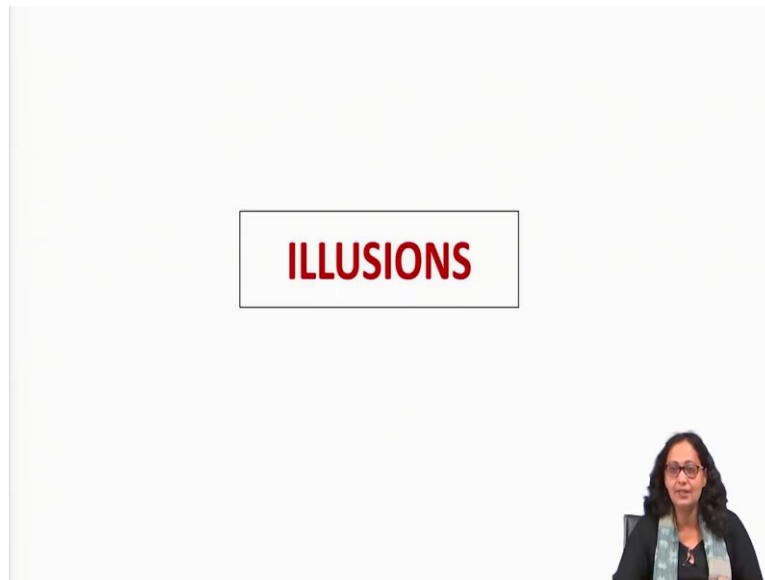


**Cognition and its Computation**  
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**Lecture - 30**  
**Constancy and Illusions**

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Hello and welcome to this is the last lecture of Week 6. Now let us get to some other kinds of illusions ok. But before I talk about illusions we spoke about constancy and basis on based on that we spoke about a couple of illusions. But before I discuss some of the other illusions I would like to point out a confusion that people generally have between illusions hallucinations and delusions.

So, what are hallucinations, hallucinations are images or visualizations that an individual may have without the presence of a stimulus ok. Now, many times there are there is a stimulus that is there which is distorted in form and seen, but the perception is different we are not going to get into the critique of that. But in simple terms illusions are where there is a stimulus, but that form is distorted ok. And we see it as something else.

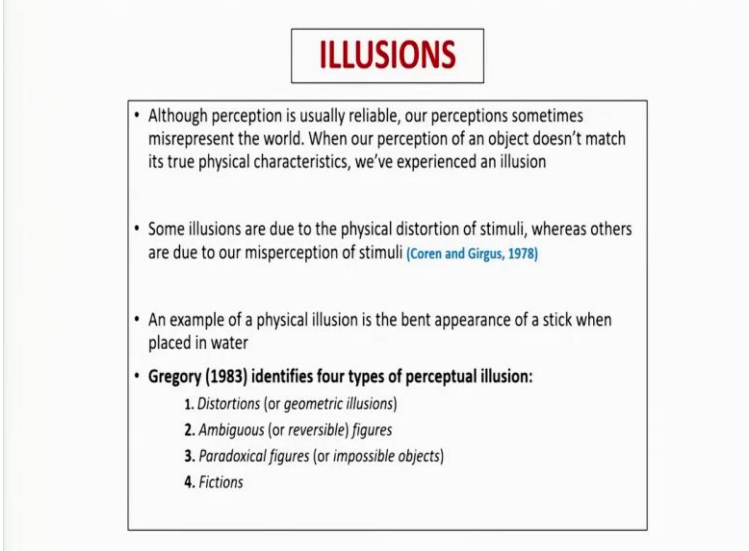
In hallucination there is an absence of that is of a stimulus the stimulus may be an organic stimulus within the individual ok. So, this the absence of the external stimulus,

but it is visualized ok or heard. So, we have auditory hallucinations we have tactual hallucinations insects walking on my skin ok when there is apparently nothing ok. Or visual hallucinations I can see somebody standing in front of me and looking at me and talking to me and so on.

