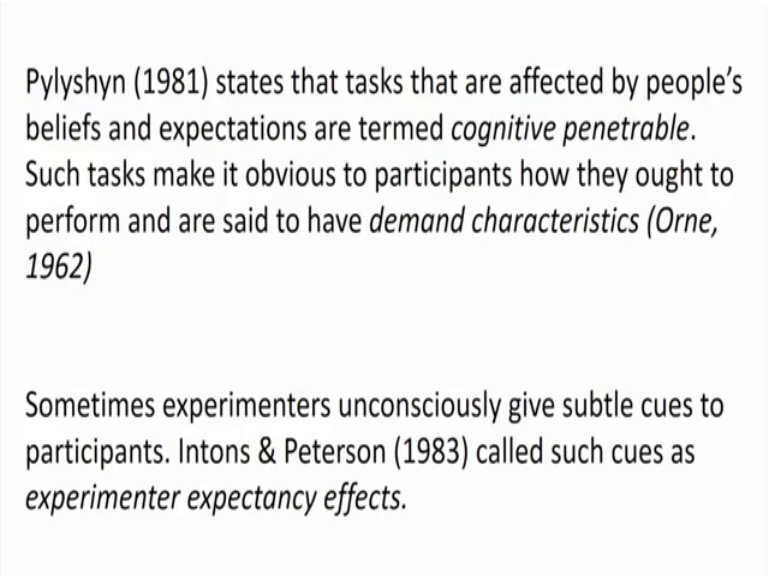

So, basically what happens is since this kind of tasks give the person doing it a chance to use the knowledge that this is the time we should took from should take from move in the coffee cup from a to b and so, what they do is they actually go ahead and mentally pause it. So, its basically not the image construction or the image movement which is taking up the time it is basically a mentally pausing the idea that people get this clue and using this clue as mentally pausing it.

Now, such tasks makes it obvious to participants that they how to perform and are said to have demand characteristics. So, such tasks basically in the coffee cup moving experiment people know that it should take at least one second two second five seconds

and so on and so forth. So, what they do is although mentally they can move very quickly they pause somewhere or they take more time because to match the idea that this this cup should this movement should be match to the actual time also sometimes experiment unconsciously give subtle cues to the participants. Now in intense and Intons and Peterson call such effect experimental expectancy effect.

So, what happens here sometimes in this experiments what the experiment tend to do is the experimented tends to give certain clues to to the subjects were doing mental rotation for example, probable nod if they verifying a particular angle or cue which has been rotated at an angle. So, maybe a subtle cue or a subtle or subtle gesture which gives the subject or which provides the subjects and kind of a clue of whether it is right or not and so, they say that these clues are the reason why they are doing. So, correctly and so, mentally imagery is suffering from these kind of problems.

The other critic is called the picture metaphor. So, what is here?

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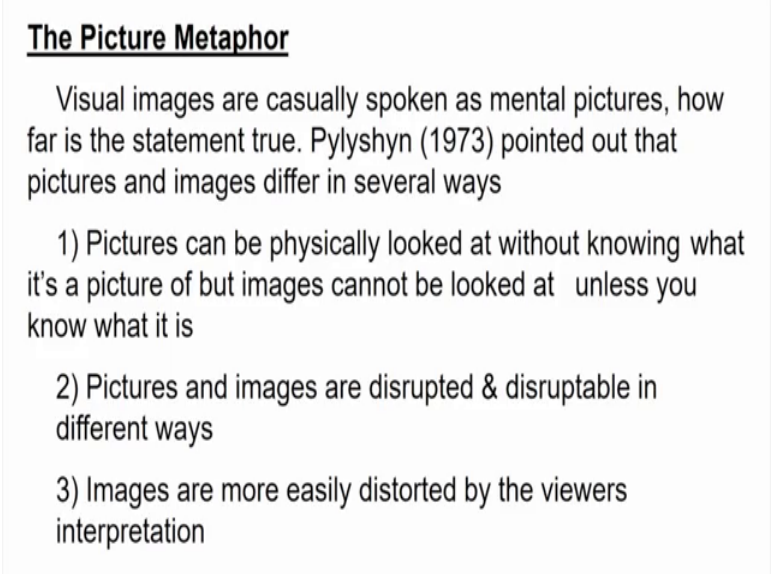

So, visual images are casually spoken as mental pictures. So, visual images are thought of an mental picture. So, how they are how far this statement is true Pylyshyn, 73 he pointed out that pictures and images differ in several ways there are although mental imagery is thought of elemental picture, but there is was demarcation between what a picture is what a mental images and so, what is this demarcation first pictures can physically we looked at without knowing what it is in a picture that were looking, but

mental images cannot be done. So, if you looking at a picture of someone you do not know right and so, in these cases.

