Introduction to Cognitive Psychology
Dr. Naveen Kashyap
Department of Humanities & Social Sciences
Indian Institute of Technology, Guwahati

Lecture – 04
Perception: Making Meaning of Sensations

Hello friends, welcome to this lecture on perception which is making meaning out of sensations. One of the basic problems with psychology is to take in the physical environment, to understand the physical environment interpret it and make meaningful observable interpretations out of it.

So, one of the basic questions the psychology faces or human beings face is to interact with the human environment, to interact with the external environment. Now, psychology is the science, which makes us understand, which makes us observe or realize how physical inputs are actually taken in are taken in by our senses and interpret it into some meaningful interpretations. So, we can understand this by a simple diagram. So, as I was saying the basic problem or the basic idea about psychology is to integrate.

Hello friends, this lecture is focused on perception, perception is about making meaning out of sensations. What are sensations? Sensations are the raw input, which the brain receives from various sensory organs. Sensations are the stimulus, which has been impinged on different sensory organs and perception is the process which makes interpretations of these sensations.

In this section, we will be looking at how do humans interpret sensations, which is the basic information, which is gathered by different senses and how do we go about making meaning from them. It is a very important part in cognition or in cognitive psychology because this is the first parts, which are the first step in the cognitive process, think of this in terms of the computer analogy. Perception is equivalent to inputting something to the computer system, perception can be thought of as the processes which take it input from various attachments to the computer, various input device to the computer and makes interpretation out of it.

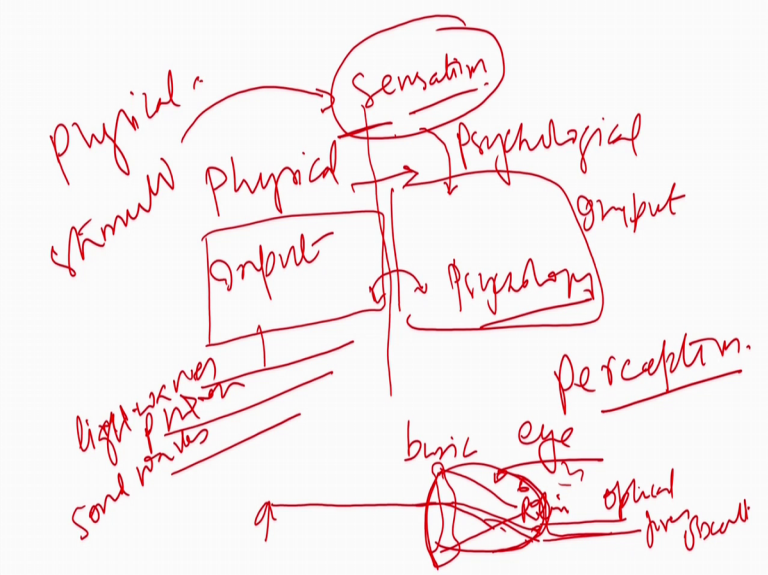
Sensations are equivalent to things like key presses on the keyboard, push of the mouse button or writing of the right pen onto a computer screen which leads to an electrical

current and these electrical current are then interpreted by the computer system in terms of meaningful stimuli. Perception is an important process as it should be able to quickly verify what is being inputted and also should be able to distinguishes between different inputs.

For example, if you press the w key and the v key the computer should be able to know when the w key is been pressed and when the v key is been pressed. Perception is a process a keen to similar to this, but it takes place in the human beings.

The perception is actually a very complicated process that is what most artificial intelligence scientists would tell you. For us, it is easy because it is a process which is very natural to us. Now, before understanding the process of perception, let us understand a little bit about what is sensation and even before understanding sensation let us talk a little bit about what psychology does? The basic aim or the primary aim of psychology is to take in, to understand the physical environment and convert the physical environment into a psychological environment.