Now, the another thing that is often confused with this is delusions. So, delusions are errors distortions of the thought process. So, delusions may be persecutory delusion somebody is trying to kill me delusion of control somebody is controlling me and you know there are multiple other forms. Now both hallucinations and delusions are a part of mental health illnesses or disorders.

Now, they have organicity behind the expressions. So, that is there is a neurobiological change and a neurochemical change that may be responsible for these illusions and hallucinations, but in the case of illusions it may happen with any individual ok it is not an illness. Now coming back to illusions again.

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**ILLUSIONS**

- Although perception is usually reliable, our perceptions sometimes misrepresent the world. When our perception of an object doesn't match its true physical characteristics, we've experienced an illusion
- Some illusions are due to the physical distortion of stimuli, whereas others are due to our misperception of stimuli (Coren and Girgus, 1978)
- An example of a physical illusion is the bent appearance of a stick when placed in water
- **Gregory (1983) identifies four types of perceptual illusion:**
  1. Distortions (or geometric illusions)
  2. Ambiguous (or reversible) figures
  3. Paradoxical figures (or impossible objects)
  4. Fictions

So, some of the other you know Gregory identified that there are four types of perceptual illusions. And they are distortions or geometric illusions ambiguous or reversible figures, paradoxical figures or impossible objects and fictions. So, in this class today we are going to just give you a very brief idea about these four types of illusions.

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### Why do we see illusions?

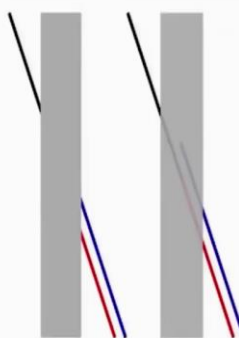
- The visual cortex is stimulated by a pathway of neurons originating in the eyes themselves. When light hits the retina, signals are sent along the optical nerve, through the thalamus and into the visual cortex
- This type of sensory stimulation generates what is known as “**bottom-up**” processing - the chain of events begins with the external stimulus before progressing upwards through the various stages of mental processing, culminating in a visual experience
- The visual cortex also receives “feedback” from other areas of the brain when we see something familiar. This creates “**top-down**” processing, whereby information about what we are looking at travels down to the visual cortex from higher cortical regions, generating a visual experience that is internally created

**In other words, it's all in your head, and is not a reflection of the real world**


The advantage of top-down cognition is that it allows the brain to fill in the gaps in our visual field by drawing on previous experiences and understandings of what the world should look like, generating the visual image that it expects to see

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### Distortions



The Poggendorff illusion

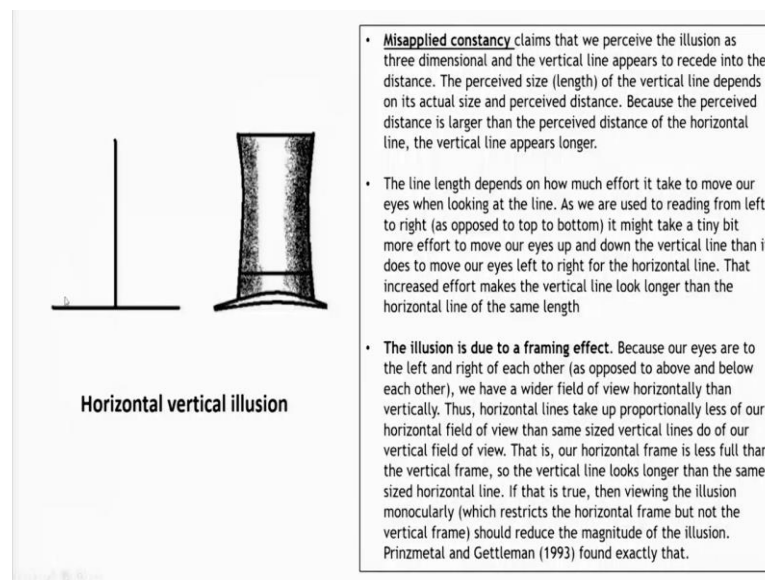


Now, so, this is the example of a distortion. So, many of you are familiar with this illusion of the Poggendorff's illusion. Now the Poggendorff illusion if you look at the left side ok and if you have removed the right side from view the it seems that the black line is a continuation of the blue line ok. But in reality it is actually the black line is an extension of the red line. Now why does this happen?