So, you have a friend friend has a friend and so, you looking your friends and other the friend's friend's picture you might not know the friends friend and so, you can very well look into it without knowing anything about it or a picture of some place that you have visited if you looking into it you might not know where this place is and you, it is perfectly to look into it, but visual imagery cannot go through those parameters you have to first know. So, if I am thinking about the united states I am actually know that this is the united states I am thinking about Berlin were I have lived for some time.

So, the idea is that I am thinking about Berlin which means that I have named it and so, I am thinking about that place. So, I have to know Berlin before thinking about it and forming a mental image about it whereas, in picture it is not necessary. So, first difference second difference pictures and images are disrupted and disruptable in different ways. So, pictures can be disrupted or it can be disrupted and disrupted in different ways for example, if certain you can cut out certain things from a picture certain. So, if you do not like your best friend who has now become your enemy you can cut him out of the picture, but if you try cutting out something for a mental image image disappears.

So, basically you cannot cut certain features from a mental image third images are more easily distorted by viewers interpretation. So, if I give you an interpretation if I say that if I show you a picture of a friend two friends together which are both common friend and then I see that this friend is a little bit should now there will not be a change in this picture, but as if I ask you to imagine a friend or imagine your friends friend and your friend and then say issued the kind of image changes the mental image will change particularly more cunning kind of an image of the second friend would appear, but in terms of picture this cannot happen. So, basically this distortions can happen in terms of images, but in terms of pictures it cannot.

And so, the comparison between the picture and mental images not true because of these factors which have been out lined.

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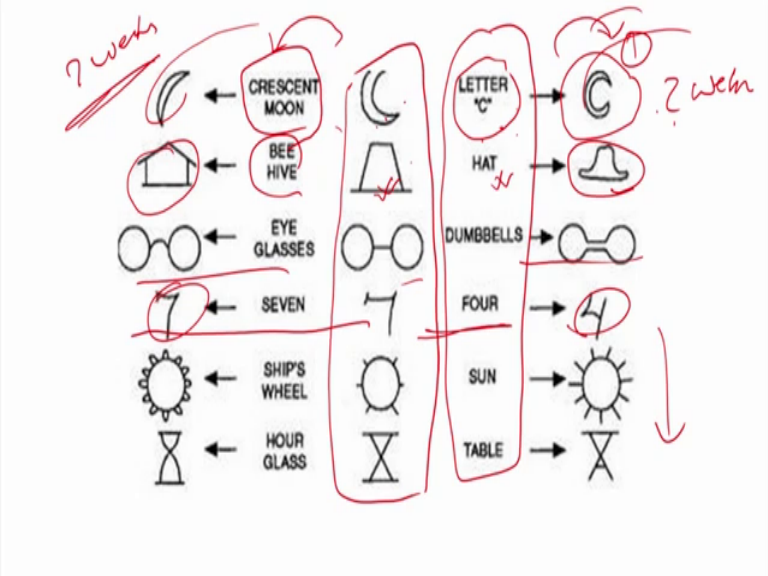

Now, also the fact that to prove that peoples view or peoples interpretation defines a picture a kind of this kind of setup was given now people were given this kind of a bizarre drawing to look at and then in two different sessions two different settings or two different retrieval sessions in one session people were shown this and they were then given a clue that this is letter c and when a retrieval was done after two weeks. So, this is retrieval one after two weeks this is retrieval one after two weeks, but then the same group is there. So, this is after two weeks then later on the comeback after one month they shown this again and then given this kind of a verbal label and after this verbal label after two weeks and interpretation or a retrieval was done; so when they were shown this and said that this letter C, this is the retrieval, but it was when they were said that the crescent moon this is the retriever.