(Refer Slide Time: 04:43)



Psychology is the process, through which physical input is converted into psychological input. What do I mean by that? In the environment; in the physical environment around us we have physical stimuli like light waves, which are packets of photons or sound waves, which are pressure differences created by sound moving to the air. Not these stimuli, this physical stimuli is converted into or is transferred into the psychological

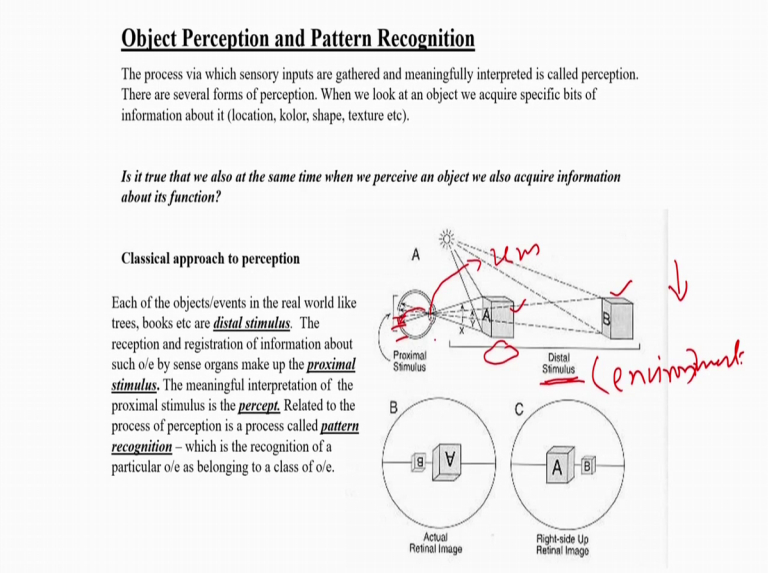
realm and the process which converts these physical stimulus into psychological stimulus is perception, but even before perception the physical stimulus has to be read in the correct format and input it into the human system, the human computer and that is what sensation does.

So, sensation is basically a system which takes in a physical stimulus like a light, wave or packets of photons which are impinging into the eye and then convert them into electrical signals, which are then passed on to certain brain regions which pick up these signals and depending on the strength of the signal, depending on the type of signal, it interprets what the signal means.

Now, let us look at one basic sense organ and try to understand how does this really happen? A basic sense organ or a primary sense organ is the human eye, now if you look at the human eye what really happens is, there is a lens with a lot of structures around it and this is how the structure of the eye looks like. There is a physical stimulus here and this physical stimulus reflects light which is falling onto it, onto the lens. The lens then redirects this light into or onto the retina, which has photoreceptors onto it. These photoreceptors, then look at or understand the strength of the light and pass these along through optical fiber nerves onto the occipital lobe or the occipital region of the brain.

The occipital region of the brain then parses the stimulus and tries to make meaning of what this stimulus is. The process through which, this light wave is picked up by this retinal part of the eye is sensation and after that anything after that is perception and so this is what perception or difference between perception and sensation is all about.

(Refer Slide Time: 08:31)



So, in this particular section we look at object perception, how does perception take place? So, the basic theories are what perception is about, now since we are not in this course, we are not focusing on to the brain too much or looking at cognitive psychology from the brain point of view, we will look at cognitive processes from more of a mind point of view. So, we will focus more on to those processes, those systems or those viewpoints, which tell you about the cognitive processes, about the mental processes which goes on in the mind when some mental event takes place.

So, what is perception, perception is a process through which sensory inputs are gathered and interpreted. Perceptions can happen in several formats for example, perception could be visual perception, it could be auditory perception, it could be Haptic perception, gustatory perception, so 4 or 5 different senses and 4 or 5 different types of perceptions. Perception, basically require us to understand or to localize where an object is, what is the object look like and what is the meaning of a object.

Now, in this particular section we will focus more on to visual perception, since this is an area which has been looked or which has been diversely studied by most cognitive psychologists. So, in terms of object perception, what does perception really mean? In terms of object perception, perception means understanding where an object is in the environment, what is the shape of the object, what is the color of the object, what is the

texture of the object, what is the form of the object and things like that, this is the first step of perception.

In a later step, these basic information which was gathered by sensation or through sensation are then mixed together and interpreted into a meaningful whole, into a meaning and this meaning comes from something called a process called pattern recognition. Now, an interesting question, when a perception happens, when we see something, does it imply, that we also know about it functions. Let us look at perception from more basic view.