There are multiple views to this, but one of the major reasons is that because this surface this plane is of a darker consistency or it has a it has a more concentrated medium as

compared to the light outside. The brain assumes that the ray is moving away from the normal. So, this correction is done within the brain and apparently it seems that this black line is an extension of the blue line. So, if you are looking at. So, this is again a part of learning ok.

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So, now let us look at the horizontal vertical illusion. So, the horizontal vertical illusion if you look at this height as compared to this they are of equal size this line and this line the horizontal and the vertical line are of equal size, but apparently the vertical line seems longer ok than the horizontal line. Now, it is better understood if you look at this hat ok. This length and this length is the same, but it seems as if this is taller than this length, why is that so?

So there were multiple for many illusions we still do not have a an explanation. So, there are different theories that are trying to explain these illusions and one of them for this horizontal vertical illusion the explanation is misapplied constancy. And that claims that we perceive the illusion as three- dimensional and the vertical line appears to recede into the distance.

So, it is like this is going further away. So, if it is going further away if you add distance then definitely this line must be longer ok. Just thinking about that idea about perceived size and which takes into consideration the distance. Now another explanation for it is

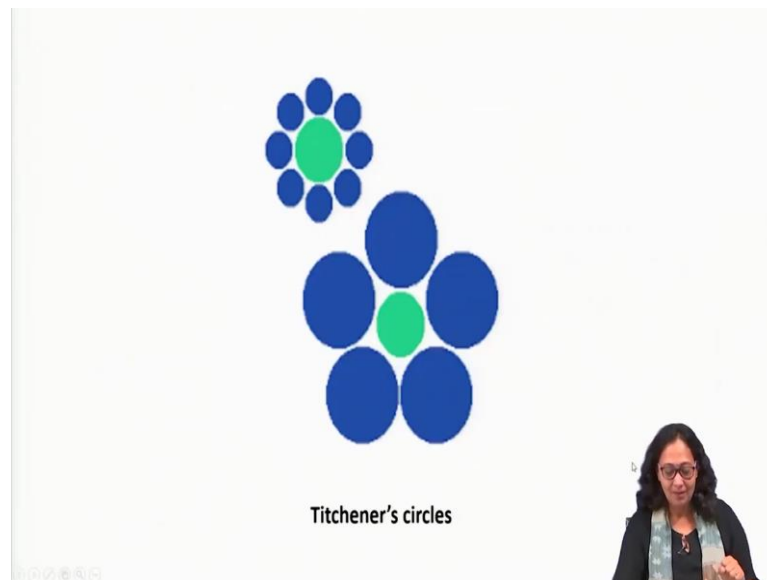
that we are habituated in moving our eyes from right to left ok. That is how our eyes function better, but for this we have to take an effort to look up.

So, that effort that is being taken is considered as an input for the brain to add on to the distance. So, make this length to the brain the idea is the input is that this line must be longer because it is taking more effort. And the third one which is a more plausible explanation is that this illusion is due to the framing to a framing effect. So, that is because our eyes are to the left and right of each other then you know this width this apparent width of view that we get it is it has a wider field ok as opposed to the vertically field.