And so, basically this is what it is. So, images mental images are dependent on people's interpretation. So, when a verbal label when this was shown in the verbal label hat was given this is the retrieval image, but when it was shown and a beehive was what was told what was ask them or what was told to them this is what it is this is the retrieval similarly this a dumbbell would result in this an eye glass would this and if a verbal label of four was given to it a four was there and a seven was given to it a seven interpreted on to it and similarly so on and so forth. So, basically this image this kind of image was given to people this kind of verbal label was given to peoples. So, these verbal labels were given to people and then later on retrieval was done.

So, depending on the kind of verbal label the interpretations or the retrieval imagery was different as of this basically proves that the imagery is open to interpretations of people the third kind of problem the critic which has been said in terms of mental imagery is called the propositional theory.

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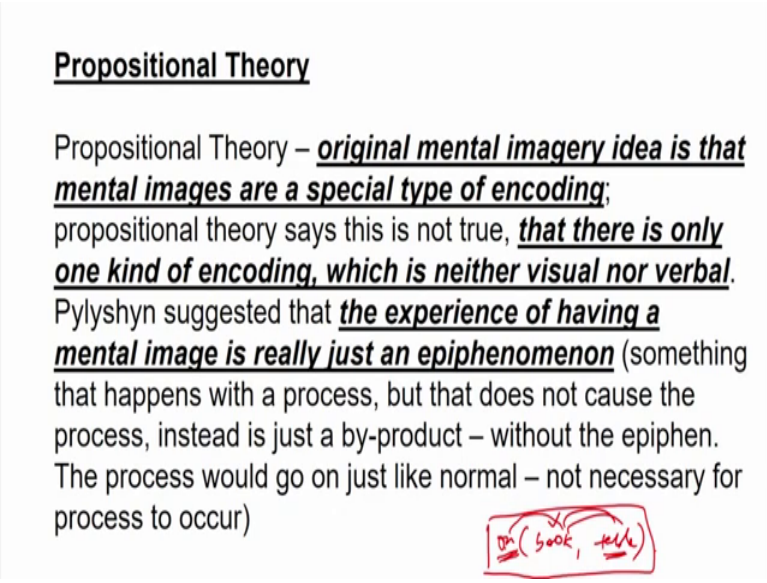

So, what is proportional theory? So, originally, it was believed that there are two codes that of mental imagery one was the vocal code or the verbal code which is from the short term memory and then there is a semantic code which is basically the long term memory interpretations on a long term memory storing. So, original mental imagery idea is that mental images are special type of encoding and so, later on when mental imagery studies it was believed that mental imagery is also code for long term memory now proportional theories they say that it is not true. So, what proportional theories says is there are no codes codes, there are no ways in which code is there that is what they say they say that there is a only one kind of encoding into long term memory and that is neither visual nor verbal in nature and they suggested that suggested that the experience of having a mental image is just really a epiphenomena.

And so, what is stored into the long-term memory is basically a preposition and what is a proposition? Proposition are basically relationship between item for example, if I write on book and table this is how remember from the first class that we did a special equivalent. So, this is a prepositional code which says that the book is on the table. So,

on what is on the first object the book is on where it is on it is on the table. So, this is how code are because this is a preposition because it makes relationship this on is a preposition which is making relationship between the book and the table and so, this is how it actually goes ahead and is safe.

So, basically then this is the code that is saved in to the l t m rather than a visual code and a verbal code also Pylyshyn suggested that the experience of having a mental images really just an epiphenomena something that happens with a process, but does not cause the process instead, it is just a by product now without the epiphenomena the process would go just like normal not necessary for process to occur.

So, what he say is mental imagery that we talked about his just an epiphenomena is nothing special into it.

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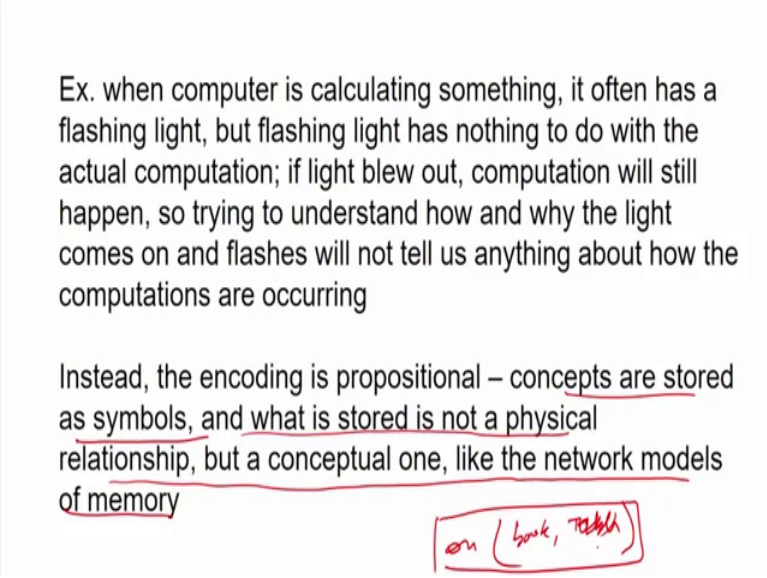

