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Module 2

Approaches and History of

Psychology

**Lecture 1: Approaches to
study Psychology**

Approaches

- Approaches refer to broad ways of understanding behavior
- Approaches are the different perspectives to study behavior
- Some approaches have direct roots in schools of psychology

Major Approaches

- Behavioral
- Cognitive
- Psychoanalytic
- Humanistic
- Socio-cultural
- Biological

The Behavioral Approach

- Human behavior can only be studied in terms of observable stimuli and observable responses to stimuli
- Human mind cannot be studied and is not a valid subject matter of scientific psychology
- According to behaviorists, only those aspects of behavior can be studied through scientific psychology that are overt and amenable to measurement

Behavioral Approach contd...

- The behavioral perspective lays emphasis at the role of environment in determination of behavior
- Behaviourists studied and developed laws of learning and emphasized that human beings are a product of the learning experiences occurring in their environment
- John B. Watson, Ivan Pavlov and B. F. Skinner were noted behaviourists.

Behavioral Approach contd...

- Ivan Pavlov, one of the early behaviourists demonstrated that learning occurs due to association of events
- John B. Watson showed that environmental events or stimuli led to specific behaviours i.e., responses
- Criticism of behavioral approach

Cognitive Approach

- Cognitive processes such as attention, perception, memory and decision making etc. are important to human existence
- Focus on mental processes is important for understanding behavior
- Behavior cannot be understood only as mechanical chains of stimuli and responses

Cognitive Approach Contd...

- In 1950s, the study and research in cognitive processes started getting prominence
- Information processing approach provided a metaphor to psychologists for understanding mind as an information processing system
- As per cognitive perspective, behavioural aspects and human action cannot be understood without taking into account mental processes

Psychodynamic Approach

- According to the psychodynamic approach behavioral aspects are determined by the unconscious processes that are beyond our awareness
- Sigmund Freud's approach - major psychodynamic approach
- As per Freudian approach, anxiety, depression or other mental problems can arise due to painful experiences in early childhood that a person suffering from the problem cannot consciously remember

Psychodynamic Approach Contd...

- The terms psychodynamic and psychoanalytic both refer to Freudian approach. However, psychoanalytic approach refers specifically to Freud's theory
- Theorists other than Freud who made important contributions to the psychodynamic perspective are Carl Jung, Alfred Adler , Karen Horney, and Erik Erikson among others

Humanistic Approach

- Deterministic view of behavior (that behavior was determined by the factors beyond our control) was not acceptable to Humanists
- Humanists viewed human beings as masters of their own will and they emphasized the ideas of *free will* and *personal growth*
- Humanists such as Abraham Maslow and Carl Rogers believed that human beings have a striving to achieve their full potential

Humanistic Approach Contd...

- Maslow emphasizes *self – actualization*, which has been understood as the inherent capacity to realize one's potential fully and become an actualized and enhanced person
- Carl Rogers developed client centered therapy in which the therapist is a facilitator of the client's self growth. It is a non – directive form of therapy

Socio-cultural Perspective

- Human beings are socially situated. The social aspects and cultural contexts determine behavioral responses, conceptualization of reality, thoughts and cognitions
- The socio – cultural approach is concerned with the study of how behaviors and thoughts are impacted by the social and cultural aspects
- Psychologists study the differences determined by social norms and culture of different groups

Socio-cultural Perspective contd...

- Psychologists interested in culture study behavioural differences and similarities among people of different cultures
- Psychologists have questioned the view of behavioural similarity and invariance across cultures
- Both uniformity and variation in psychological processes and behaviours occurring due to socio-cultural factors are important and need to be studied

Biological Approach

- This approach is concerned about studying how brain and physiological processes and other bodily aspects influence behaviour
- This is a much advanced approach now and includes behavioural neuroscience and evolutionary psychology
- Psychologists using the biological approach study physiological aspects of behaviour through experimental method.

- After going through this lecture you should be able to articulate how different approaches study behaviour.
- In the next lecture (Lecture 2 of Module 2) we will begin the discussion on historical origin of psychology and the advent of scientific psychology

Thank You



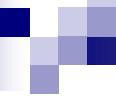
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Module 2

Approaches and History of Psychology

Lecture 2: Historical Origins of Psychology



History of Psychology

- Focus: Schools of psychology
- Paths to modern psychology: Ancient philosophy, religion, physiology, physics
- Roots in philosophy: Most important antecedents to modern psychology
 - Not a scientific phase
 - Western philosophers

Roots in philosophy

- Several questions were investigated
 - ❖ How do we know?
 - ❖ Nature of the relationship between mind and body
 - ❖ Definition of mind (Changed several times); different implications for the function of mind and for the human being

Roots in philosophy

- Early Greek philosophers (Socrates, Plato, Aristotle)
- Middle ages (Descartes)
- British Empiricism (Hobbes, Locke, Berkeley, David Hume, James, Mill, James Stuart Mill)

Early Greeks

Specific contributions

- To recognize that mind and body differ in nature (Dualism)
- Nature of mind and body and their relation to each other (Dualistic position: separating mind and body)

Early Greeks

....contd.

- Suggested the notion of understanding the unknown by reducing it to its constituent parts
- Two methodological approaches:
Empirical and Rational
- Laws of association: Contiguity, Similarity and Contrast

Middle Ages

- General intellectual darkness
- Toward the end of the middle ages a few thinkers questioned the dogma (15th and 16th century)
- French philosopher and mathematician Descartes stands in direct relationship to the history of modern psychology

Middle Ages

....contd.

■ Descartes

- Dualist (interactionist)
- Accurate descriptions of nervous system
- Path of nervous impulses

From Descartes onwards rapid development of science

Emergence of psychology: British philosophy and physiology

British Empiricism

- Dealt with problems that have a bearing on methodology and orientation
- Scientific phase not yet in
- The term psychology was used but not independently from philosophy
- Empiricism places the origin of mind in sensation

Empiricism contd...

- Higher mental processes – complexes of persistent impressions held together by associations
- Associations due to certain conditions present at the time of sensory impressions (repetition, contiguity)
- Notion of *tabula rasa* (blank tablet)

Empiricism

... contd.

- Greeks: Questions about nature of mind
Empirical – associationistic tradition:
answers in elementalism and
associationism
- An experimental/ observational approach
was now required to explore these issues
(paved the way for scientific psychology)

Empiricism

To summarize –

- Primary material of mind – sensations
- Mind can be reduced to its elements by analysis
- John Stuart Mill: Ideas generated from elements are not merely the sum total of individual parts (Gestalt psychology)

Scientific Psychology

- Psychology became empirical
- Unique contributions by Weber, Fechner, Helmholtz and Wundt
- Wundt: Founder of Psychology as a formal academic discipline. Established the first experimental lab in Leipzig, Germany in 1879
- Wundt: Leader of the first school of psychology



Thank you

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Module 2: Approaches and History of Psychology

Lecture 3: Schools of Psychology

Schools of Psychology

- Wundt: First laboratory of Psychology in Leipzig, Germany in 1879; Leader of the first school of psychology (Structuralism)
- Migration to Leipzig
- Psychology grew either from the Leipzig lab or as different schools of thought outside Germany
- For several decades (1900 to 1930 approx.) psychology took shape through schools

Schools of Psychology

- Structuralism
- Functionalism
- Behaviorism
- Gestalt Psychology
- Psycho - analysis

Structuralism

- Wilhelm Wundt, Edward Bradford Titchener
- Wundt: Experience as the subject matter of psychology (experience dependent on an experiencing person)
- Structure of mind (analysis should be applied to psychological phenomena)

Structuralism contd...

- Structure of the mind
- An attempt to compartmentalize the mind into its basic parts – mental elements (sensations)
- Introspection: Trained observers objectively examined and verbally reported what was going on in their minds in response to controlled stimulation; objective attitude

Structuralism contd...

- Criticisms of structuralism due to reliance on introspection
- Not verifiable, retrospection and memory distortions, subjective, influence of observer's attitude, considerable laboratory training
- How to study conscious processes of children and mentally disturbed individuals?

Structuralism contd...

- Reliance on introspection as its main method led to criticism of structuralism
- Introspection as a limited method
- Failure to relate mind and action
- Narrow in approach

Functionalism

- American psychologist William James (psychologist, pragmatic philosophy)
- The study of mind as it functions in adapting the organism to its environment
- Functionalists were influenced by Charles Darwin's approach
- Opposed the reduction of mind to its components

Functionalism contd...

- Emphasized studying consciousness as an ongoing process (stream of consciousness)
- Mind as functional in adjustment - not a static entity
- Structuralism: What the mind is made of?
Functionalism: How it functions?
- Connection between mind and behavior
- Learning as adaptive process
- Regarded introspection as a limited method

Behaviorism

- Against structuralism and functionalism
- Main proponent: American psychologist Watson (began his career in psychology at Chicago University)
- Pavlov, Skinner, Thorndike
- Opposed introspection --- emphasized objective experimental procedures

Behaviorism contd...

- No place for mental or cognitive concepts
- Subjective mental states cannot be the subject matter of psychology
- Major emphasis: Study of observable behavior such as actions, responses, performances
- Goal of psychology: To identify S-R relations

Behaviorism contd...

- Environmental influences as all important
- Major contribution to theory of learning
- Pavlov in Russia provided an interesting demonstration of the use of S-R analysis in his description of classical conditioning
- All behavior, no matter how complex, can be reduced to learned S-R units - Watson

Gestalt Psychology contd...

- Emphasis on whole, rather than parts
- Basic principle: The whole is more than the sum of its parts
- Gestalt psychology - theory of perception; principles are applicable to other domains
- Rejected the S-R approach
- Emphasized experimentation and observation

Psycho-analysis

- Synonymous with the name of Sigmund Freud
- Complex ideas about human personality and behavior
- Work on hysteria and clinical practice
- The unconscious, structure of personality, defense mechanisms, psycho-sexual stages of development

Psycho-analysis

- Unconscious mind consists of emotions, motivations, thoughts, and memories that are beyond conscious awareness
- Ego defense mechanisms - psychological strategies that are used unconsciously; protect from anxiety and conflicts
- According to Freud, psychological development in childhood occurs through psychosexual stages of development

- Structure of Personality: Id, Ego, Super-ego
- Id – Unconscious – Basic impulses such as sex and aggression, seeks immediate gratification, pleasure principle
- Super Ego – Mostly preconscious - Ideals and sense of morality, internalized from parents and society
- Ego – Mostly conscious, mediates between id impulses and moral principles and inhibitions of super ego, reality principle

Thank you

Introduction to Psychology
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Lecture - 05
Perception
Sensory Mechanisms

So, welcome to this first lecture. Initially, before I take you into the details of some of the topics which might be very interesting to you from behavioral point of view.

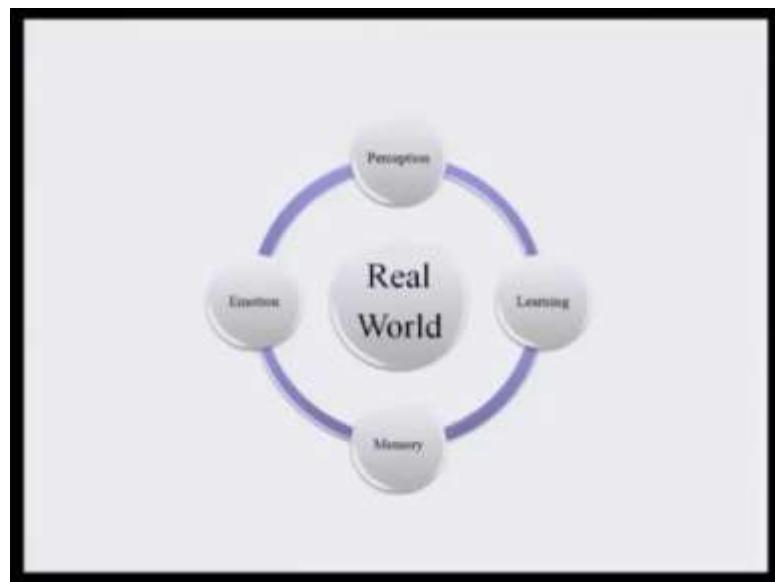
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Just look at the line that you see on the screen. What do you see right now, you somehow guess that this is perhaps a curve line that someone has drawn, I extend it little more and then you realize that fine the line has now taken more sharp turn towards the right and then I further try to extend it. It is difficult to make a sense out of it and then I add these lines and you can very easily now make out who this person. This is the image that gets generated in your mind.

When this image gets generated in your mind, suddenly you recollect not only the name, but you recollect whole sequence of events attached to this very individual who is known as the father of the nation. You have derived certain type of a mental images of a certain type of representations like, freedom you derive you might even derive the political map of a country called India you might have recollection of philosophy that is now called as Gandhian philosophy whole lot of things gets recollected.

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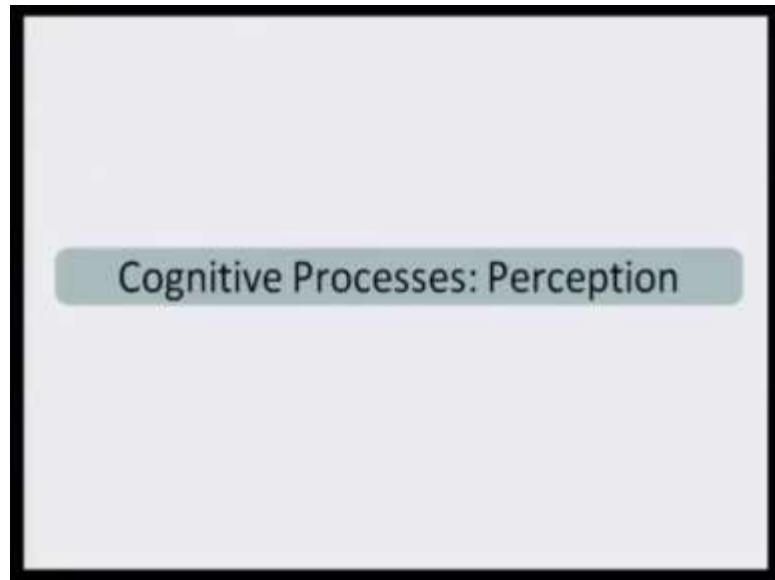


So, actually when you look at the real world we take certain inputs from the external environment. Sometimes it might be that might draw some inputs even from our internal mechanism and then we try to assign a meaning to it. In psychology this is what we call as Process of Perception. Now the fact that I fail to decipher the line even though it was being extended couple of times till I got substantial cue to identify that I am looking at the line drawing that represents the Father of the Nation. I was searching for a possible cue so that I could assign a meaning to it this process is what is called as Perception.

So, when you see these things or when you saw the line that you saw right now to derive an image of what you are looking at you have learned certain things certain things got recollected from your memory and then it did induce a sense of feeling within you. So, initially we will begin with the process of perception, then will go to learning, then will

come to memory and finally, we will be talking about emotional process the affective process.