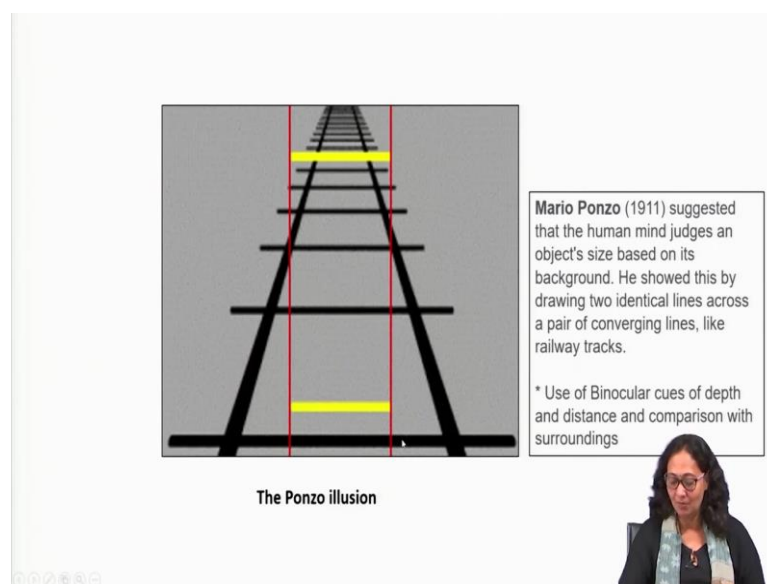
So, that is why this width you know as we see it this seems lesser as compared to the amount of area that we can perceptualize visualize. But here because the width to travel is less that is why this seems to cover a larger area of that width. Now so, if this were true then if this hypothesis were true if then if we use only one eye two then that width would be reduced and actually and Prinzmetal and Gettleman they worked on this hypothesis and they found that it is true.

So, because of the area of our visual field is larger when we are looking at a horizontal line this distance appears to be smaller. So, the proportion of area covered is smaller. So, that is why it is considered as a smaller line as compared to the vertical line. So, if we and they saw that when they when you look at it with just one eye then this apparent width is reduced. So, it is more the magnitude of the illusion is reduced.

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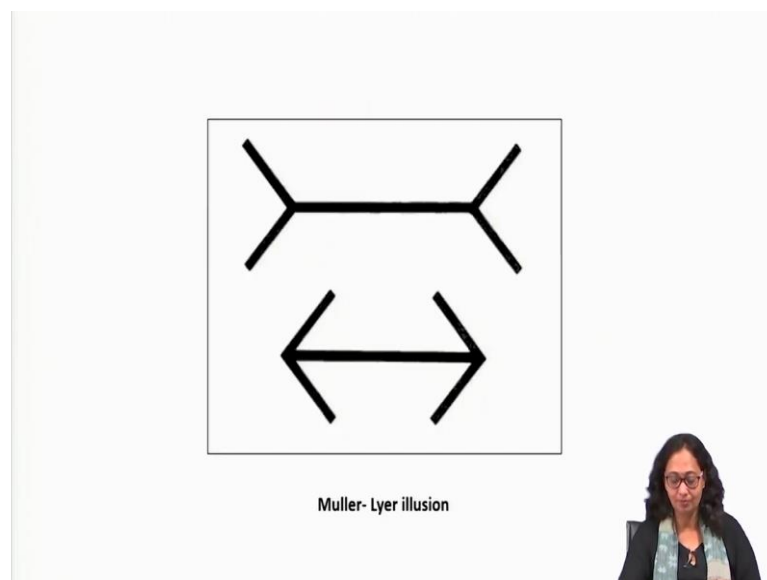


Now, this the Ponzo illusion is another popular form of distortions and you know we look at an objects size compared to the background. So, we look at so, these are of the same size; the yellow and the both the yellow bars are of the same size, but because of the other inputs that we are getting because of the binocular cues of depth and distance that we are getting. So, of the gradients texture gradients, the width between the lines ok and there is the convergence of the lines.

So, that makes us that adds on to the perception and the yellow bar here seems longer seems of a greater length as compared to this one. It is if you just think about the eye from this perspective for the two eyes the width would be this much, but if it was for the vertical movement the width the area would be less. So, it would seem longer it is the same perception as in the horizontal vertical illusion.

Now, this is again an example of the background. So, these two green circles are of the same size, but because of the background inputs the circles being smaller here as compared to the circles being larger the size seems to differ. So, as again the background information is very very important as to how we perceive. So, it adds on to the illusionary effect.