Think of any summer day, you are sitting in the classroom looking out through the window of the classroom and what do you see, you see a green tree, a bunch of bicycles which are parked outside as it would happen mostly in outside my classroom, some students talking, a little bit of grass, a little bit of building and so on and so forth.

The idea here is that when you actually look out or when your eye actually looks out of the window, it is not the tree that you see, it is not the cycles, bicycles that you see, the vehicles that you see, it is not the building that you see or the shape of the building that you see, what you actually see, when you see, when you look outside the window is some kind of information about various light waves, which are affected from these basic objects into the environment.

So, perception is a step or is a process through which these basic information about the color, about the texture, about the form of what you are looking outside and making interpretation out of it, in terms of what is a building and how is the building and what is a person and how is it different from each other. So, that is what perception when involve and let us come back to the original question which I just asked you is when we perceive something, when we look at something and when we identify something do we also go ahead and understand it function. Now, we will leave this for a time being and answer this a little bit later.

This particular question has it is answer on something called the Gibsonian approach proposed by J. J Gibson, who believe that as we see an object, we also see its function. So, the next time when you see something new, a new model of a car do you also actually perceive it is function or something which you have not seen before a new model or a new type of object out there in in the visual field, in in the market, do you

also perceive it is function and there is a lot of debate which is the there. Gibson in view or Gibson believes that, most organisms when they look at something they not only see the object, classify the object or understand the object and make meaning out of it. They also have gathered some idea about the function of this and that is this debate between something called the classical approach and the Gibsonian approach. More about Gibsonian approach a little bit later.

So, let us then start studying about the classical approach to perception. The classical approach to perception starts with identifying something called the distal stimulus and something called the proximal stimulus. Look at the figure, which we have here as you look at it what we see, there are 2 objects on the field or on the environment. These objects have a particular shape, a particular texture, a particular form and light is reflected from these objects onto the retina. The retina looks at this light and converts them into electrical impulses, even before that the light which is reflected from these objects fall on to the lens of the eye.

The image of the object, these objects into the environment which forms on the retina is inverted in shape. So, as you see these objects or inverted image of this object falls onto the retina, this image which is on to the lens is then straightened up by through certain processes and these processes send this image back to the retina. The retinal cells are very specialized cells, they are not only able to tell you or correct the orientation of this object, they can also, at this very point at the first step of perception look at or make the optical areas of the brain or the optical centers of the brain provide information about the various shadings, the various lights, the various textures, the kind of intensity of light which falls onto it, the various edges and so on and so forth about the object.

These information's taken together when passed on to the brain an interpretation of it is made and this interpretation is then compared with some kind of already stored template and that is how perception happens. So, basically the objects in the environment as envisioned by the classical approach is generally called the distal stimulus and the one the image; the inverted image which falls on to the retina is the distal stimulus, the interpretation of the distal stimulus. Now, understand the distal stimulus is just packets of photon or intensities of light, which are actually falling on to the lens and later on to the retina.

The interpretation of these lights which are falling into a tree or a box is what is called a percept. So, the percept is basically the psychological concept. It is a, it is an interpretation which the brain does of the proximal stimulus.

So, basically what I am trying to say here is the distal stimulus is the object in the environment, the proximal stimulus is the image of the object in the environment or the inverted image or the object in the environment, but recognizing an object or what an object is or the meaningful interpretation of our object or distribution object as a tree, as an animal, as a child, as anything else, as humans, as buildings is basically what is the percept.