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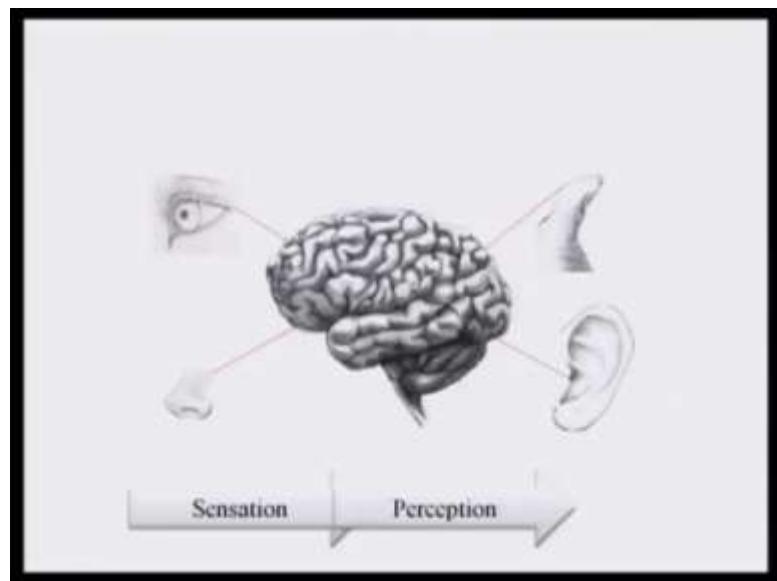
Before we come to perception let us understand one thing, that the brain before it arrives at a conclusion before it assigns a meaning to something it would require a trigger, it would require a sensation from outside.

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- Internal/ external stimuli evoke responses.
- Stimuli stimulate the sense organs.
- The brain processes signals received from these sense organs.
- Thereafter, we assign meaning to these sensations.

So, any information that comes to brain whether it is through the any external source or it is through the internal source this is called Sensation. And as you know that we are endowed with certain sensory organs. So, these sensory organs whether it is eyes, ears somesthetic sensors tongue all these sensors, they send certain type of stimuli to the brain. So, the internal or the external stimuli that evoke response in us, is always important for a perceptual process to begin. So, when the brain will start processing the signals that it receives from the environment, it will then suddenly go ahead with process of assigning meaning to it.

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So, any perceptual process that we are looking at from the point of view of sensory input coming through sense modalities will finally, look for a possible meaning that would be considered as the most appropriate representation of what the brain is finally, decide for. And this is what is called Perception.

What we will do as part of this very course is that initially our focus would be on the process of sensation. So, we would look at the basic sensory organs, the eyes, the nose, the ears, the somesthetic sensors, the kinesthetic sensors, the vestibular sensors, the olfactory mechanism and then we would know try to get a feel that this is how the brain gets the information and this is how we understand what is there in the real world.

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For doing this I am taking this very example, here you see boy who is primarily playing in the park. This boy is primarily trying to aim at the color disk that he is looking at. Suddenly he finds a bird there and he starts following the bird because the chirping sound attracts him. If he is hungry, then he removes the rapper and eats a chocolate and then suddenly while eating he sees a rose in one of the corners of the park and he goes and smells it. These are the processes that all of us experienced throughout our life.

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Transduction

- Physical energy of the stimuli are converted into impulses for transmission to the brain.
- This process is called transduction.

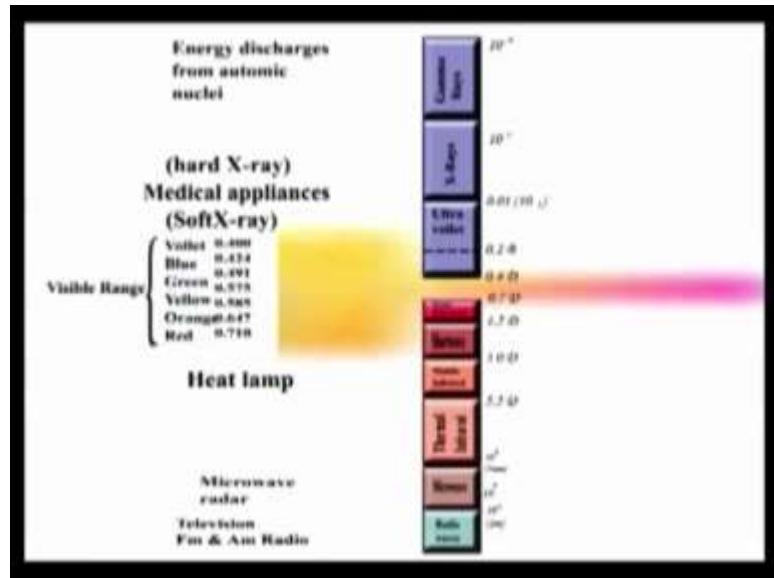
So, when the physical energy of the stimuli, when it is gets converted into the impulse and get transmitted to the brain. So, that the brain can finally, make a meaning out of it, this is called as Process of Transduction. So, the physical energy getting converted into an impulse which the brain can process is the process of transduction and this transduction is we can consider as the first step towards perceiving the external world.

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- Human beings have five important senses:
 - Vision
 - Hearing
 - Taste
 - Smell
 - Touch
- In addition to touch, the skin contains senses for heat, cold, pain & pressure.

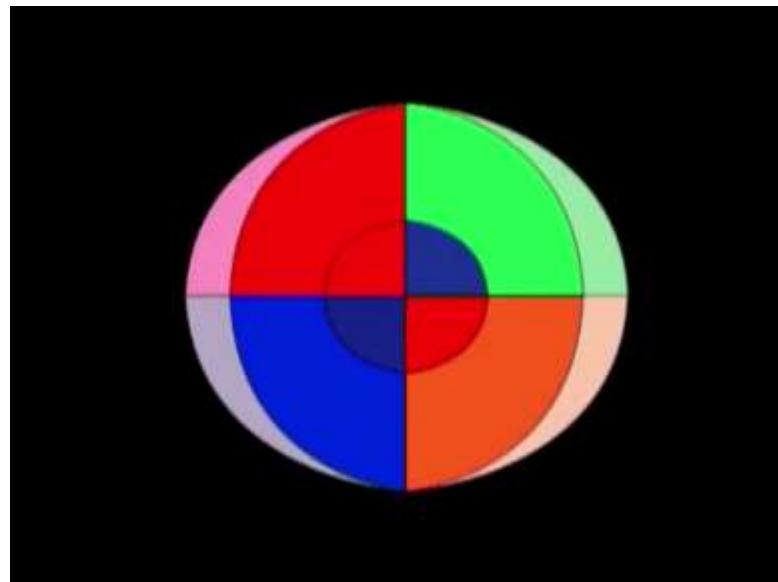
So, we have as human beings five important sense organs. A Vision, Hearing, Taste, Smell and Touch and in addition to touch the skin also now provides you with the senses of heat cold pain and pressure.

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Now look at this very video. Let us now understand that fine once we know that this is what our eyes can process, how does the visual system works. To comprehend the visual mechanism clearly let us look at this video, here you see the electromagnetic variations emitted by various objects as you already know the visual spectrum extends from about 380 to 780 nanometers. The colors represent the visible spectrum.

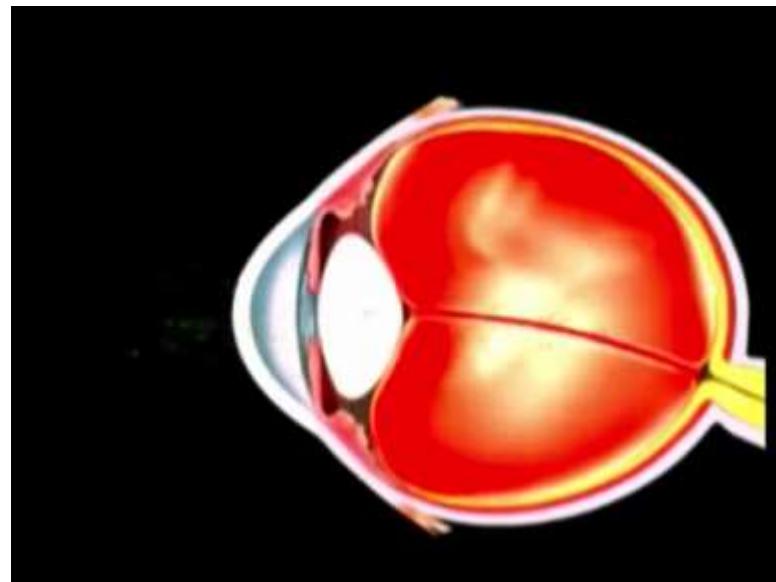
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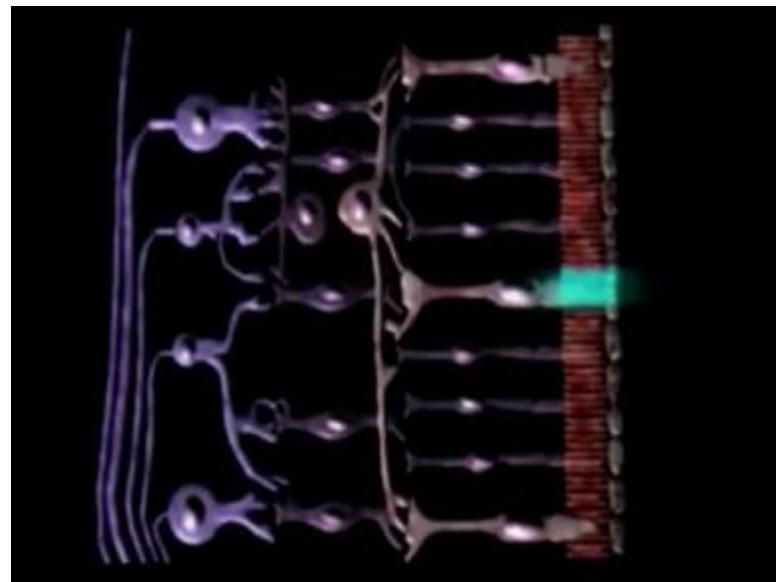
This is a colored disk and this boy is aiming at it we are trying to understand the visual mechanism. So, what did he see, to comprehend this let us look into his eyes, the light from the colored disk entered the eye through Pupil, Cornea, Lens and Interiors of eye ball it has now reached the Retina.

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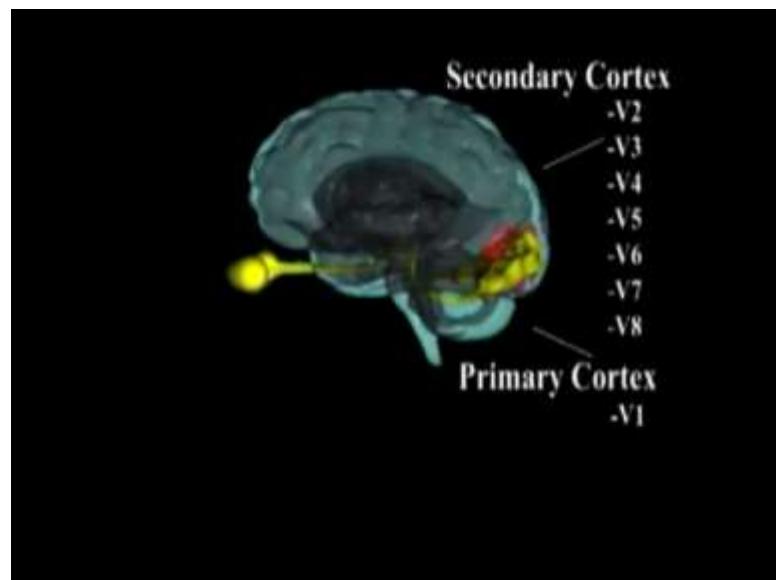
What you see now is a photo micrograph of the rod and cone sense in the eyes.

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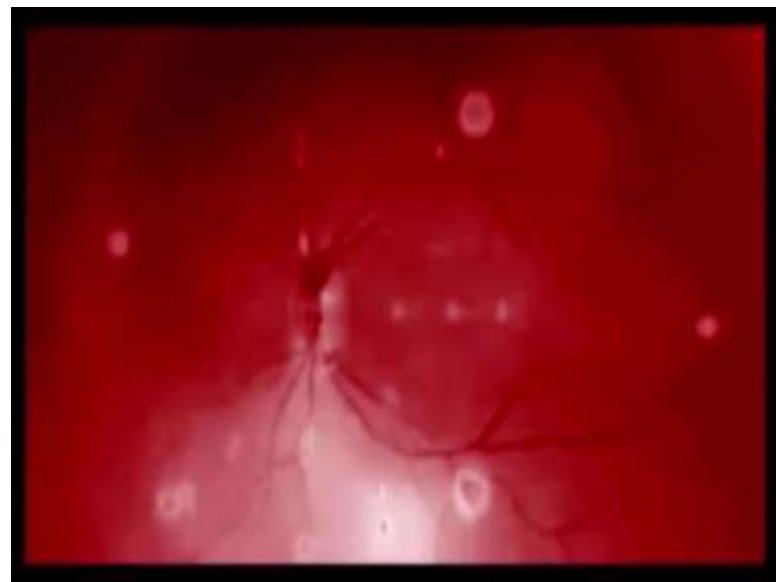
You are now looking at the ganglion cells that is M and P cells and the bipolar neurons. The light passes between the ganglion cells and the bipolar neurons. The bipolar neurons send the signal back to the ganglion cells. There after the optic nerve carries the signal to visual cortex.

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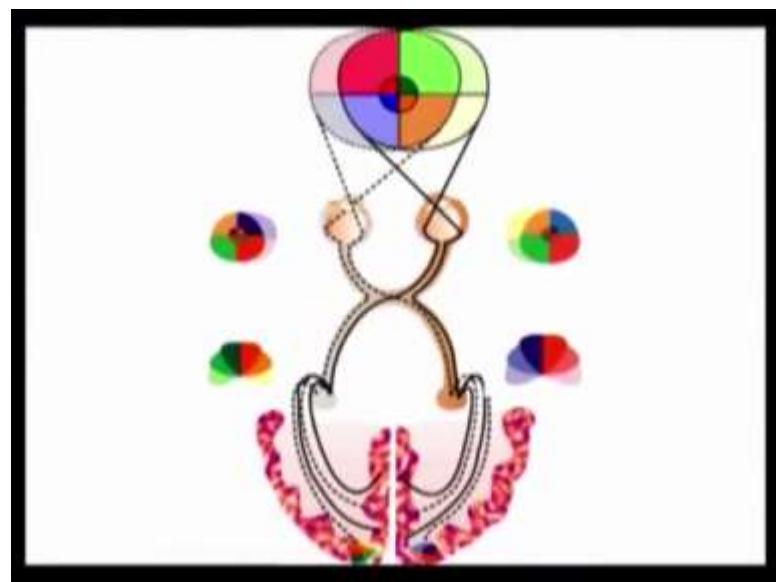


You now see the primary and the secondary visual cortex. That is visual area 1 mentioned here as V1 and areas 2, 3, 4, 5, 6, 7 and 8.

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Here you see the optic disc fovea and blood vessel. The visual sensation in this boy completed now, he was aiming at the colored disk. So, what did his brain see? The

extension of the color disk that you see with dashes shows the visual field of left and right eyes respectively. The part of the colored disk that you see next to the eye balls show the respective projections on the Retina of the left and the right eyes. The bright yellow light represents movement of signal across the brain. Some of optic nerves from both the eyes cross to other side of the brain at optic chiasm.