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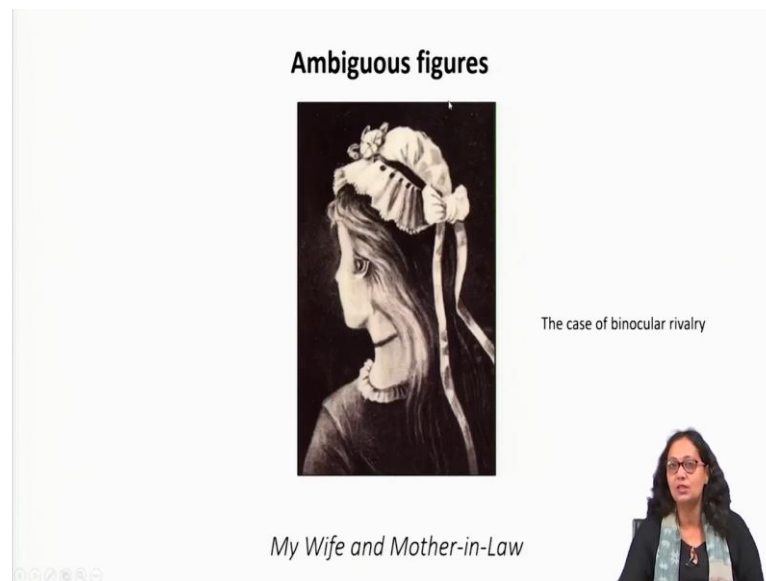


The Muller Lyer illusion is one very common illusion that is used for makeup ok. How? Now let us look at this these this horizontal line and this horizontal line is of the same length, but because here it is a bow head. So, because the extension is still here and this is an arrow head. So, there is movement backwards. So, how does the eye look at this input?

The eye follows this and moves in. So, this is the extent the maximum length that the eye travels in for this line for the upper one ok. The maximum length the eye moves is from here to here. So, it is not only the line, but from the edge of the bowhead to the edge of the bow head on the right

So, this distance as compared to this distance of the arrow head or even this maximum distance of this arrow head is larger. So, in comparison so, that is how the brain compares and say thinks that this is a longer line as compared to this. This concept is used in makeup to stretch the eyes to make using eye makeup to make the eyes look longer or you know the lips look broader so, by stretching it.

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So, these are apparent tricks that are used by makeup men. Now this is ambiguous figures it is another kind of illusion and what happens here is for any form that we see I have discussed this when we spoke of form perception. So, if you look at this image this is of an old woman. So, this is her eye left eye, this is her mouth and this is her chin and she is looking somewhere this side ok.

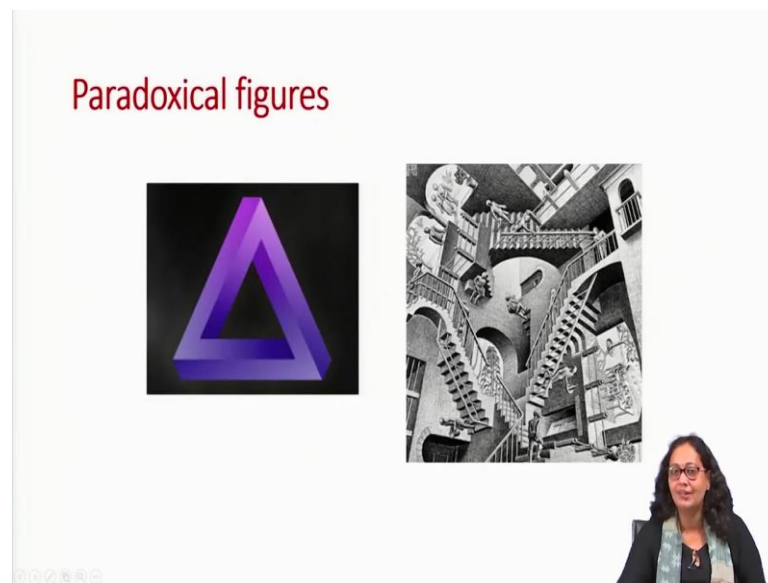
Now the same image if you look at if you think that this is eyelash over here and this is the nose and this is the chin then this is the throat then it will seem a young girl ok. So, this is an illusion of an ambiguous figure where or you can actually see both the kinds both images of a young girl and a woman. So, this is a bi stable image. Why is this a bi-stable image? As we discussed earlier in form perception.