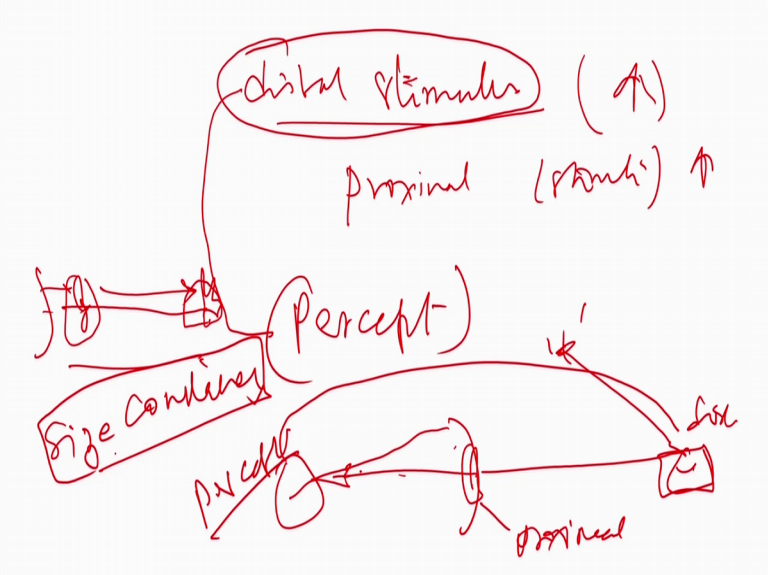
Now, the percept actually gets compared with fixed patterns, which are stored into the brain and this is called pattern recognition. Once, the occipital areas gather information from the eye, the optical nerves about basic information's, about the proximal stimulus such as the shading of the stimulus, the contours of the stimulus, the kind of intensity of light, which is falling on the stimulus. From there a meaning is interpreted and this meaning is interpreted in terms of comparing what the occipital lobe has as an input from the eye and comparing them to pre stored concepts, to prestored input and representations which are already in the brain. This process of comparing the input from the eye to prestored representations in the brain and making meaning out of it, is called pattern recognition.

Which is the rig? So, pattern recognition is the recognition of a particular object or event as belonging to a particular class or event. Pattern recognition is the process which makes you differentiate between 2 kinds of trees or 2 kind of people. In computer science pattern recognition is very important; as pattern recognition let us you identify clusters or visible patterns in huge amounts of data. One of the most prominent problem in computer science is having a lot of data, but not finding patterns in it, not finding clear identifiable patterns into a lot of data and what are the solutions of interpreting a chaotic data or huge data is to find similarities.

Finding similarities between items is what is called making classifications or making patterns and then identifying these patterns with pre restored pattern is what is the process of pattern recognition. So, a similar process happens here.

As you can see in figure B and C, the actual retinal image is always inverted, but what really happens is the eye reinterprets this or re corrects this particular thing into the actual image.

(Refer Slide Time: 20:43)



Now, one of the basic debates here is whether distal stimulus, which is the image that is in the environment and the proximal stimulus, which is what forms into the eye. The debate that most psychologists, our perception psychologists have is whether distance stimulus is equivalent to what a percept is. So, whether the distal stimulus, the stimulus in the environment in our case, if this is the eye and this is the lens and this is an object in the environment and this is the light falling from the sun which is being reflected here, this is called the distal stimulus, this is called the proximal stimulus and this is the brain interpreting this image as a percept.

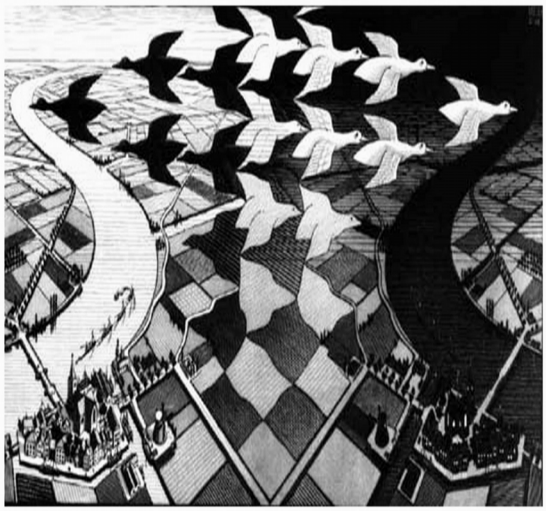
Now, the debate has been whether this percept is equivalent to the distal stimulus. Many a psychologists have debated this and the idea is that they are not clear. Do a small experiment to see, what do I mean by this.