The neural conduction in the optic nerve reaches the lateral geniculate nuclei. The spread of colors on the left and the right sides show the inputs to the left and the right lateral geniculate nucleus respectively. Finally, the input reaches the visual cortex. Once again the colors, that you see in the part of the cortex represent the input that has reached the primary visual cortex on the middle surfaces of the left and right hemispheres of the brain. It is worth looking, that the full colored disk that the boy was looking at has been preceded differently by the two eyes and of course, two hemispheres of the brain. What is remarkable is that the parts of this information finally, combine and we perceive it as a color disk.

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Vision

- The convex lens of the eye makes an inverted image fall on the retina.
- The shape of lens changes in order to bring light from near objects to a sharp focus on retina. This process is called accommodation.

Now, primarily what is important for us to understand here is, that the convex lens of our eyes, it makes an inverted image fall on the Retina and the shape of the lens changes in order to bring light from near objects to a sharp focus on the Retina and this very process

of bringing sharp focus on the Retina is what is called as Accommodation. So, what we have done we have talked about transduction, we have right now talked about accommodation.

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Retina

- Retina is the light-sensitive layer at the back of the eyeball which contains two types of photoreceptors- RODS & CONES.
- Human retina contains about 120 million rods & 6 million cones.
- It is obvious that numerically it is actually rod-dominated.

Now, the Retina is a light sensitive layer at the back of our eye balls which contains two types of photo receptors the rod cells and the cone cells. And it is very interesting to understand that numerically our Retina is rod dominated.

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Vision

- OPTIC NERVE carries visual information from retina to the brain.
- BLIND SPOT is the point of exit of optic nerve. It has no photoreceptors.
- Visual acuity is maximum at fovea, and is graded from the fovea out towards edge of the retina.

Then the primary things that you saw in the video right now over the optic nerves which carries the visual information from Retina to the brain and the point where the optic nerve makes an exit from the eye is called the Blinds Spot, because it does not have any photo receptors.

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Transduction in Vision

- The rod & cone cells contain photosensitive pigments.
- Rhodopsin is the pigment present in rod cells. It exists in the cis-rhodopsin configuration when not excited.
- Excitation by light makes it to change to trans-rhodopsin configuration.

Now the rod and the cone cells they contain photosensitive pigments and very interestingly the rod cells for example, when it is not excited it is in the cis-rhodopsin configuration and when the light falls on it, it changes into the trans-rhodopsin configuration and this concept we will again carry when we come to memory and when we would be talking about iconic memory.

There we would be saying that right at the level of this sensory organ certain amount of time, very brief period of time, some amount of information is retained and at that time we would be referring to iconic memory, but right now we are not going to memory, but I would just request you to remember this fact. That the chemical configuration changes and to have a second round of excitation this trans-rhodopsin configuration will have to return back to it is a cis-configuration state.

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Characteristics of Rod & Cone Cells		
Characteristics	Rod	Cones
Number	Approx. 120 million	Approx. 8 million
Response	Light and dark	Light, dark & colours
Sensitivity to light	More sensitive than cones	Less sensitive than rods
Dark adaptation time	30 minutes (Approx.)	10 minutes (Approx.)
Light adaptation time	About 1 minute	

Now, let us just compare the characteristics of the rod and the cone cells in terms of number of course, as I said that our Retina is rod dominated. So, we have approximately 120 million rod cells compare to just 8 million of cone cells, in terms of response rod cells are of course suppose to process the light in the dark condition whereas, cone cells also have the responsibility of identifying the colors. They are sensitive to colors. In terms of sensitivity to light rod cells of course, are more sensitive

compared to the cone cells. If you experience a dark situation, in terms of dark adaptation time the rod cell it takes approximately 30 minutes to adapt whereas, the cone cells they take approximately 10 minutes to adapt, where is in the light condition both these cells they take approximately 1 minute for adaptation.

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Characteristics of Rod & Cone Cells		
Characteristics	Rod	Cones
Optimum Operation	Night, darkness	Day, bright light
Location	Most dense just outside the fovea	Throughout retina; Most dense in fovea
Neural Connection to Bipolar Neurons	Pooled connection	One-to-one connection

And again now the optimum operation of the rods cells can be seen during darkness whereas, cone cells maximum operations can be seen during bright light. And in terms of its location on the Retina the rod cells are more dense just outside the fovea whereas, cone cells are you know distributed throughout the Retina and it is more dense on the fovea, and in terms of neural connection to the bipolar neurons that you saw in the video, the rod cells are they are into pooled connected form format whereas, the cone cells they are one to one connected.

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Audition

- As we saw importance of visible spectrum in the case of visual sensation, similarly we have limitations with respect to our audible range.

Now, in the video that you saw for the visual mechanism; you realized that we have a limitation in terms of our visible spectrum, it's not that entire range of light can be seen by us. So is the limitation even with our auditory mechanism.

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Look at this very video, to comprehend the auditory mechanism let us look at this video. This young boy is fascinated to the chirping sound of the little bird; he is scrolling and approaching the bird. How does he here this sound.

Look at his pinna, his pinna collects the sound energy that is generated by the bird. This sound travels through the ear canal and strikes his tympanic membrane. That is his ear drum. Here sound energy is transformed into mechanical energy, the oscillation of the ear drum makes the malleus ,incus, and stapes move. Besides transmitting the energy, these bones also amplify the sound. You can see the oscillation of stapes in the middle ear.

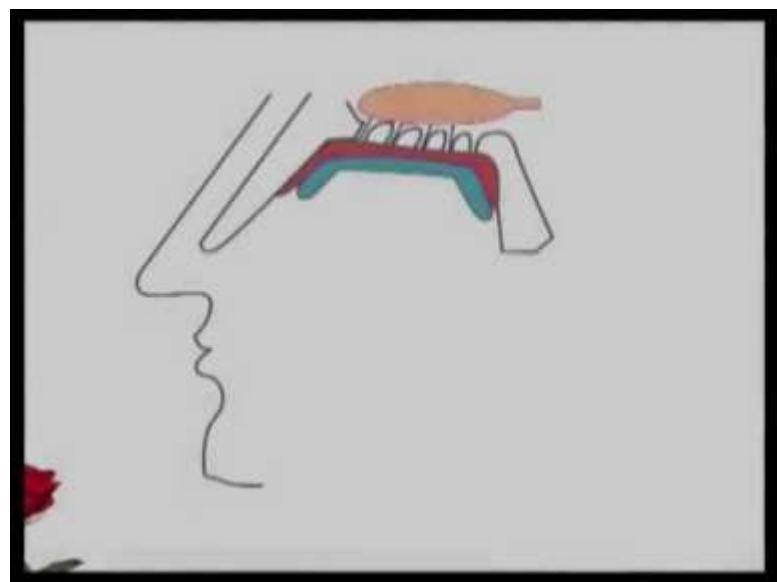
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This now presses the oval window and the vibration enter cochlea. You now see the organ of corti. The wave in the cochlea has reached there; the organ of corti has numerous hair cells, which act as receptors. The pressure on the waves stimulates these hair cells which in turn generates receptor potential. This neural firing travels to the brain through auditory pathway and the child senses that he is listening to this melodious sound of the bird.

Having seen how this child was actually listening to the chirping sound of the bird. Let us now come to the mechanism of Olfaction. This boy now after chasing the bird goes to a corner of the park looks at the flower. Look at this very video.

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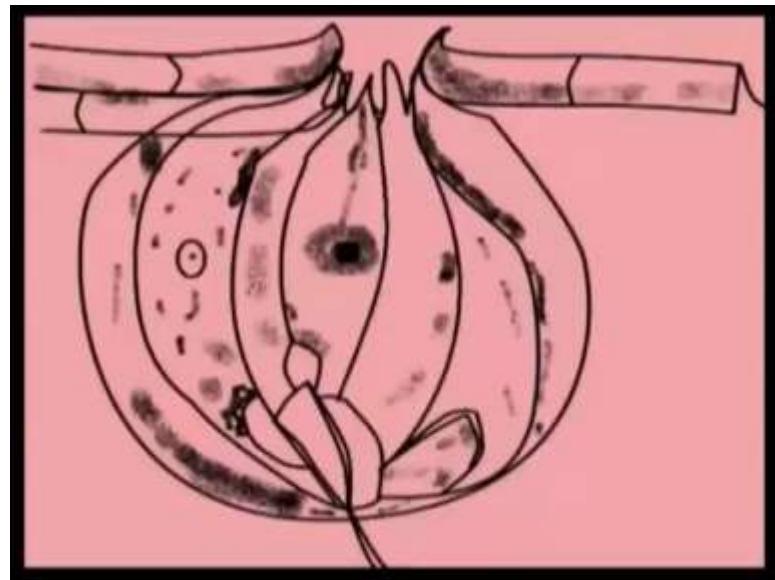
Let us look at this video to understand the olfactory mechanism. This young little boy is too fond of roses, he goes and sniffs the rose in his garden. How does he identify the smell of the rose? As you see here, the vigorous intake of air by this boy has made the OBP release in his nose. The receptors at the olfactory epithelium specialize in a particular smell, this unique odour reaches his olfactory bulb.

You see the olfactory bulb olfactory nerve and the mitral cells. You now see the olfactory receptor neurons that are blue, green and red in color here. You can see the OBP released and the conduction of odour signal in the olfactory receptor neurons. These odour signals are now transmitted from olfactory neuron to the mitral cells and finally, the olfactory track carries the message to the brain. This is how this young boy got this smell of the rose.

Now, after having had the smell of the flower now the boy feels hungry and he thinks of eating chocolate, look at this very video which would explain the mechanism of taste.

This young boy is enjoying a chocolate, how does he get the taste of it, look at his tongue.

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The tip of the tongue sensitive to sweet and salty taste; side to sour and the back to bitterness you can see small bumps that contain the taste buds, these bumps are called Papillae. You can see a taste bud. The chemical components of chocolate dissolve in the saliva and goes down to the services between the papillae. This chemical interaction triggers adjacent neurons and these impulses travel to the parietal lobe and limbic system of the brain of this boy. This is how he got the taste of the chocolate.

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Taste

- Sensitivity of the tongue:
 - Tip- Sweet & Salty
 - Back- Bitterness
 - Sides- Sour

Now, if you combine all the video that you seen, you saw the video for the visual mechanism, you saw the video for auditory mechanism, you saw the video for the olfactory mechanism and finally, the taste mechanism. So, if you combine all these now video that you saw right now.

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Sensation

- We have discussed five basic senses till now.
- The visual & auditory systems are exteroceptive systems since they are sensitive to external stimuli.
- The somatosensory system also has an exteroceptive function.

You can very easily sense that fine this is how we make a sense of world. So, till now we have discussed the five basic sense modalities. The visual and auditory systems are exteroceptive systems. Since, they are sensitive to our external stimuli, whereas somatosensory system also has an exteroceptive function to perform.

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Sensation

- Beside these five senses, Kinesthesia & Vestibular senses are also of importance.

So, beside these five senses, we have two important sensations one is the kinesthesia senses another is the vestibular senses and both of them help us like anything in terms of living in this very world.

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Sensation

- Kinesthesia is the feeling of motion of the body parts involved in some form of movement.

Now, Kinesthesia is the feeling of motion of the body parts involved in some form of movement. Imagine the situation say for instance, you are traveling you are walking, you are running. Now basically what you are doing is that you have perception of your body parts, how it moves and that gives you a constant feed back in terms of synchronizing your movement, so that you can perform the act that you are performing. Whether it is say walking running whatever it is. It is this very kinesthesia sense which gives you a complete feedback as to how your body parts are moving and this helps you a perform the task meticulously.

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Sensation

- The vestibular senses are responsible for making us have the sense of spatial orientation
 - to know the position of our body in the space, and
 - sense of balance- getting information about the relative position of related body parts during movement.

The other sense that we are now coming to is the sense what is called as the Vestibular senses and these are senses which are responsible for making us have the sense of spatial orientation. spatial orientation would mean that it helps us know, the position of our body in this space. Say for example, if you are say - trying to jump for instance. You have to understand very well the relative position of your body in the space.

So, the sense of balance during movement all types of movement is basically dependent on the vestibular senses.

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Let us now see these small video clips from the Beijing Olympics. These are some of the finest movements, that human beings are capable of performing. All this require extreme degree of coordination. Now that the video footage that you saw, you had a gymnast who was moving without looking at object that hand was resting the body weight upon. In the other case you saw an athlete performing on the surface of the ice and it was a perfectly synchronized movement even though the body weight was rested on 1 foot, 2 foot both the feet and then even while the whole body was you know swinging very fast.

Now these are the processes for which you require sound vestibular mechanism. So, with this we come an end to our discussion on the first topic, where we focused exclusively on the sensory mechanism. Just to recapitulate we have discussed about the visual mechanism, we have talked about the auditory mechanism, we talked about olfactory mechanism, we also talked about the taste mechanism, these four mechanisms and then we additionally we took into account the kinesthetic and vestibular senses. So, this is how the input comes to the brain. Once this following the process of transduction the information comes to the brain, our brain then tries to assign an appropriate meaning to this. If we succeed a assigning an appropriate meaning to what we have sensed this is what is called as Perception.

Key words - perception, transduction, vision ,audition, taste , sensory mechanisms

Introduction to Psychology
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Lecture - 06
Perception
External Factors in Perception

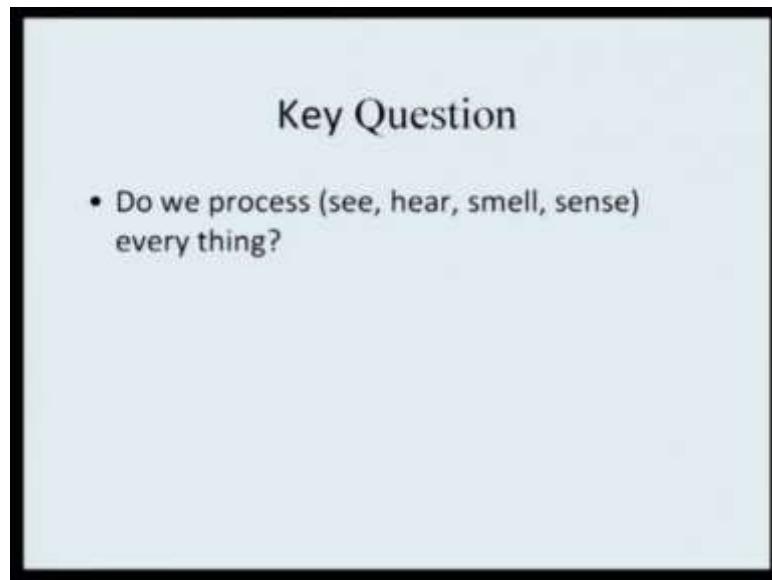
We will now continue our discussion from this very process of Sensation. What we done till now, that we just saw how these sense modalities they acquire the information, external information from the world and then how the signal gets processed in the brain, and then we discussed that well, we all try to assign the meaning to what we have seen and depending on the meaning that we assign to the object that we have perceived, we are seen in fact, not even perceived, we try to you know look at the appropriateness of that meaning. If we are able to give an appropriate meaning, fine perception is taken place, sometimes we do commit error while during that. So, in the process obsession nothing went wrong, but while assigning meaning we do commit an error and that is when we say that illusion has taken place.

We will little later, we will also come to illusion, but right now I will now going to little more detail of the perception phenomena, but before that although I do not want you to go into detail of it, I would just like you to very quickly look at the screen and you see this is the major connection of the visual system. When you look at the major connections ultimately you realized that it is the tertiary and the Paralympic system of the brain which gets activated at the end.