And he has given several examples of have not used for example, he says that when a computer is calculating something it often has a flashing light which shows that it is calculated and most people believe that this flashing light represents what it is calculating, but actually the flashing light has nothing to do with it is an epiphenomenon it has nothing to do with what is going on similarly mental imagery is epiphenomenon like this because if the light blows away tomorrow or if light is dysfunctional which does not means the computer stops working.

So, this light is just a by product of whatever is happening and so, light has nothing no relevance to the computation similarly mental imagery has no relation to the computation because codes that I used in mental image is basically propositional in nature. So, instead of encoding instead the encoding is proposition in nature where concepts are stored as symbols and what is stored is not the physical relationship, but a conceptual one like the network model of memory. So, that I showed to you this is a proportion and so, in the proposition I have a book network a concept and at able concept and then the relation to this is the on concept, I can basically this is a proposition which is safe this is neither verbal nor visual in nature.

So, what is stored in memory long term memory are concepts and symbols and this concept of symbol from some kind of a network and this conceptual network and this is how the storing happens in long term memory.

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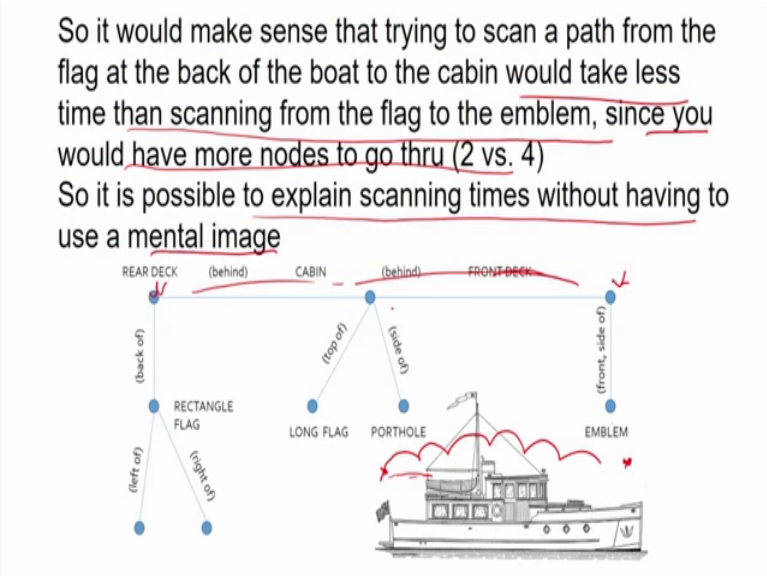

So, it would make sense that trying to scan a part from a flat to the back of the boat to a cabin would take less time then scanning from the flat to the emblem because when we are scanning from the back of the boat to the front of the boat. So, from the back of the boat to the cabin has is longer. So, look at this image I am. So, I am scanning from the back of the boat this is why the emblem is and this is why the cabin is. So, if I am scanning from the rear deck to the front deck it has three levels to go from and so, it should their three prepositions to be verified and so, takes more time where as if I have

to verify the emblem which is there from here it has two levels only. So, it is easier that is what it says it should it would take less time than scanning from the flag to the emblem since you would have to move from two level of networking or two levels of the hierarchy two four levels of the hierarchy.

So, it is possible to explain scanning times without having to use mental images and that is why is the higher scanning time and the lower scanning time that people are using in terms of complex and noncomplex images remember Finke's idea is because of the fact that not people of making images it is because the number of propositions that they are testing the number of hierarchies that they are moving in a network is more as compared to less.

And so, you have to verify come to the emblem from here from the porthole, it will take more time because more number of network. So, more number of propositions have to be tested then if I have move from here to here where the number of propositions is less.