The percept, the meaning that the brain does or the brain makes of anything in the environment is entirely different from what actually is in the environment. So, brain recreates or adds on to certain things, adds on to certain values to or certain elaborate interpretations to what the proximal stimulus is, a small experiment to basically tell you the difference between what a percept and what a distal stimulus is.

Extend your hand in front of you and slowly bring the hand towards you, what do you see? You see your hand moving towards you, but do you see or when you see your hand moving towards you actual physics says that as the hand moves away from you, it is size on the retina is small and you should see a smaller hand, whereas when it moves towards you, the size of this particular hand increases as the distance between your eye in the hands increases. So, you should see a bigger image, but is that what you see, is that what you feel, no.

When the hand is extended and when it is near the eye at both the times, the hand; your hand has the same shape or the percept of the hand has the same shape, which basically proves the fact that the proximal stimulus, the changes in proximal stimulus do not make changes into the percept and the percept is entirely different from what the proximal stimulus is. This particular feature is called size constancy, a feature of a perceptual system which maintains sizes of things, more about size constancy in later units.

(Refer Slide Time: 23:57)



Now, one of the basic things in perception is to identify what is in the environment and one of the basic approaches for that is the Gestalt approach. Let us start with the Gestalt approach, look at the figure displayed on your screen, what do you see? There are 2 interpretations of this figure, it could be that white birds are flying towards your right or it could be the black birds are flying towards your left.

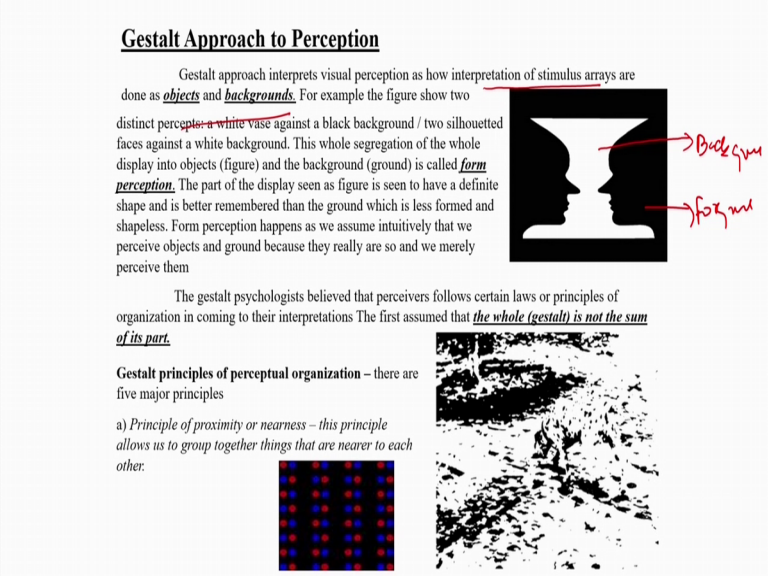
These interpretations depend upon which part of the figure, which part of the image you consider a figure and which part of the image you consider as the background and that is what Gestalt is say. The basic interpretation, basic idea of Gestalt is in terms of perception is, what is figure and what is background, what part of an image is figure and what part of an image is background and this is the first distinguishing that happens in terms of making the percept. These kind of images are called reversible images.

(Refer Slide Time: 25:14)

Look this image, what do you see? Most people when they see this image, they see an old woman, but if I tell you that this is a reversible image and you also can see a young woman out of it, you will be surprised, but then, I can show you how to change this figure or how to change this picture into a young and a old woman. This part over here that I am highlighting is what creates the difference. The red color part becomes the mouth of the old woman, whereas it becomes the necklace of the young woman and as you see this part over here becomes the nose of the young woman and the eyes of the old woman.

So, basically then percepts or meaning that are made from physical stimulus is depends a lot about subjects motivations, subjects expectations and a basic process about understanding what is the figure and what is the background.

(Refer Slide Time: 26:34)



So, let us look at, jump into one of the first approaches in understanding perception. There are several theories, which is out there, which help you understand perception. One of the basic theories that we are going to talk today about is Gestalt approach to perception.