And remember these are the areas of the brain which has to do with emotions. Similarly, if you look at the major connections of the auditory system, right from the process at the level of inner ear, where the nerve starts conducting the information; you realized it finally; once again the sensory mechanism in terms of it is neural under pining goes up to the tertiary in the Paralympic area in terms of order recognition. In terms of smell again we see that the limits gets in the picture and if you look at the test mechanism once again the later life, hypothalamus and amygdala gets into action. What primarily you see here again for even find touch pressure in (Refer Time: 02:34) that. Once again tertiary in the Paralympic area gets activated.

What is important to realize here is that every time, whenever we have this process of sensation taking place and the brain trying to assign meaning to what we have sensed, the areas of the brain which are actually supposed to take care of the emotional aspect that gets activated.

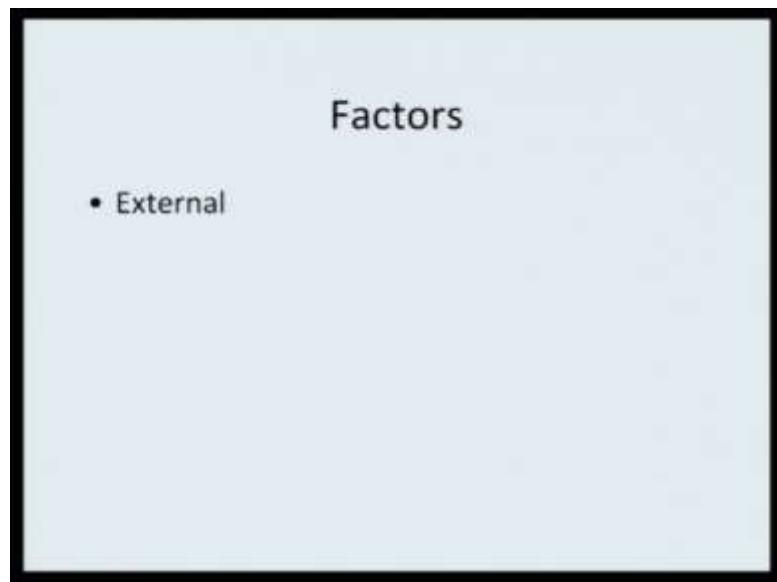
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So, whenever we sense from the external world, the process of perception is not what you call free from emotion. So, the moment we try to assign the meaning, remember last time we had discussed in the previous lecture that right at the level of sense modality, we can store the information for very very brief period of time and I told you that remember this whenever we come to our discussion on memory at that time once again we will talk about sensory memory and this was with the reference of iconic memory.

So, memory gets activated there now we are saying that fine, emotion also gets activated now that we have to understand. Now sensation is conducted in the brain how the brain assigns meaning to it the key question is that is it that we processing each and everything that comes to us ? So, do we see everything that is available in the visual spectrum, do we hear everything in the environment, do we smell everything do we sense everything. So, on what ground does the brain decide, that this has to be processed and this has not to be?

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Now there are many things, with respect to perception. I am in a particular type of environment. There are external stimuli around me, which comes to my brain through my sense modality and at the same time I am at a particular type of a position in the given environment. So, the perspective that might particular sense of modality will take, for example, if I am looking at the camera right now, the perspective of the object which is available in my visual field. Other type of external stimuli and at the same time my own decision to act the way I want to at that point in time in environment.

So, there are many many factors that will now come into picture. What we are doing right now for the purpose of understanding the perception process, what we are doing that in this very lecture we would be talking more about those external factors that has to do with the strength of the signal. So, we are looking at the external factors right now, we are not looking at the other aspects, other aspects we come in the coming days. Now the most important thing when it comes to the external factors is the concept called Threshold or Limen.

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Limen

- Absolute limen: Minimum intensity of stimulus that can be detected 50% of the times .
- Difference limen: Smallest difference between two stimuli that can be detected.
- Terminal limen: Threshold at which original sensation changes to another one.

Three terms are to be remembered here, the absolute limen, the difference limen and the terminal limen. Now absolute limen means that this is the minimum intensity of the stimuli that you can detect a minimum 50 percent of the time. So, whenever you have absence and the presence of the stimuli you should be able to detect it half of the time.

Now, difference limen is basically nothing, but it is the smallest difference between two stimuli, that you can detect and then comes the terminal limen where you realized at the threshold changes to the extent that you do not consider the sensation. The perception to be exactly what you thought it initially was the measure of the sensation changes. Now let us understand this with an example you just know on your computer monitor where you or watching this lecture right now, Just minimize the volume make it come to zero and now you start increasing it, slide the slider now and then you realize it although physically the value changes it says 0 1 2 3 4 5 6 likewise no you get a indicator which tells you that the sound quality has changed which has increased, but somehow you are not able to listen to it.

So, the first case when it was 0 there was complete absence of this auditory signal. You can do it, do the same in the visual signal to turn your screen black and then you gradually you start know adding brightness contrast feature and then you realize that although physically things are changing, psychologically you are not able to make out. So, in the first case although the sound level is changing you are not able to detect it, you

are not able to hear it and then comes a time above which you can hear me. So, similarly if you change the brightness contrast feature, there would be a point when you would be able to make out that this is the object available on the screen right now. So, that very incentives of the stimulus were from absence to presence can be detected by you that is called Absolute limen.

Now, although you are able to make out that I am saying something you are not able to detect the increase in the volume. First case was 0 means absence of the process to presence now within presence you want to increase the volume, now you again knows the use the slider and you see that physically the sound level is increasing, but then you realize that the notable difference that you wanted make, that you wanted to increase the volume up to this level, that is somehow of not reaching and then comes a point when you realize that, yes! Now the sound quality has changed, it has increased and then if you now still continue moving it beyond 100 percent one 150 percent 180 percent, then you suddenly realized that this is no moral lecture it is converts into noise.

So, that very threshold, where the intensively of the sound becomes pain full for you the lecture converts into noise is terminal limen. So, in terms of external attributes of the stimuli that we are sensing in order to assign a meaning to it, what is the intensity of that various stimuli, absolute limen, difference limen, terminal limen has important role to play there. Now along with this comes an interesting thing, right now we have talked about it, that we have to make a distinction between the previous and the new state.

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Weber's Law

- Just-noticeable difference in a stimulus is proportional to the magnitude of the original stimulus.
- Smallest level of difference between two given points of a sensory stimulus that can be detected.

Weber gave a law, basically this is talked about know the area of psycho-physics in experimental psychology we will come to read about it. Here we would be briefly looking at what it means and why it is so important for psychologist to understand with this law - he says that the just noticeable difference in the stimulus is the proportion of the magnitude of the original stimulus.

So, there is a smallest level of difference between two given points of a sensory stimulus that can be detected. So, if you are able to know realize that this is the magnitude of the original stimulus and if the magnitude of their incoming stimulus is above this level, only then that difference can be detected. The best example of it could be that you hold a torch in your hand and go in a bright day light, whether your torch is switched on or off you are not able to make your sense out of it because the outside light is brighter than the light of the torch, but the same phenomena if you repeat in dark situation you would very easily be able to detect that your torch is on; the reason being that their magnitude of the stimulus, the intensity of the light which is imitated by the torch in the first case this is much less than the light already available in the environment. So, during day time you do not detect the torch is on where as in the night dark you are able to detect it.

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Just Noticeable Difference (jnd)

- Example- If the headlight of the vehicle is on during night, it is noticed unconditionally; during daytime it is not.

Take another example if the head light of your vehicle is on. Now during day time once again you would not be able to make out whether the head light is on or not. In the dark situation whenever the outside light decreases, you would very easily be able to say that, but the headlight of my vehicle is on. So now, because the existing intensity, the intensity of existing stimuli, if that is strong enough, then the intensity of the new stimuli has to be above that to be detected, that is what is called as Just Noticeable Difference.

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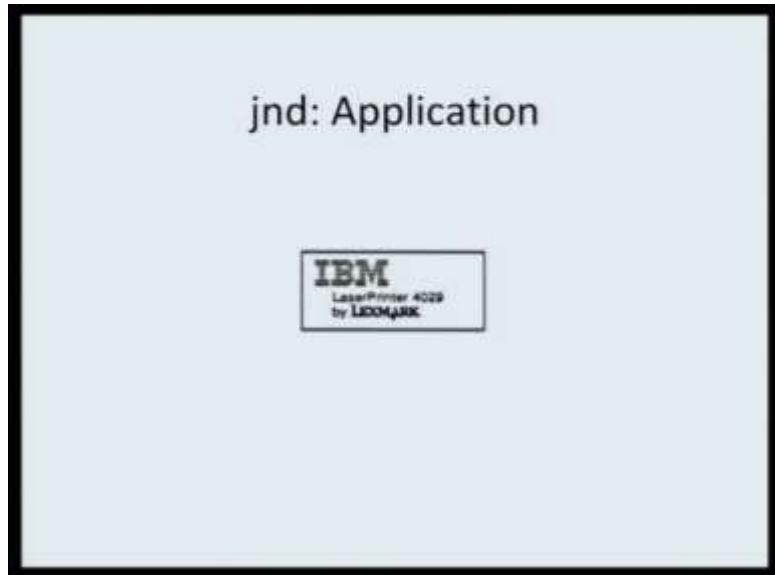
jnd: Application

- Change in brand name



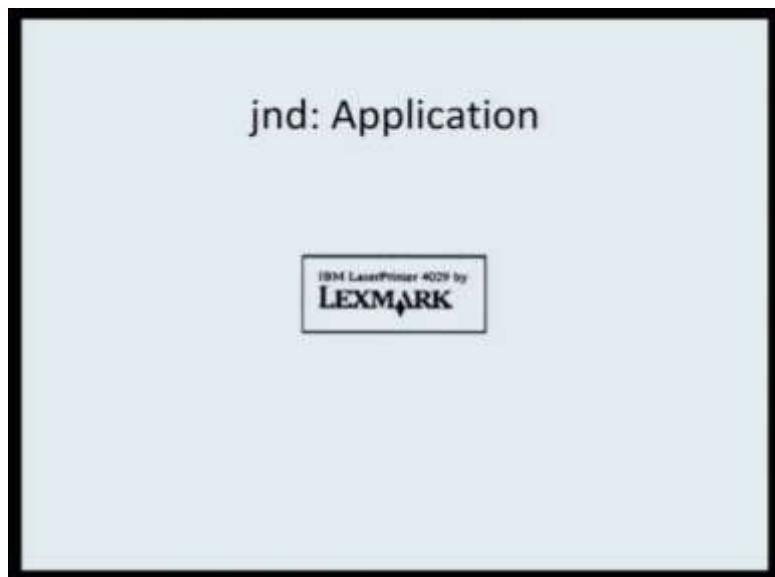
I will give you two examples. The first example is of the changing the brand name, when IBM introduced Lexmark printer. Look at the change in the logo that you see of IBM.

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In the first case you see only IBM. Now, you are see IBM Lexmark 4029 by LEXMARK just look at font size also. So, earlier you had only IBM, now you have addition of laser printer 4029 by LEXMARK.

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Now, there is change. Suddenly IBM laser printer 4029 the font size decreases and LEXMARK has replaced the other remaining space.

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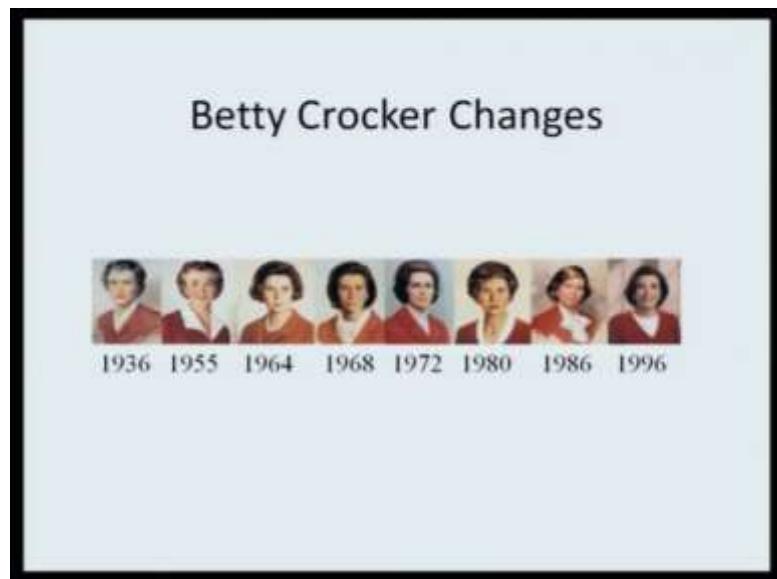
And then you see Lexmark goes in the top, laser printer 4029 comes at the bottom and IBM is removed. Now this is an interesting application of just noticeable difference now if you look at the first logo and the last logo you see a big difference. Why? you saw that difference because there was the difference in the space in the defined area of the logo had stark difference, but if you look from one face to the other and gradually if you look at the four phases; that means, that while positioning this printer IBM wanted that in the memory of the users, Lexmark printer should be attached to IBM and therefore, there it should not be considered this is something new that has come to the market rather the existing brand name should suffice the positioning of Lexmark printer.

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Now, let us come to another example. This is the example of Betty Crocker; now Betty Crocker over the years when they changed their brand ambassador.

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Now, look at this change you know right from 1936 to 1996 you see that a series of models were used for endorsing the product. Now the lady in 1936 is far different from the lady that you see in 1996, but if you look at the intermediate faces, the model who endorses the brand 1936 and the get up of the model who endorse the brand in 1955. You see much of similarity. Similarly between 55 and 64; 64 and 68 and then you realize that

Betty Crocker basically what it was trying to do is that the models who were endorsing the brand the difference in their physical appearance, they tried their best to make it come below the just noticeable difference level.

Now, if the previous and then new, these two models, their physical appearance if does not touch the just noticeable different level; that means, you would consider that some makeup has been changed, but by and large the person who endorses the brand remains the same. These are the interesting applications of just noticeable difference our real life.

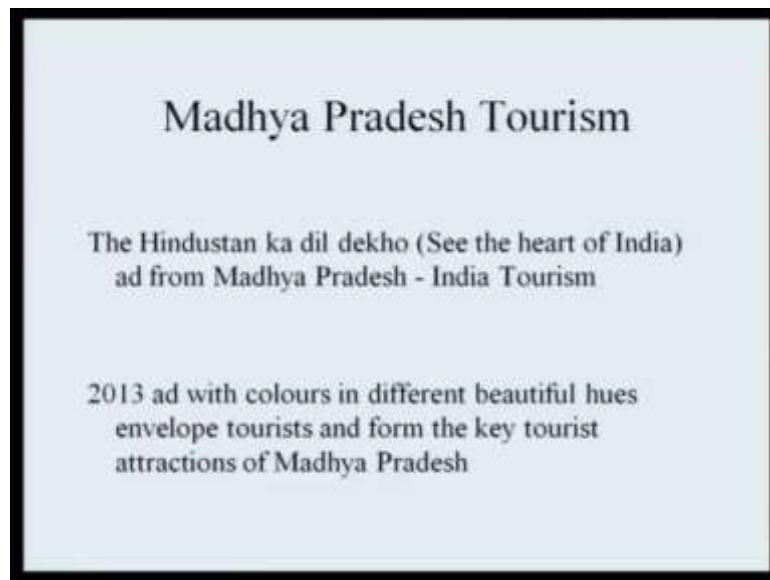
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Weber's Law

- The change required for getting a stimulus perceived as 'different' will depend on its initial strength.
- Stronger the stimulus, greater the requirement.