For a form to be identified the background has to be contrastingly different and background should have less image a less meaning than the form so, the form because the form juts out or projects outward we see it distinctly and clearly. When it does not? There we have the idea of a camouflage so; it gets merged into the background.



But in this case the background can become is equally meaningful to be a form. And similarly so, if that is why it shifts the perception shifts from the old woman to the young girl this is the eye lash of the young girl the nose and the face this is the chin and this is the neck.

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This is a paradoxical figure this is another illusion and if you look at this apparently this seems perfect, but you will see that if this is inside of a 3D image then this cannot be the outer edge or if this is the outer edge then this cannot be the inner edge. So, this is another illusion. Similarly with this it might remind you of Hogwarts and Harry Potter, but if you look at this.

So, if a person if you look at this individual at the end of the stairs if he is going this way then another person may not come down this way because that would be on a different plane. Now apparently these figures do not seem wrong, but this is this cannot happen. So, this is an illusion.

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Now, let us get to another kind of illusion that is the fiction. If you look at this image the Kanizsa triangle you will see a white triangle inside ok and there are different forms of the Kanizsa triangle it is. Now interestingly there is no drawing of a triangle ok. So, it just comes out because the brain fills in that information we studied about the gestalt laws of perception and we know that the brain cannot keep an empty space.

So, if you write an a which is not written properly then also the brain would take it as input would fill up the information and connect the lines and make it a name we talked about this earlier. Now, here also because the angles of the triangle are on a darker contrast and these look like you know it gives a shape.

And so, it looks like an angle again this white part and there is a continuation the brain as if tries to form a continuation to the next angle on top above and here and this creates an image of a triangle that is jutting out. So, this is again an illusion. Now why do we have these illusions? So, one reason is that the visual cortex is stimulated by a pathway of neurons originating in the eyes. So, there is an input that is travelling from the retina and through the optic nerve to the thalamus and into the visual cortex.

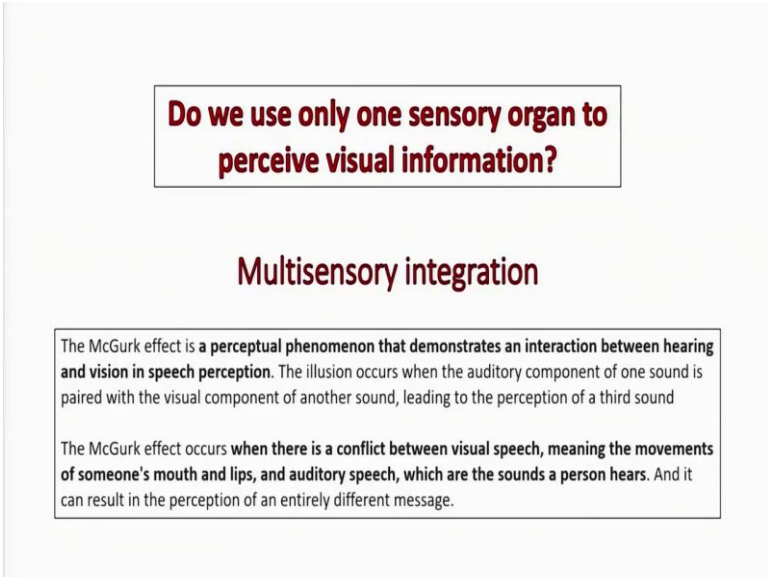
So, that is one pathway of information. So, this is known as bottom up processing. And so, it starts with perception of the stimulus on the physical background and taking in the inputs from there. Also the other inputs of the so, the retinal adjustments that is made to perceive an image. The other kind of information other kind of processing is from the top

down. So, top down is feedback that the brain receives from things from knowledge stored earlier.

So, from our memory systems of things that are familiar to us. So, the top down processing actually helps in correcting information or optimizing an experience. So, from the higher cortical regions the visual cortex receives input and then a blend of the physical input bottom up processing and the top down processing both merge together to give us a perception. That is why perception is in our head it is not in the real world.