Now, one of the first primary interpretation of Gestalt approach is, Gestalt approach it interprets visual perception as how as interpretation of stimulus erase into objects and backgrounds. What does gestalt approach start with? What is the starting point of a gestalt approach? The Gestalt approach believes that, processing of a percept starts by parsing or interpreting the stimulus; the visual stimulus or electrical patterns, which are transferred from the eye into foreground and background. So, interpretation of an image, interpretation of a visual field will start by first distinguishing that into foreground and background.

So, the first step into the understanding of figure according to Gestalt approach is basically parsing or interpreting the figure and the background. As we saw in these figures, as you change the object, as you reclassify a figure as a background and background as a figure, the meaning of the image changes.

Look at this figure; this is again a reversible figure. Now, depending upon what you are looking at or where you are focusing your background and foreground is that will define what the figure actually means. If you consider black, white as the background and black

as the foreground, you actually tend to see, start seeing 2 people facing each other, but reverse this if you make black as the background and white as the foreground you start seeing, immediately start seeing the image of us. This particular feature of distinguishing an object, of perceiving an object as a figure in background is called form perception according to the Gestalt test.

What does this help us with? Understanding or breaking something into figure and background, breaking an image into figure and background, helps us with several things. First, the figures tend to have show better shapes and tend to be remembered better than the backgrounds. As soon as you interpret a visual environment to figures in backgrounds, what really happens is the contours of the figure, the idea about the figure or the part of the image which you consider as figure is remembered much better with, much better perception, then the background.

Now, form perception happens, when we actually are able to classify part of it, this image into figure and into background. Now, distinguishing the figure into; distinguishing a visual field into figure and background requires us to understand or markup subjective contours. Now, these contours will actually define what a figure is and what background is. For example, in this particular figure as you can see, these lines are the contours which define what a figure or an background is. The Gestalt psychologists they believe, that perceivers follow certain laws or principles of organization in interpreting any percept or any kind of perception.

And one of the first laws, that the Gestalt is were hooked up to or they proposed is something called the law of hold and part. What is the law of hold and part? Gestalts believe that we, when we perceive something; when we perceive an image, when a perception of an object or event is done, the perception is in terms of the whole object or event. It is not in terms of parts of the event or object and that is why the Gestalt are in a just direct opposition, to what the structure is believe. Now, the structurally school of psychology, believe that any mental event, any mental process can be broken down into it is part and it could be studied that way.

For example, what gestalts would say, if you are looking at a cold lemonade; the cold lemonade can be broken down into, the idea of a cold lemonade, the perception of a cold lemonade can be broken down into it is physical form, which is in terms of it is

temperature, sweetness, bitterness, which are all physical quantities and also in terms of the idea of what this lemonade would taste like, in terms of sourness, in terms of sweetness. So, the psychological part of a lemonade or the psychological content of a lemonade is the taste and the feeling that you get after drinking it, whereas the physical part of a lemonade, will be it is coldness, it is temperature, it is sweetness, it is saltiness and so on and so forth.

So, a basic opposition to this particular aspect, to this particular school was provided with the Gestalts who believe that, it is not possible or it is next to impossible to interpret perceptions, to interpret meanings about objects in terms of holes, in holes and parts, in terms of parts. What they believe, that any perception has to be in terms of holes and also that holes, the hole of an object is always different from a part. Remember, in the first lecture on introduction, we looked at briefly on the Gestalt approach and there I said to you that the holes are not, are different from it is part, is one of the prepositions of the gestalt approach.

There I brought forward an explanation and I will borrow that explanation again. If you are hearing a song, the song has lyrics, has music and several other things included into it. So, the feeling that you get after hearing a song will not be equivalent, when you hear the song in parts, meaning which, if I first make you hear the lyrics, later on I make you hear the songs, instrument playing and several other things one by one.

For the come, the meaning of the song or the feeling that you get after hearing the song in parts, will not be equivalent to what it will be in terms of holes and that is what Gestalts say. Gestalts say that perception is generally in terms of holes and these holes are divided into figures and backgrounds. Part perception is not possible and one of the reason for dividing a perceptual environment into figures and background is because, when you divide a particular environment into figure and background, the figure is the one which is perceive and the background is the one, which is not perceive, is the one which is supporting you and as soon as you change meaning changes.