Now, the change that is required for getting a stimulus perceived, as different will always depend on the initial strength. That would mean that stronger is the stimulus in the first case for establishing your brand in the present example, you require that the signal of or the strength of the incoming stimulus should be very very strong. You must have seen these two ads of Madhya Pradesh tourism.

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Now, let us look at the first add. Now, you have a very nice depiction in a very very artistic form the major tourist destiny destinations of Madhya Pradesh has been shown to you. This was one of the very popular ads of tourism and then much later in 2013, another adds for Madhya Pradesh tourism came into being. Now you remember one thing, the way the previous add know which said known Hindustan Ka Dil Deko, See the Heart of India and the way the entire tourist destinations were depicted and the face of the women was taken into account to express the emotional component that would be

embedded in this whole phenomena was done certainly you know something very very exceptional.

Now, when in 2013 Madhya Pradesh tourism decided to replace this very ad by another ad. There was a necessity because the first signal had such strong strength that the next ad had to be much more superior to that in terms of it is signal. I am seeing basically talking about this very example to explain the importance of Weber's law in psychology. Now look at this very ad.

What you see here is that the same tourism destination which was depicted in the previous ad are being once again being visible shown to you, but this visual representation is now in terms of using various colors, in different beautiful hues. Now the form is created of the say tourist destinations that was shown in the previous add also, but instead of showing you that image of, the tourist destination now it is colors in different hues which are used to give you mental image of that and this would primarily now show you that see, the previous ad was so in fact that the next ad to have very strong strength of the signal to be received, if it is going to replace the existing add.

So, in terms of now real life situations this is; however, Weber's law has a very important role.

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Perception

- Till now we have discussed how we sense the incoming inputs from the environment. All of them refer to sensation.
- Sensation refers to the stimulations one receives from the sense modalities.
- Perception is preceded by sensation.

So, till now what we have discussed is that the incoming inputs from the environment, they are assigned a meaning and once we succeed at assigning a meaning to it we said at this is perception.

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Perception

- To ensure that a sense modality receives stimulation, the stimulus must reach absolute threshold.
- Absolute Threshold refers to the minimum intensity of stimulus that the receiver can detect fifty percent of the time.

Now, to ensure that sense modality receives stimulation, the stimulus must reach absolute threshold. Therefore absolute threshold becomes the minimum intensity of stimulus that the receiver can detect at least 50 percent of the time.

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Perception

- When we attach a meaning to what we have sensed, perception is said to have taken place.
- Hence, whatever we experience is our perception.
- The sensory cues that are received by the brain and the relevant past experiences that one already has are organized to derive this meaning.

When we attach a meaning to what we have sensed, we say that perception is taken place and whatever we experience is our perception. Therefore the sensory cues that are received by the brain and the relevant past experiences, that one already has, it is derived back to our working memory in order to provide meaning to whatever we have sensed.

So, this is how perceptions takes place, but remember one thing perception need not always emulate reality.

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Perception

- Perception doesn't emulate reality.
- The raw information received by the brain are transformed or reworked in order to perceive it.

The raw information it is received by the brain is transformed or it is reworked in order to perceive it.

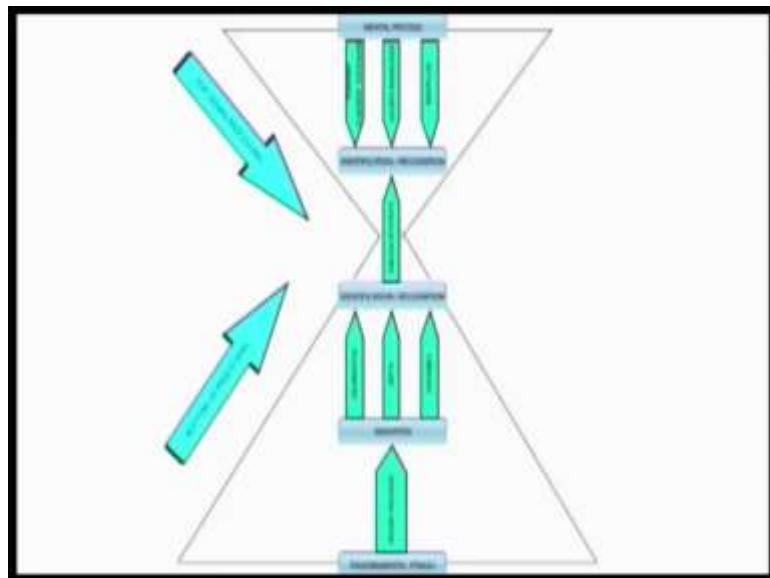
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Perception

- Hence, a percept is an outcome of mental processes such as form synthesis, feature differentiation, recollection of past experiences, and stimuli comparison.
- These operations can be top-down or bottom-up.

Hence a percept is an outcome of mental process. Such as form synthesis, such as feature differentiation recollection of past experiences and stimuli comparison. So, these operations can either follow top down process or it can follow bottom up process, let us understand this.

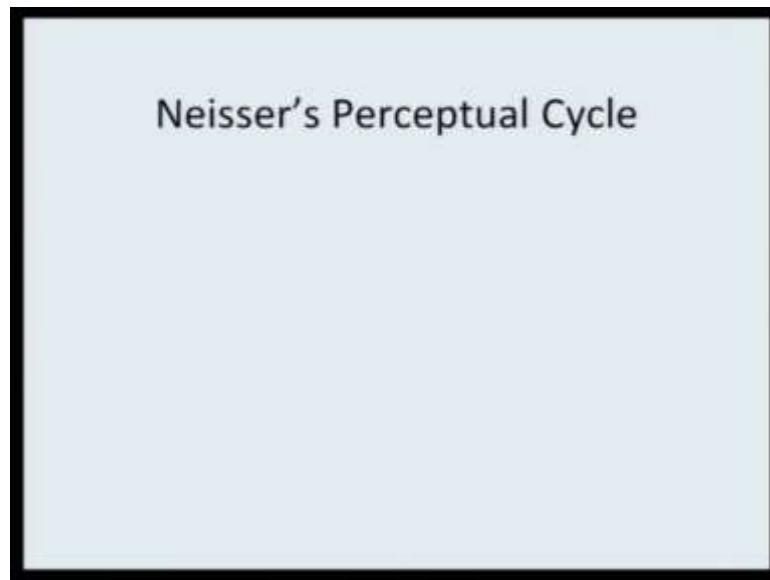
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The knowledge and memory pertaining to this stimuli and the language to understand and express it are crucial. Expectations and belief and motivation are also important. All these constitute mental processes and are top down processes. The environmental stimuli

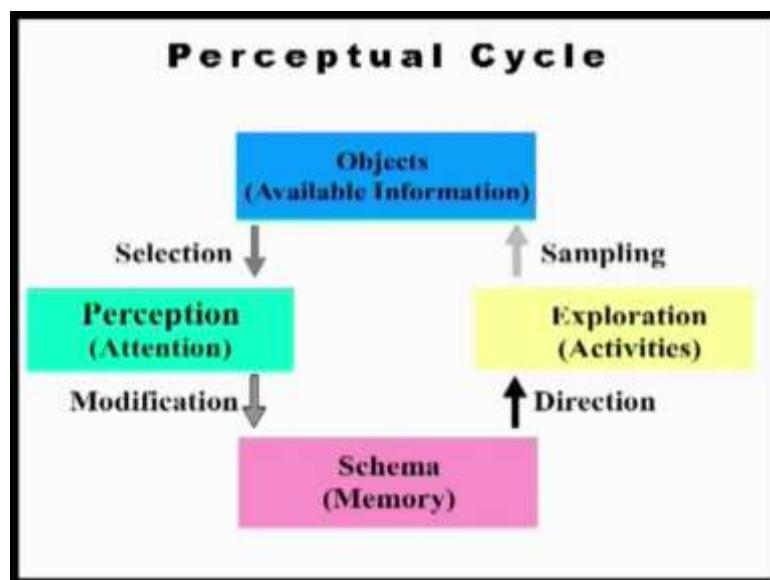
are processed by the sensory organs, this leads to sensation, these stimuli undergo perceptual organization based on their inherent characteristics. These are the bottom of processes. A synthesis of these two processes leads to identification or recognition of the stimuli.

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Let us now understand perceptual cycle proposed by Neisser.

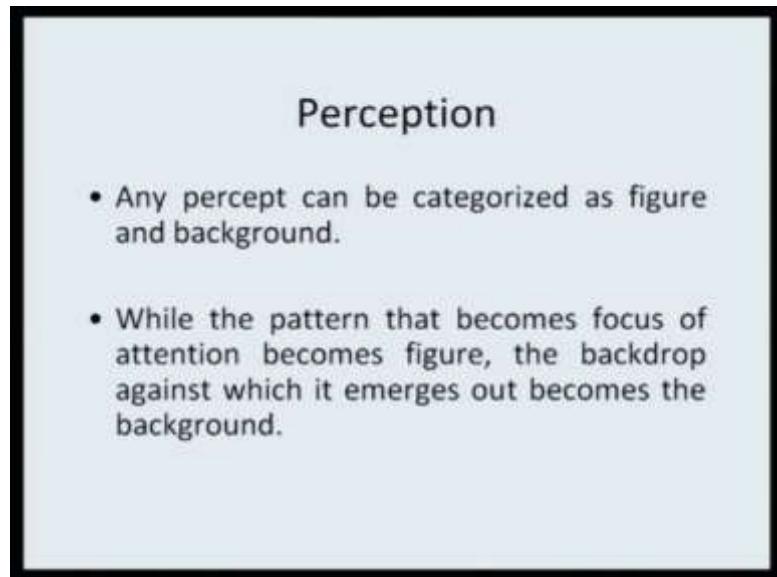
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In 1976 Neisser proposed a model integrating the bottom up and top down process into a cyclic process. This model focuses on the perception, attention and categorization. While

perceiving an object, one selectively attends to the available. This is further modified by anticipatory Schemata.

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So, what we have understood now is that any percept that can be categorized for assigning a meaning has to be differentiated in terms of figure and background. So, while the pattern that becomes focus of the attention becomes the figure, the backdrop against which the figure is seen is considered as background.

For instance if you are looking at me right now, if I am the object, then this green background against which you look at me becomes the background. Say if I write something on this green board and if you are looking at that very object although it is standing front of that green board I become part of the background and the concept, the alphabets sentence is written on the green board becomes the object. So, figure and ground always remains interchangeable in nature and little later, we will come to the concept of contour, where we would be basically talking about the fact that more you are able to make a distinction between figure and the background, more clarity you have in terms of perceiving object in the real world.

So, we will end here and we will once again continue with the strength of the signal in our third lecture.

Lecture – 07
Perception Theory of Signal Detection

Let us now recapitulate whatever we have discussed till now. First lecture we focused on sensation, second lecture we looked at the concept of liman or threshold, we looked at absolute difference and terminal liman, then we talked about Weber's law and we took certain live examples I would say to understand how the concept of threshold and how the concept of intensity of the stimulus the way it is described in Weber's law, how that makes an important type of a contribution in terms of understanding our physical world.

Then we ended the second lecture saying that always you one has to know figure out one has to extract the figure against the background. And this very idea of categorizing figure versus the background is an important phenomena in perception. We also said that figure and background could be interchangeable and we always look for contours if we are able to establish it well and good if we are not able to establish it we have confusion. Little later I think towards the end we would also take some of the examples of reversible figure.

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Perception

- A figure need not always be in front of or above the background.
- The process of making distinction between a figure and the background also depends upon the search for contours.

Reversible figure means, if you look at it from one point of view then you see another type of an impression emerging out. So, something half of the figure becomes the background and remaining half becomes the figure and then it keeps changing. And depending on what you consider as background the figure changes, but that we would see little later. Right now, we are again looking at the strength of signal. Let us come to an interesting theory.

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Theory of Signal Detection

- Roots in communications & radar system.
- Draw attention of psychologists in the 50's and 60's
- Understanding behaviour while detecting weak stimuli
- Difficult to be explained by traditional theories of thresholds

Basically this very theory has its root in communication and radar system, but in 1950's 60's it dragged the tension psychologist because psychologist were interested in understanding human behavior. And they tried to understand the strength of the signal and its role in detection of the stimuli especially in conditions where the intensity of signal is very weak. What was realized that Weber's law ,Fechner's law these laws were not sufficient enough to explain how human beings respond in situations when the signals are weak. And this lead to what is called as Theory of Signal Detection.

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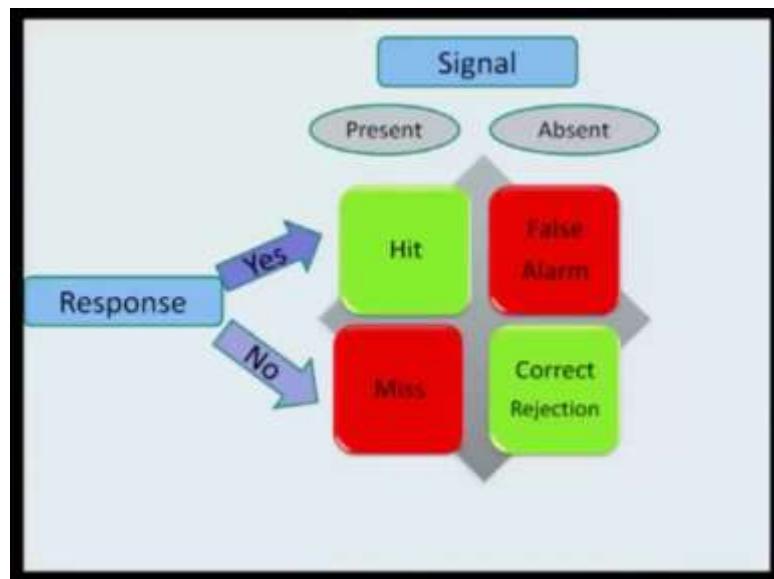
Now look at this screen, you see fighter aircraft, the radar system. And the radar of course, has to be sensitive enough to receive this signal back from the flight and finally signal has to be detected by a human being.

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So, when you look at the radar system everything seems very nice, but the problem with the human operator is that he or she has to figure out the presence of the signal. Again some type of a noise. Noise in psychology here is whatever is not your intended target is the noise. Let us understand this very theory by taking this example.

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You make a grid it is a two by two grid, so whether the signal is present or the signal is absent that is category one. And category two in terms of the human response the operator says yes or no. So, yes versus no in terms of human response, presence versus absence in the case of signals. What are the possibilities? First, when the signal is present and the person responds yes it is present. This is called hit condition. Second condition when the signal is absent and the respondent says that yes signal is present. although signal is absent. This is called false alarm.

The third situation when the signal is not present, and the respondent says that it is not present, this is correct rejection, and the fourth situation where the signal is present, but the persons says the operators says that no it is not presented. This is a miss condition you have miss detecting signal.

Now, why this is so important from of course communication prospective, the radar system it make sense because the radar is suppose to detect the signal so that it can make distinction between the own aircraft versus enemies aircraft. But signal in itself does not make any sense, the human operator has to detect the human operator has to say the fine I have identified this signal which we are saying that this is hit condition or the signal is not present you say that fine signal not present it is a correct rejection. These two conditions are fine. But think of two other conditions that is marked red here, that the signal is absent and you say it is present it is a false alarm.