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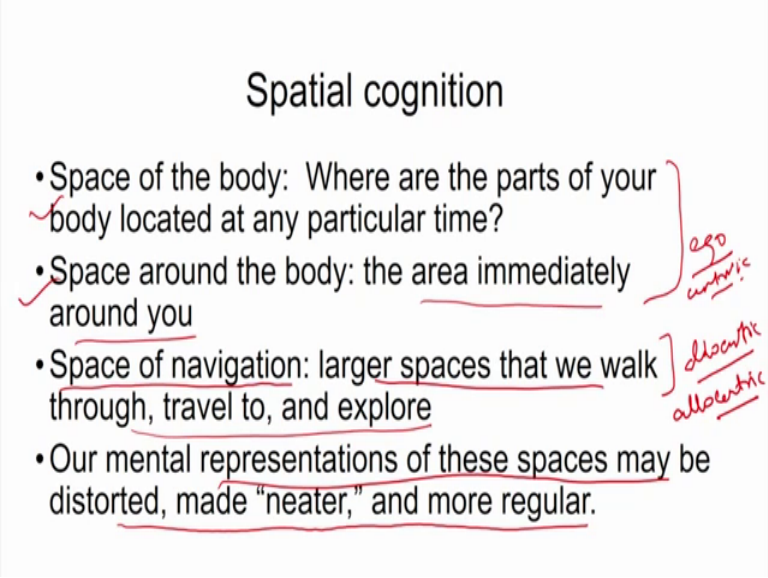

And so, the last section has to deal with something called special cognition. So, basically how do we move in a special environment and so, the three ways of moving in a special environment when we move in spaces when we move in enclosed spaces are any kind of space out there that he thinks to be looked at first there is something called the space of the body.

Now, this is where are the parts of the body located any particular time. So, while moving in a special location while moving in your environment we use three different kinds of information first is the called the space of the body. So, we move according to something called the egocentric approach or the space of the body approach in this case the movement is done in terms of where my hands and legs are. so left from my left my right towards the front of me towards the back of is kind of a thing. So, where my body parts are and based on that I make a movement in spaces in spaces which are finished with locations and the second is the space around the body the area immediately around you and so, it could be in terms of not in terms of the body not in terms of certain regions of the body, but in terms of the area around the body; so in front of me at the back of me kind of a thing.

So, in both of these are basically they go centric, right. So, towards my left hand toward my right hand, but in front of me in back of me is kind of space around the body. So, towards the left of my left hand towards the right of my right hand is basically space around the body. So, two types of information both are egocentric in nature and that is what we use we also use spaces of navigation largest spaces that we walk through travel or explore.

So, in this case what we say is this is called the allocentric movement. So, a l l o c e n t r i c allocentric and this is egocentric. So, egocentric is making yourself as the centre allocentric is making external object; so left from the right from the cabin back from something front from something from. So, using something into the environment during certain land marks movement using landmarks in these cases I am using the body as object of movement.

So, spaces in front and back of me or spaces rely in relation to certain body parts or I could use spatial navigation in terms of certain features or certain objects which are there into the environment which are called landmarks now our mental representations of these spaces may be distorted made neater and more regular. So, basically based on these we create something called the spatial map or cognitive map and this cognitive map actually help us in moving and this is the mental image that we make. So, when we make a mental image of the space around us we use three reference points one is with the self, it is with our self then with landmarks and combine them together to form mental images

and these mental images are used to move around any space out there into the environment any space into the environment.

So, basically what we did in this today's lecture is we tagged onto what we learnt in the last lecture. So, what we did was we verified the fact that mental imagery is there a by looking at rotational studies now with in addition to that we look that that is how rotational studies complement the idea that mental imagery exist and we looked at certain kind of answers in terms of angle of rotation being the only factor which guides the rotational mechanism or the rotational time that we take.

In addition will also looked at certain principles a mental imagery. So, 5 different principles in terms of Finke's theory and then we looked at certain critics or certain criticisms of the idea of mental imagery for example, demand characteristics the idea that the code that the brain uses are only propositional codes or the fact that pictures are not mental images and lastly we looked at how special cognition is stored. So, spaces around us are stored as mental images and I said there are three reference point in terms of your body in terms of the external landmarks and in terms of spaces which is in front or back of your body.

So, thank you and we will meet again in the next lecture.