A good example to bring here is the image on to my right bottom. Look at this image, what do we see, it is a dot image, which has been created by psychologists to understand how perception works and as you will see that this image has several dots into it. This was created by a fine art painter and if you look closer, if you go closer to the image all

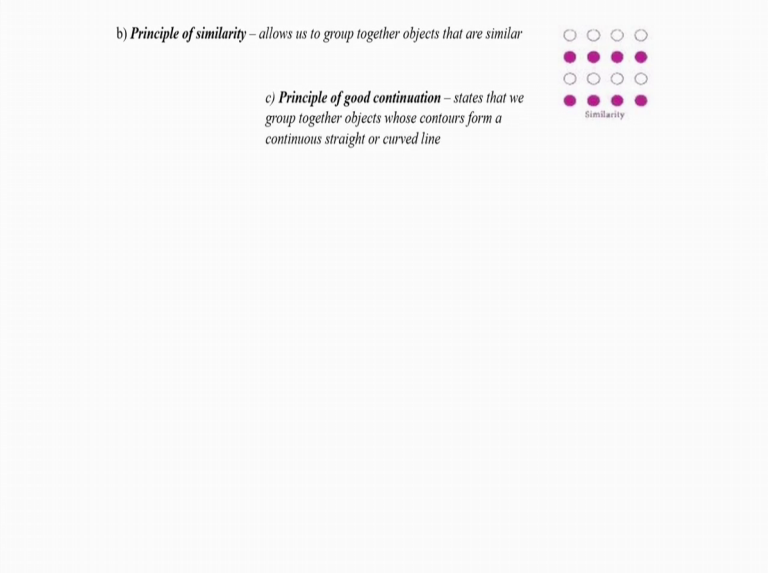
you see are dots and patterns, several dots, black dots and on white backgrounds, but as you move yourself away from this image and as you put, start putting something called top down processing, start thinking about it or start deliberately making meaning out of it, sooner or later you will realize that you see a dog, a shape of a Dalmatian here. This Dalmatian, the shape of this Dalmatian here is what, is the meaning that we get from this particular visual field and this happens only when we are able to separate this shape, which now becomes a figure and everything else, which is the background.

Now, Gestalts they came up with or they proposed several principles; are several organization principles which make people, help in making successful perceptions. We will discuss some of this, although there is a list of perceptions, perceptual principles, organization principles, the Gestalts, but we will discuss some of them here. There are 5 major perceptual organization principle and gestalts; the first is called proximity or nearness principle.

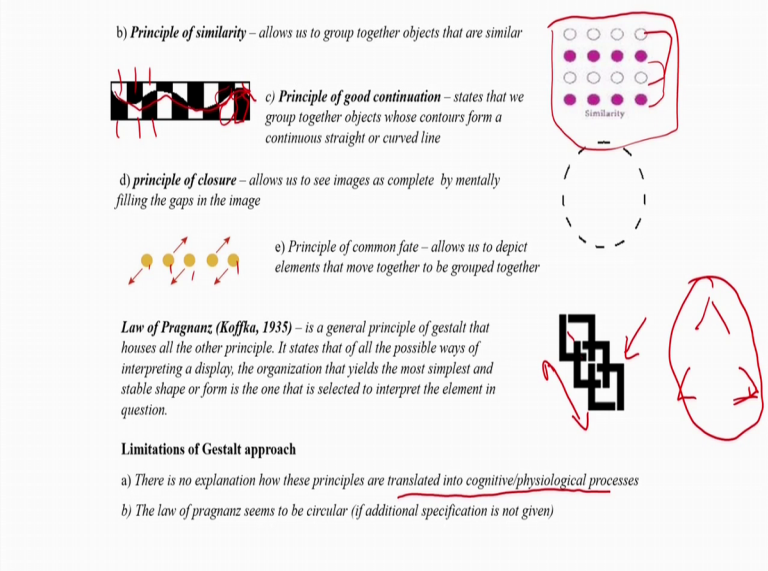
It says that when objects are close together they are perceived as together, then when objects are far away from each other. Look at the figure, on the bottom of your screen, what do you see? You see and when I ask you to interpret this, what most people are going to interpret is, that there are dots, blue and red dots, columns of blue and red dots. Although, no where it is clear, whether these are columns of blue and black dots, but people club these blue and black dots since they are close together, since they are proximal together into 1 and now they say, there are most people try to explain this figure as 4 columns and of repetitive blue and black dots and this is what the perception of, the principle of proximity really means.