What would this mean? If you have a system for combating the enemy aircraft that is forcibly entering into your territory and you are the operator who based on the understanding of the radar signal gives a signal, that fine the enemy aircraft has entered into our territory. The field guns will start firing at that very aircraft. You committed a mistake. When the signal was absent you said that is there is a signal and therefore you raised a false alarm against which the support system started combat operation. And the second case is again far more dangerous where the signal is present but you said, no it is not present, then enemy comfortably enter the your territory. There is the big prize that the country pays for that.

So, you realize that the role of the human respondent is extremely important in terms of detecting the signal. And that is reason why signal detection theory is taken into account when we look at the perception mechanism. Now in terms of detection of this signal what is very very important is the strength of the signal. Remember in the second lecture also we were saying that the strength of the signal has to play role and because the signal has to be detected therefore it is called that fine this is the discriminability index.

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Theory of Signal Detection

- Discriminability Index (d'): This is the estimate of the strength of the signal.
- The signal is discriminated depends on the separation and spread of noise and signal and noise curves.

This is the strength of the signal and the way you estimate it and accordingly that would shape your response. So, the signal is discriminated depending on the separation and spread of noise in signal and the noise curve.

So, you take one experimental example here and then you would move to graphical plotting of the response in this very situation what is called as the ROC curve.

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Theory of Signal Detection

- Percentage of hits and false alarms depends on individual's sensitivity to the signal (d')
- Cost-benefit analysis of a situation

Now, the percentage of hit and false alarms depends on the sensitivity of the operator to the signal. Signal has strength that we have discussed still now and we have said that fine it is the strength of signal which plays an important role. Stronger the signal higher are the chances that we will detect it, but besides the strength of the signal what is also important is that I as an operator how sensitive I am. And that would be dependent on the cost benefit analysis. What would be the cost benefit analysis? I am rewarded or I am punished for the response that I elicit therefore, cost benefit analysis will always play an important role.

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Theory of Signal Detection

- In a given perceptual task one has to detect a given stimuli (signal) in the backdrop of non-stimuli (noise).
- This means that a decision outcome always comes amidst some degree of uncertainty.

So, in a given perceptual task one is always suppose to detect the signal that is the stimuli against the non signal that is the noise. And this means that decision outcomes always comes amidst certain degree of uncertainty. You are not very certain, the strength of the signal plays an important role, and your sensitivity plays an important role.

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Theory of Signal Detection

- Variation of criterions: Experimental demonstrations
- d' remains unchanged-
- If P is rewarded for hits and not punished for false alarms, then the subject should set the beta very low and maximize hits, not worrying about false alarms. This would a lax criterion.

Let us look at one of the experimental demonstration of this. We are taking a case that fine now the strength of the signal remains constant. In the first case what we were saying was that the strength of the signal changes and therefore it has an impact on the response. Now we are saying that strength of signal is a made constant and it is cost benefit analysis that you make as operator, fine.

Now, if the operator is rewarded for hits, but he is not punished for false alarms then the beta value that one sets is very very low. And this, what happens is it will maximize the number of hits because the operator is not worried about false alarm. The reason he is rewarded for hit, but he is also punished for the false alarms. Even though I committee an error I do not get any adverse remark for it and if I succeed fine it is very good. So, what I would do I would relax my criteria. Earlier if I was using a very very stringent filter to say that whether the signal was present or absent now I do not do that.

What has happened to me? My relaxation of the criteria which leads to maximizing of hits because I am not worried about the false alarm is primarily guided by this cost analysis that I am making that I am not paying a cost, but I am always deriving a benefit out of it. So, cost benefit analysis comes into play here. Think of the other situation d prime has not changed now.

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Theory of Signal Detection

- Variation of criterions: Experimental demonstrations
- d' remains unchanged-
- If P is not rewarded much for hits but punished for false alarms, then the subject should set beta very high so that false alarms will be low. This would also result into low hits.

So, the strength of the signal has not changed but I am not rewarded much for hit, but I am punished for false alarms. What would I do? My beta will be very high. So, that the false alarms also become low. This of course would also result into low hits. So, if I am told that fine whether you go for a hit you correctly identify the signal is important but it is not as important as if you committ an error while doing that. Take situations; say in the court of law two attorneys are arguing against a possible client who is likely to get death penalty. The cost involved is very very high. And therefore, what happens you suddenly realize that your beta is now very high because you do not want to create a false alarm, you do not want to argue saying that he is culprit because you know that if proven guilty the court will give him a death penalty. So, you walk with extreme degree of caution.

The previous example of the aircraft and radar warning system that we were taking, if your signal by default you press a button raising an alarm and in turn it triggers air strike you would be very very cautious; because false alarm the prize that you pay for it is very high. You understand this situation now. Case one, when hits are rewarded and false alarms are punished. In second case when hits are not rewarded, but then for creating false alarm you receive punishment.

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Theory of Signal Detection

- Variation of criterions: Experimental demonstrations
- Graphically plot the results with false alarms on the x axis and hits on the y axis.
- The curve represent the pattern of responding expected for a given d' at all values of criterion. This curve is called the receiver operating characteristic (ROC).

Now, if you graphically plot the result with false alarms on the x axis and the hits on the y axis you get a curve and this curve is called the ROC curve; the Receiver Operating Characteristics curve. This curve represents the pattern of responding expected for a given d' prime at all values of criteria, so you change your criteria. The d' prime remains the same and then you see that how depending on the criteria that you have selected and the value of that criteria the curves will change.

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Theory of Signal Detection

- Variation of criterions: Experimental demonstrations
- When d' is 0, noise and signal + noise curve are the same and false alarms and hits will be the same. That is represented by the diagonal in ROC graph.

Now when d' prime is 0, noise and signal plus noise curve are the same and false alarms and hits will be the same. That is represented by the diagonal in ROC graph.

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Theory of Signal Detection

- Variation of criterions: Experimental demonstrations
- As d' increases, the ROC curve bows away from the diagonal.

If d' prime increases the ROC curve bows away from the diagram.

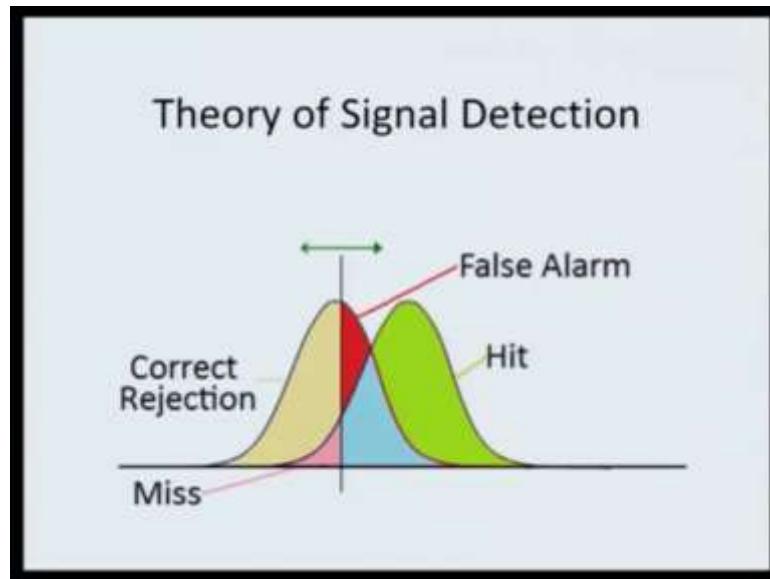
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Theory of Signal Detection

- During second world war ROC curve was used for analyzing radar signals.
- Later it was used for representing signal detection in psychophysics.

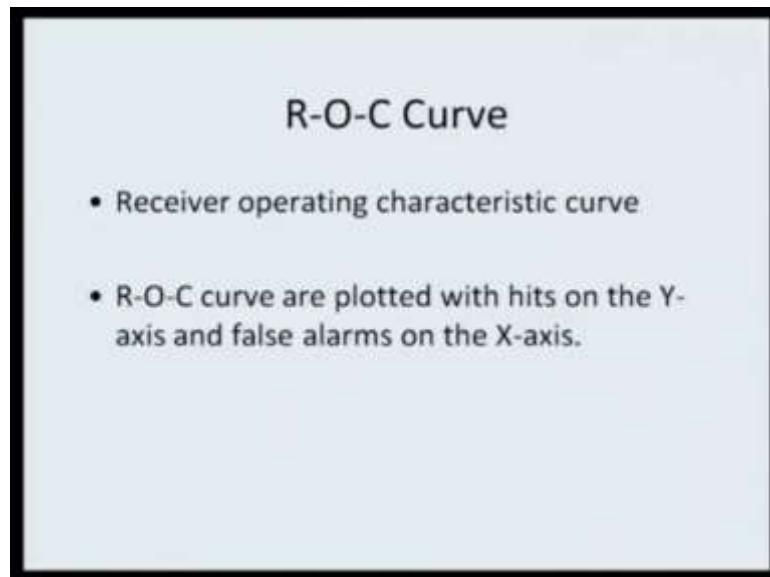
And you would realize the practical implication of it of the fact that during the Second World War ROC curve was used for analyzing the radars signals. Of course now we talk about it fondly discussion on signal detection in psycho physics.

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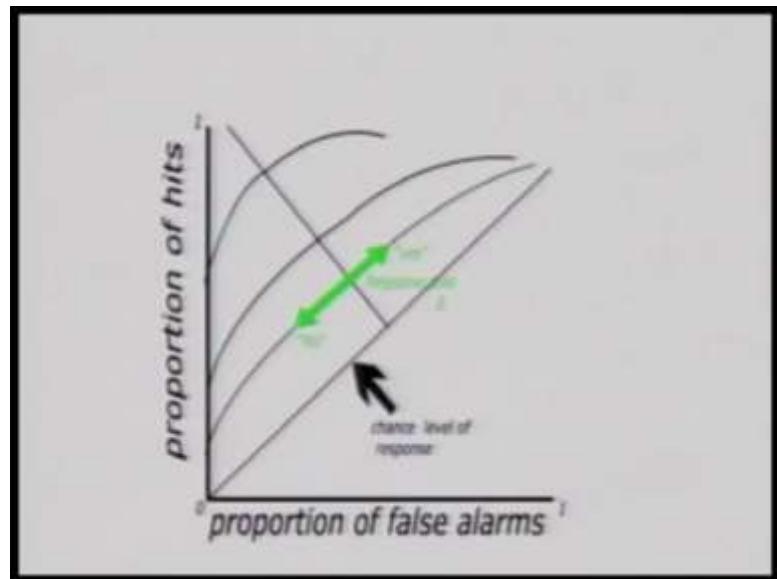
So, you see the graphical representation here, the correct rejection, false alarms, hit and the miss that is defined by the Theory of Signal Detection.

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And now look at this very video which explains ROC curve.

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Look at this graph now you have the proportion of the hits and then you also have the proportion of the false alarms and then of course you have the chance level of response wherein know depending on the d' prime as such, you give your hits and the false alarms. So, the detection of the signal will actually dependent on your ability to discriminate between the signal against noise, the stimuli against the non stimuli. Think of the other example; in real life situation where one has to detect signal and miss the noise ,the best example in the present day would be camouflage situation.

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Camouflage

- Real life situations where one has to detect the signal amidst noise.

When you try to make the signal of the stimuli is weak enough so that the figure and the ground cannot be detected as two separate situations.

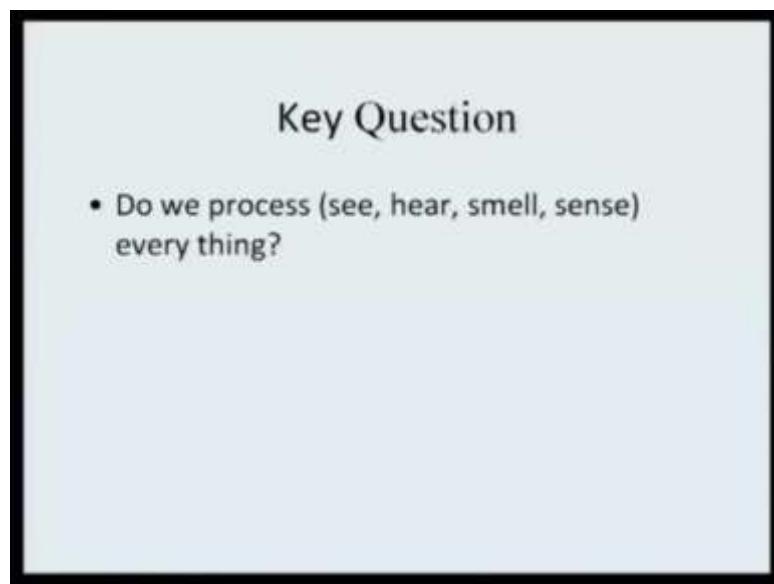
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You must have seen movies, in real life's, several images where you have an individual who will put different colors on the face or put some bushes on the hair will add some

bushes the body also, uniformed at the way were they also multiple colors. And then when you make a survey when you look at the object from a distance you are not able to detect the background and the stimulus. So, the object is not very clearly perceived against the background that against which is seen.

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So, coming back to our key question that we initiated in our second lecture; do we process everything? What do you say now, what we have discussed till now that number one it is the intensity of the signal that we receive in the environment that would determine whether we would be processing it or not number one. But number two what we have also seen is that the characteristics of the criteria evolved by the user the individual who responds also important. So, the intensity of the stimuli and one two what I decide the criteria that I said for responding both these things will have its importance when it comes to responding to a given situation.

Now that we have understood that fine, the intensity of this signal and the criteria that we set both of them have a role to play. And fact we are now saying that all images all figures have to be extracted out of the ground. What is important once again we are coming to this concept that you have to draw a line difference the contours.

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Figure & Ground

- Contour is the gradient change between the elements of a percept.
- Ambiguity in contours leads to reversibility between figure and the background.
- Edges & Contours are critical.

Now, basically contours are nothing but these are change in the gradient between the elements of a perception. So, ambiguity in contours leads to reversibility and I said that little later we will see few examples of reversible images. But in reality in most of the cases we have the edges and we have the contours. If you are able to establish this distinction then you would be very easily able to see visual image against a background and similarly you can hear a sound against the noise that you are hearing.

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Look at this very example; a famous example that you find in all text books. What do you see here, is all know mix of black and white patches, it is extremely difficult to decipher what is object and what is the background just concentrate at it. Are you able to see? Now let me help you out. Try to look at this very area, can you see the object now? Answer is yes. How you can now detect the object, because in this case this was the area that you are shown and very conveniently now you can look at these black and white patches and you can make out that you are looking at a dog against familiar type of background. Exactly similar type of thing works when it comes to human beings.

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Now, look at this very example. This is a photograph published in news paper where an Indian army soldier is shown in a camouflage and he is basically taking part in an exercise Sudarshan Shakthi in somewhere in Barmer district in Rajasthan. Now if you look very clearly it very difficult if the same soldier is put on the ground and you look at the background there making distinction between the figure and the background becomes very difficult.