So, a visualization and a perception is different perception is understanding of the situation with meaning. This meaning comes from the top down processing from the cortical regions. You will understand this a little more in the next section when Professor (Refer Time: 19:20) will be talking about the neurobiology of perception and attention ok.

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**Do we use only one sensory organ to perceive visual information?**

**Multisensory integration**

The McGurk effect is a **perceptual phenomenon that demonstrates an interaction between hearing and vision in speech perception**. The illusion occurs when the auditory component of one sound is paired with the visual component of another sound, leading to the perception of a third sound

The McGurk effect occurs **when there is a conflict between visual speech, meaning the movements of someone's mouth and lips, and auditory speech, which are the sounds a person hears**. And it can result in the perception of an entirely different message.

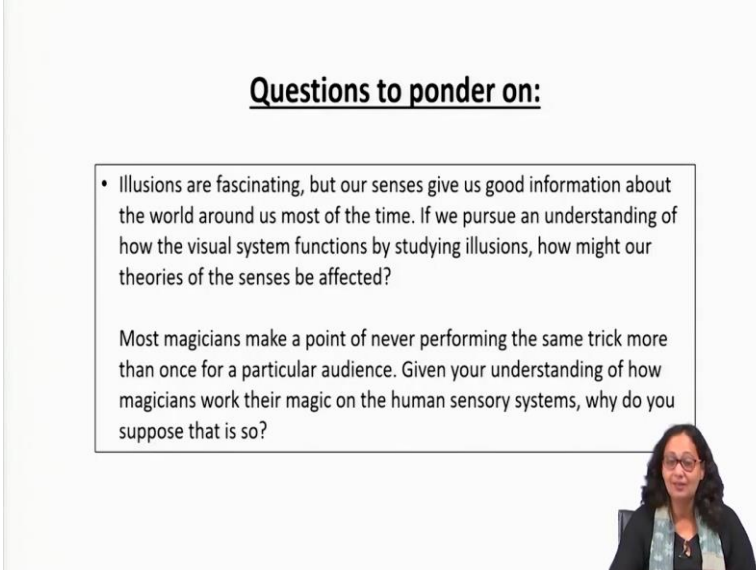
Now, when we talk of perception are we generally doing it from one single modality that is are we perceiving only through the visual modality; no. Many times there is an integration of two modalities.

So, the if you are listening to me right now you looking also looking at my image and you will see you will notice that when you listen to information and also see the image or when you are reading the slide you do it better ok. Now there is a very very interesting

phenomena or called McGurk McGurk's effect. Please go through it in the next week we are going to talk about McGurk effect again. But there is a you can check it out online and see that this effect is an interesting phenomena where you know there is a disturbance between the different sensory inputs. So, when there when the when does the McGurk effect occur when there is a conflict between visual speech and the that is the movement of the mouth and auditory speech. Then the what the sound the sound that a person hears is very different from what is being said.

Please do go through this before you know we speak about the explanations of McGurk effect try and understand you know go through the solution online and you know. It is irrespective of whether you have knowledge about that about the illusion or not we still have the illusion. So, that is the that is a beautiful thing about perception you know sometimes our knowledge adds to the illusion sometimes our knowledge is you know overridden and we still have that illusion.

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**Questions to ponder on:**

- Illusions are fascinating, but our senses give us good information about the world around us most of the time. If we pursue an understanding of how the visual system functions by studying illusions, how might our theories of the senses be affected?

Most magicians make a point of never performing the same trick more than once for a particular audience. Given your understanding of how magicians work their magic on the human sensory systems, why do you suppose that is so?

So, well; I will end this with two questions for you to ponder on ok. And the first one is that it illusions are fascinating and it gives us information about the world. If we pursue an understanding of how the visual system functions by studying illusions. How might our theories of the senses be affected just ponder on this question.

And the next one as you are well aware illusions are something that magicians often use ok and they never perform the same trick more than once before the same audience ok.

So, given your understanding of how magicians work their magic on the human sensory systems why do you think they would not repeat it. So, just ponder on these and see if it affects your perception of how you look at illusions in constancy.

Thank you so much.