Principle of proximity says that when 2 objects are brought together or when multiple objects are brought together they are combined into togetherness or they are interpreted as together and this is one of the principles of organization or perceptual organization, which helps us in making perception, in understanding or making interpretation of the visual field.

(Refer Slide Time: 38:30)



(Refer Slide Time: 38:43)



A second principle that the Gestalt is proposed is the principle of similarity. What does this principle say? It says, that in if, in a visual input or a visual field we have objects, which are similar together, we tend to club those items which are similar as grouped together and so when I ask people to interpret what this is and when I asked my students to interpret what this is, most people come up with the answer saying that there are 2 rows, alternating rows of red and white dots. Now, when they say 2 alternating rows of red and white dots, they club the red dots together and white dots together.

A third principle is a principle of good continuation. This principle suggests that, when we group objects together, whose contours form a straight line or a curved angle they are grouped together. So, when I asked most people to look at this particular image. Since, these objects share a curved contour, it is most people actually go ahead and say that this is a wave pattern, whereas most of us can disagree to this, saying that it is not wave pattern as this and this part, this and this part, this and this part can be separately different, but most people see these as wave pattern because the contours of these lines are similar, are forming an arc.

A 4th principle is a principle of closure. Looking at this, most people tend to interpret this as a circle, whereas this is not a circle. Now, the brain what it does is using a principle of closure, it tries to make or close this figure to make it, to make the easiest interpretation out of it and the easiest interpretation of this figure is the circle. The brain fills up the gap, which is their, into the image.

The fifth principle is a principle of common faith. This principle is difficult to explain on 2 d surface, but then a basic idea is that, objects which move together in a particular direction are grouped together. As you can see, since these objects tend to move on the upward direction and these objects tend to move on the downward direction, they grouped together as moving together and that is why, we say there are groups of balls which are moving up and which are moving down.

What is the need of the Gestalt principles? One of the basic needs of the Gestalt principle is that it helps us into organizing, the perceptual details; the details from the visual environment and make meaning out of it. Gestalt principles help us into organizing the information which is coming on from the senses together to make some meaningful interpretation and Gestalt principles, the organization principles of gestalt also help us in a quick pattern recognition.

Another important Gestalt principle is something called the law of pranks. It is against general principle, which all other principle; which holds all of the principle and the interpretation of this principle is that the simplest meaning is always the most correct meaning. What this principle says, that looking at anything the most simplest explanation that is available for a particular image, for a particular event or idea is the most correct idea or most correct interpretation of that event or image.

Looking at this particular figure here, most people can define it in number of ways, but the most simplest explanation of this is squares which form chain. As you can see, these squares actually tend to form a chain, in the most; simplest interpretation of this is that squares which are arranged in chain. Now the Gestalt approach is not without limitations, there are a number of limitations to this particular approach.

One of the most basic limitation to the gestalt approach is that this particular principle or Gestalts view cannot be translated into cognitive or physiological process. There is no one to one agreement of how these principles of organization of the Gestalt gets translated into cognitive processes or what cognitive processes actually come into plate, what physiological processes or brain processes come into play when these principles are in operation.

Another interesting or I would say another limitation of this approach is the circularity of the pranks. If the simplest explanation of this figure is the triangle, this happens because it is the simplest figure or the most eligible stable figure that I can see. I can go circular about it, saying that since this is the most stable image I can see, about this the most actually the effect that I see about this, is the triangle and so this is the simplest interpretation into it. So, it is circular in nature; the pranks law is circular in nature and without additional information the law of pranks does not actually go ahead and interpret anything or give any meaningful input.

Thank you.