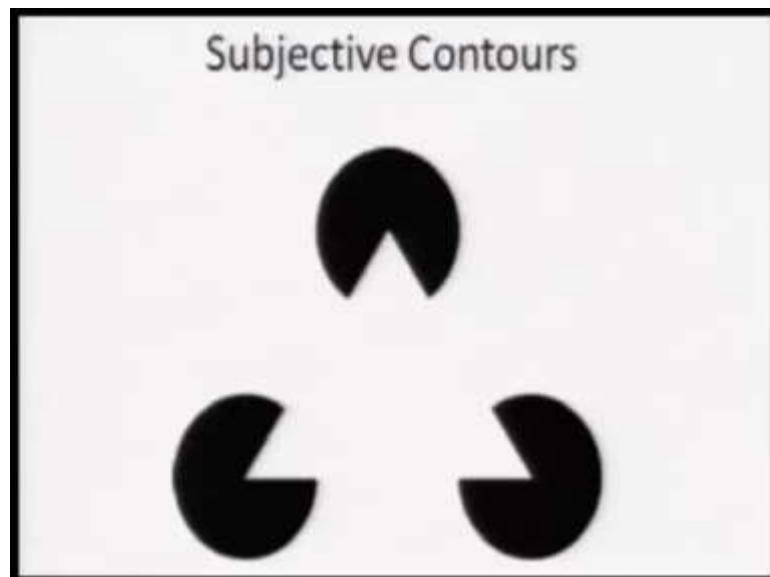
Now if you compare all this, the first case where when we were trying to look at the flying aircraft and somebody sitting in front of the radar screen who is suppose to detect the stimuli how difficult it would be. You saw the back and white patches where you are supposed to look at the dog against the similar background how difficult it was. And again here you see it would be extremely difficult if you are not told what you are actually looking at and that too where looking at a very close shot. If nothing of this information was given any you are looking at this very objective from a distance it would have been extremely difficult to extract the image the figure out of the background.

Now coming back to the example of subjective contours, these where the cases where contours are still available. The strength of the signal makes that very difference. And of course your sensitivity. So, one is your sensitivity other is the d prime value these two

things would make a difference. But, case is where the contours are missing what do we do? And it has been observed that as human beings we create our subjective contours.

And subjective contours play extremely important role the reason being that what you actually see in environment does not have that line of distinction, and because you have to read the figure against the background. So, what would be the possible figure and what would be the possible background would depend primarily on the fact how you are subjectively training to draw that line of distinction what is called as controversy. Look at this vary video to understand subjective contours.

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Look at this image, what do you see? If I ask you are you looking at white triangle lead over three circles, the answer could be yes for many of you. Or you just then perceive that it is actually three independent circles with a piece cut out from each of them, but there is no triangle as such.

So, it could be very easily interpreted as if you actually look at three independent black circles with the piece cut out of them and there is no triangle as such. But even though the background is white I am sure all of you would when you look at this image you

automatically draw a line to complete the triangle. To perceive that there is a white triangle above this, this is subjective contour.

We have already seen this image let us look at it again look at the three black circles in the triangle. You can see a sharp gradient change between the circles, triangle and the background. Now move the triangle and super impose it over the three triangles, you still see the triangle by filling creative subjective lines. You do not see three circles with piece cut out of them. Well, you were aware that the triangle was super imposed on the circles. Now see these three circles, they all have a piece cut out of them all though this time a triangle has not been super imposed you still perceive white triangle a put over three black circles. This was an example to demonstrate the concept of subjective contours.

Now that we have understood subjective contours in the next lecture we would be focusing on perception of form, how do we make out the forms that we see in the world, shape, size, and all these things.

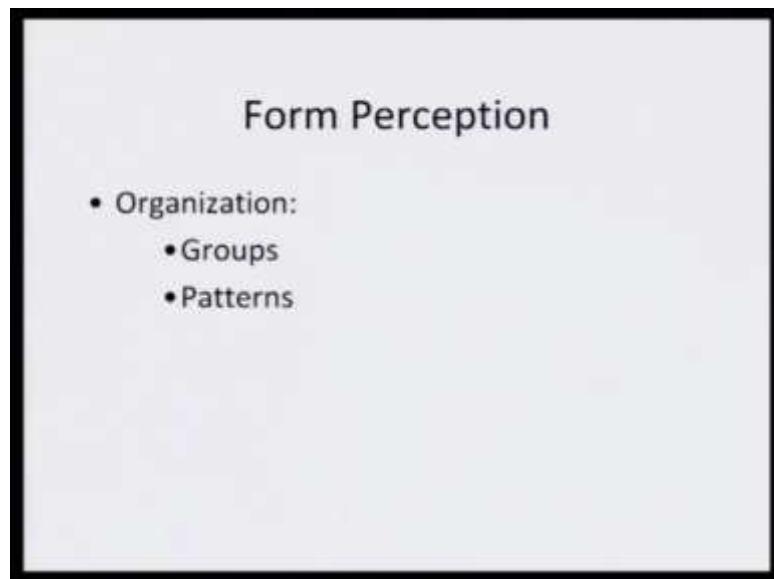
Key words -signal detection, hits, false alarms, roc curve, contours ,camouflage

Introduction to Psychology
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Lecture – 08
Perception Gestalt Principles

Till now, we have talked about what you call extraction of image from the background depending on one, the properties of the external stimuli, two, the readiness of the person who is trying to perceive the object and three, what we were talking now towards the end of the third lecture was the idea of drawing contour, so that the image can very easily be extracted out from the background.

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Form Perception

- Organization:
 - Groups
 - Patterns

So, today we would be talking about Form perception. Wherein we would try to emphasize on the organization of form, how groups and patterns they emerge.

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Gestalt Principles

- Kohler- Which gestalts would be formed from ambiguous stimuli
- Law of Prägnanz: Simplest organization demands minimal cognitive effort.
- In German Prägnanz means 'clarity'.

And in this context we would be talking about the Gestalt Principles. Gestalt basically means whole, complete. According to Kohler, Gestalt would be basically formed from ambiguous stimuli.

So, how you try to complete your perception, based on whatever is available to you, that is that holistic part of the percept is the Gestalt Principle. The core principle is called the law of Pragnanz and then there are whole set of laws which are considered as part of Gestalt Principles. Now law of Pragnanz basically says that the simplest organization is one that demands minimum cognitive efforts. In German Pragnanz means clarity. So, those cues in the external environment that does not required too much of mental effort from your side, in order to decipher the figure from the back ground. Those knob organizations basically would constitute law of Pragnanz.

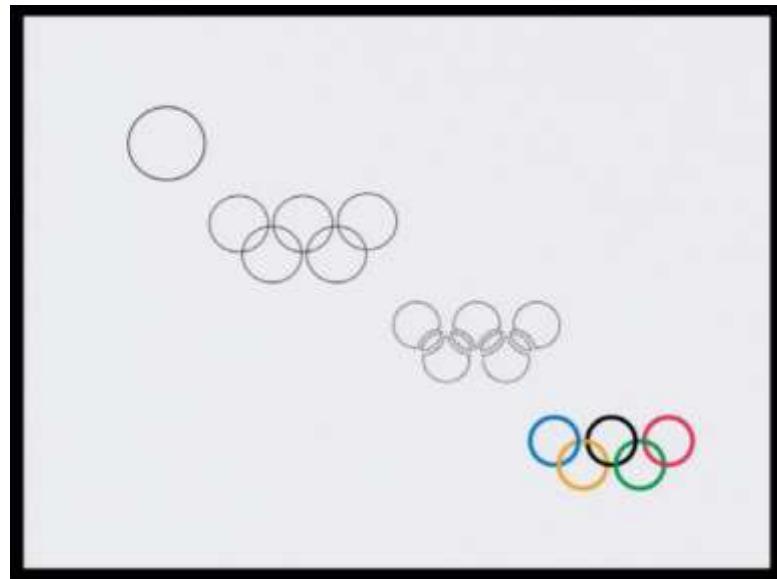
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Gestalt Principles

- Simplest organization- Minimal cognitive effort
- Therefore, they emerge as a figure.
- Simpler and symmetrical forms are easily perceived.

So, that basically means that as human beings we would also always like, to minimize her cognitive engagement in terms of deciphering the image from the back ground. So, simplest organizations would always require a minimum cognitive effort and therefore, minimum time, minimum effort, best type of mental representation that you derive from external environment this is what would be considered as the Principles of Pragnanz. So, simpler and symmetrical forms, these are the two types of forms which are very easily perceived because it is too simple and because it is too symmetrical therefore, you do not have to cognitively engage yourself in too much of know derivation of extraction of cues, derivation of cues, arriving at a conclusion combining them and then finally, deriving a meaning out of it. Hence simpler symmetrical forms will always you perceive very easily by human beings, this what the law of Pragnanzies.

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Now, look at this very circle on the screen. You have one circle, the second circle, third, the fourth and the fifth. Now all of them have come one by one and then they form a pattern out of it. Now when you look at this very pattern, you started from the first, came up to the whole now set of five rings. Now look at the third image there, you could have sense is that way also. So, all types of now combinations where you realized there are a small pieces cut out of the two conversing rings there, but then we do not perceive things in such fragmented order, rather we always look at them as a whole, as a complete. You provide various colors of the rings and this is what we call as Olympic rings.

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Now, this is the logo of Rio Olympics, which is scheduled to be held next year and you do not see all these smaller elements, you do not detach them and perceive them separately rather you always perceive them together. So, simpler, symmetrical and this is what the law of Pragnanz says.

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Look at this very logo. You have three distinct components, but they are too simple and also the form is symmetric. Simpler symmetrical this is what the log of Pragnanz and hence when you promote tourism in Norway, you suddenly feel the basic components which define what Norway means, three elements put in a very simpler format, put in a very symmetrical order and this is what law of Pragnanz is. Perception is very easy, deriving sense is very easy, remembering is very easy, cognitive efforts is minimized and then you are also have the best of the outcome that you want.

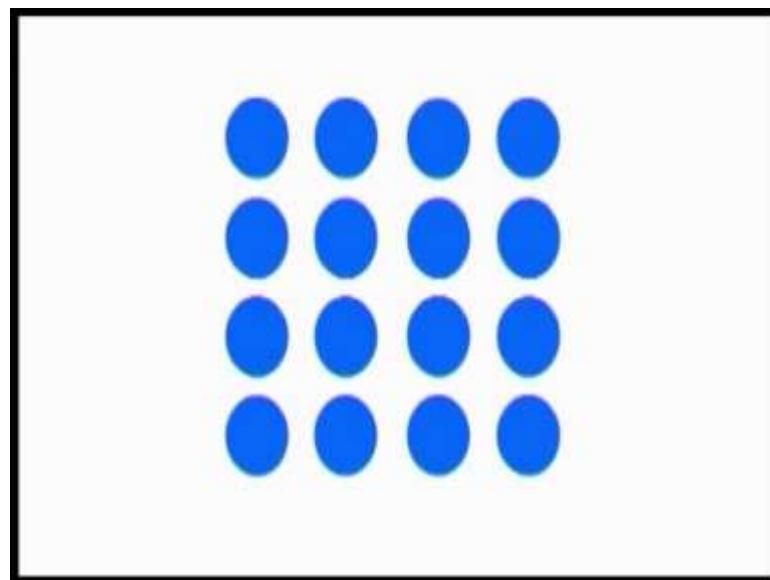
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Gestalt Principles

- Law of similarity: Similar objects tend to group together
- Continue with the earlier example of circles and then take example of a logo

Now, law of Pragnanz is the core of the Gestalt principles and then there are whole other sets of laws. We will talk about them one by one. The second law is the law of symmetry, law of symmetry basically says that similar object that always tends to group together. So, we first in the case of law of Pragnanz we took the example of circles. So, we will continued with the earlier examples of circle and then again now go to the example, which has a logo there. Look at this very video, you find 4 circles there and finally, you have 16 of them now.

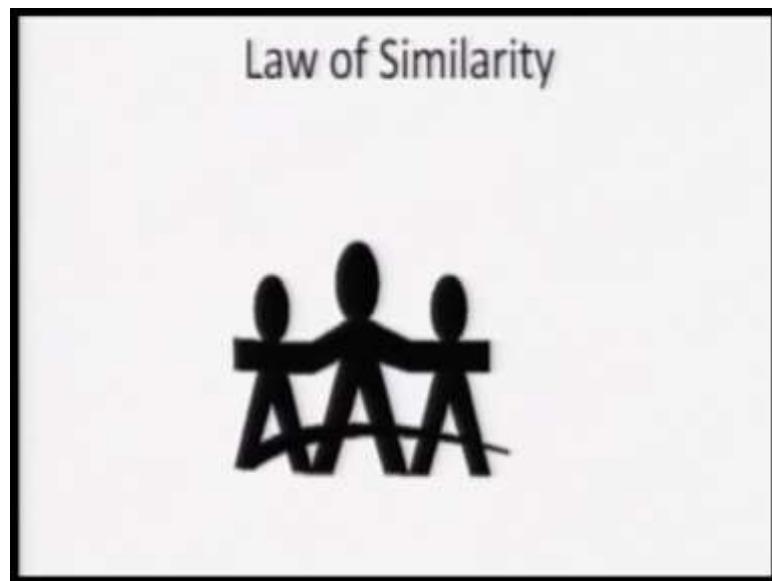
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So, although they are independent circles with tend to perceive them as groups. The colorless circles form one group, now while the rows of red circles form another one. Now let us make this situation little more complex, we had just 4 circles, finally leading to 16 circles and we had the red color ones and the colorless circles now. So, this is how we were trying to look at the formation of groups based on similarity. Now if you have some much more complex situation, once again you have a row of 4 colorless circles multiplying into 4 rows. Just as the previous example, the blue circles form a group when all of them become similar, right now with their blue colors the ones which are bigger either horizontally, vertically, or diagonally they tend to form a group.

So, we basically look at the difference and depending on now what you are actually trying to look at, you will always search for certain reason based on which you can form a group.

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So, that you perceive it better. Look at this very logo, it is very commonly known logo to us and you know actually when you see here, you find law of similarity being used, but we discussed was that similar objects they will tend to come together and here you have now three different representations. All them they tend to group together because they follow the law of similarity.

The next law is the law of Proximity. Proximity means nearness.

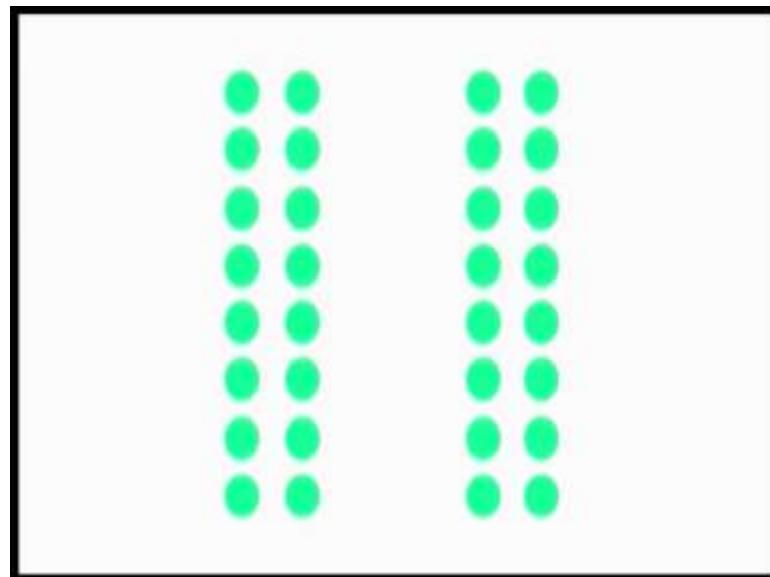
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Gestalt Principles

- Law of proximity: Objects nearer to each other are grouped together.
- Continue with the earlier example of circles and then take example of a logo

So, objects which are nearer to each other, they always tend to form a group. Once again you will continue with the example of circles and then again take an example of a logo.

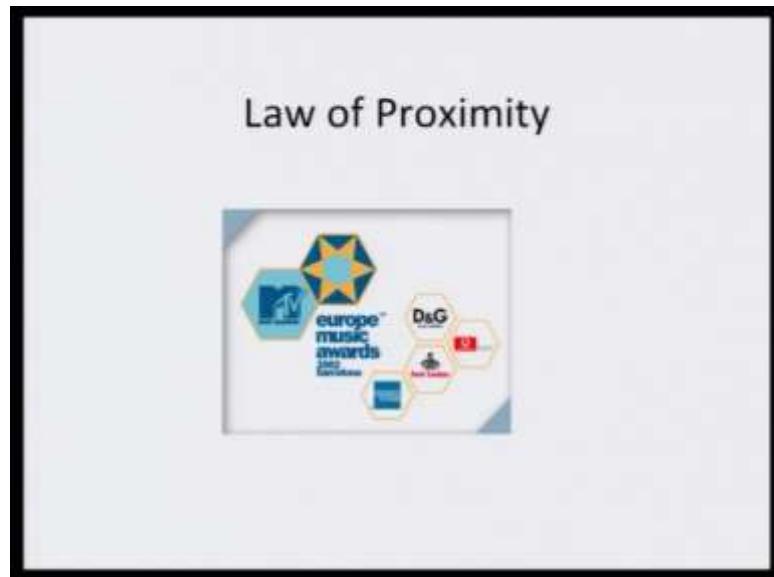
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Initially you see 4 columns of green circles, that are equidistance, but when the 2 columns move closer to each other, they tend to move on the 2 ends. They form 2 distinct groups. The first 2 columns form one group, while the remaining two they form another group. So, this is the law of Proximity. Initially they were now seen as a distinct columns because now they were equidistance, but the movement you have a separation

now you see that now you have one column and the other column although color and the size the form remains the same, this is the law of proximity.

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Now, look at this very logo. Here you have no structures, which basically forms honeycomb, but then they very easily because they are nearer to each other, you can very easily consider that they form one group and you advertise for a particular event along with the sponsors the major sponsors of the event. This is how law of proximity is beautifully utilized in the world of usual communication.

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Look at this very still image from Beijing Olympics. Now here what you find, is that there are whole lot of arrangements and then you have when you look at this very image, you look at things little differently. Now this very segment, they tend to form one group, this very segment tend to form one group, this segment forms another group and this is how you have different types of the representations here, where although the bigger screen carries now whole lot of things. When we look at it we combine separate parts together, and then we try to sign a meaning to the external stimulus that we have been looking at.

Now, law of proximity the way it defines here is that you have things which are closer to each other. So, one set of performers are on the left hand side, who are closer to each other and then there is a big distance between the other groups. So, the left and right very easily get divided. Those in the center of course, they have a different color of the costume, but then there are again separated from the these two groups, but then within themselves they are very close to each other, they are very nearer to each other and hence the law of proximity helps us consider that this is group 1, this is group 2, this is group 3, there all very symmetrical, but then because of their nearness to one group compared to the other based on their proximity we consider them to be forming three separate groups.

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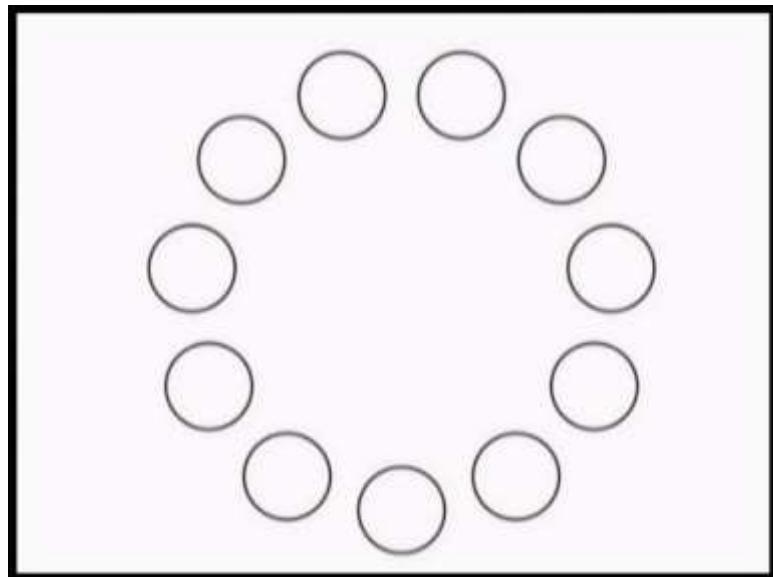
Gestalt Principles

- Law of closure: A discontinuous shape is perceived as complete if it represents something familiar.
- Continue with the earlier example of circles and then take example of a logo

We come to the next law, that is law of Closure. Law of Closure basically says that if you have a discontinuous shape and when you perceive it we always tend to complete it,

and this complete is based on whatever we are familiar with. Let us take this very example, again we are basing on the example circle and then again we will move on to an example of a logo.

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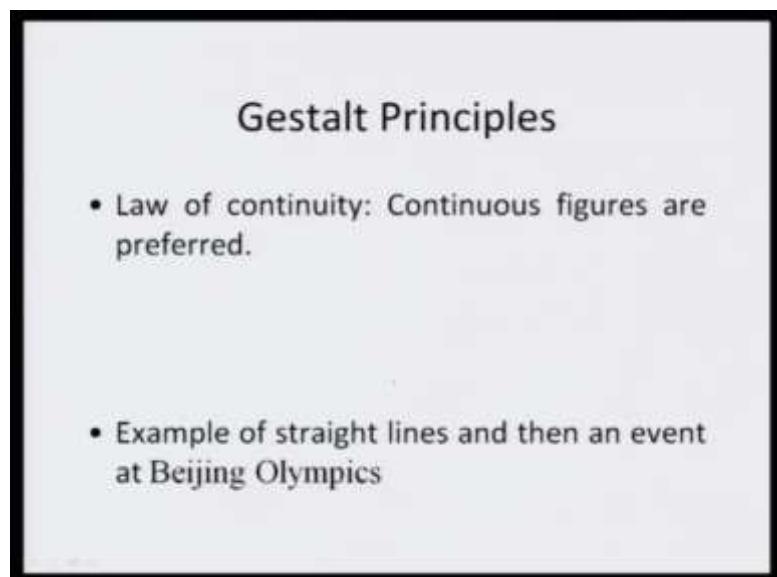
You see a circle right now. Another one and yet another one, although you see 11 different circles, but you perceive them as a ring. Their individual identity is not taken to account. So, this is an important thing here that now when you look at the continuous things. When you look at the patterns that emerge, the discontinuous shapes is perceived as a complete if it represents something very familiar.

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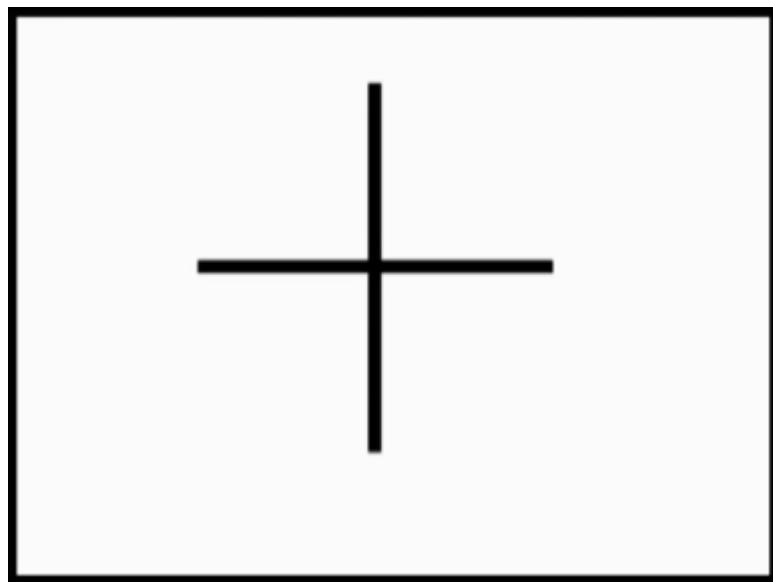
You look at this now famous visual icon. Now this is a logo of WWF. If you visit their site you see this image. Now you see here, here I am moving the cursor right now, you see WWF. Now you visit their site and you see exactly this very representation. Now when you actually see it you can very easily make out what you are looking at and you see it as panda because their gap that you see you try to know close it you try to fill it and therefore this is not no looked upon as you know some black filled areas against white background, but rather it is looked upon as an animal.

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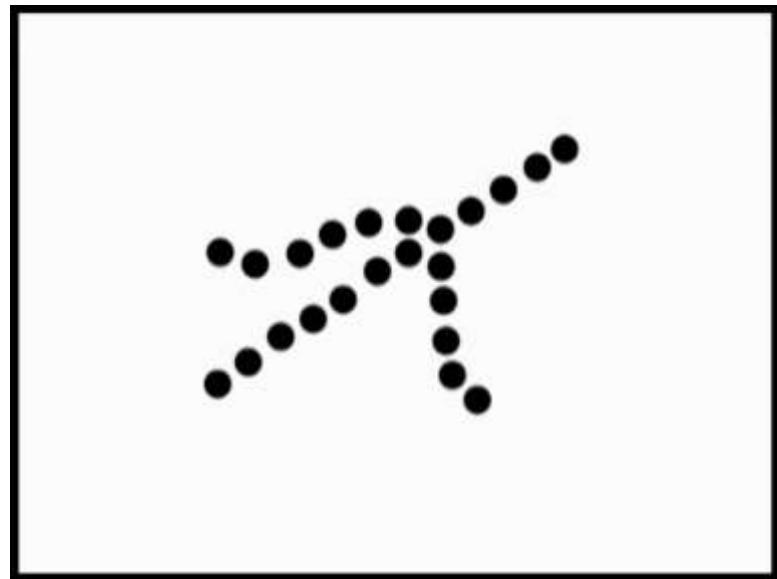
We come to the next law that is the law of Continuity. Law of continuity basically says that continuous figures are always preferred. Now till now we were repeatedly taking examples of circles, now let us take example of straight lines and then we will look at one of the events from Beijing Olympics to understand law of continuity. The law of continuity says that the continuous figures are preferred by us. So, something that runs in continuation.

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You can see a bold straight line entering from the left side of the screen. Now another one enters from the right side. Although they are two separate lines as you initially saw, but when they join, you see them as one straight line. When two more straight lines enter from top and bottom respectively, you perceive an x-y coordinate. When two of these lines become red, green, blue or yellow they are perceived as one continuous figure. When they are all back you perceive them as x-y coordinate.

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Let us look at another example of law of continuity; here you see dark black circles appearing on the screen. These circles are perceived as collective unit because they share a common feature of direction. Now initially use look at it as straight line and the movement is now the other line, the curve one comes there, you perceive it differently. You see as if it represents some type of direction.

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If you visit now Indigo Airline, this is one of the airlines that you must have certainly seen here. When you look at their logo, actually you see what now you saw here. Now

when you look here, now look at your screen this very part where I am moving the curser. You actually see this law of continuity. This image although this is a collection of dots something that you saw right now in this animation, but the movement you see here now it gives a direction and it now makes you feel and fine, you are actually looking at something usual representation of airline.

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Now, let us look at this video you see have the law of continuation working.

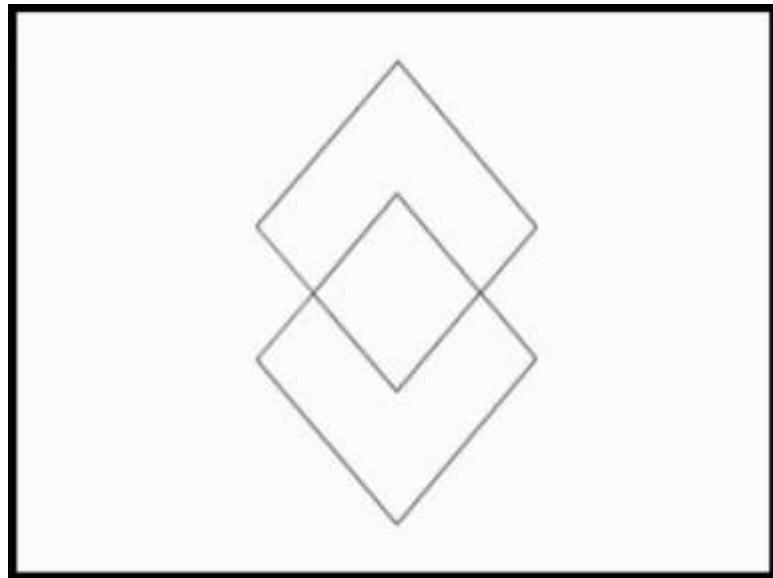
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Gestalt Principles

- Law of Symmetry: Symmetrical objects are collectively perceived.
- Example of square and then example of a logo

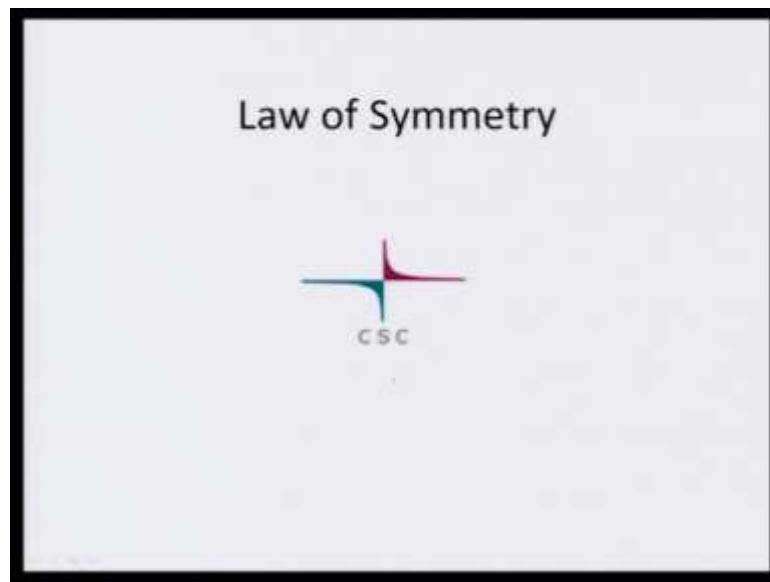
The next gestalt principle is law of Symmetry. We have been talking about symmetrical objects now, right from we began with our discussion on Pragnanz. Now law of symmetry says that symmetrical objects they will always be collectively perceived. Let us take the example of these squares and then we will also move to an example taking again a logo into account.

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Look at this sky blue square and the blue square dropping out of it. This overlap helps you see another square. Let us look at these squares without any color. We will perceive them as two squares. When the top and the bottom parts are removed we clearly see a small square, but when they are brought back, we perceive two big squares overlaying each other. This demonstrates that in spite of distance symmetrical objects are collectively perceived.

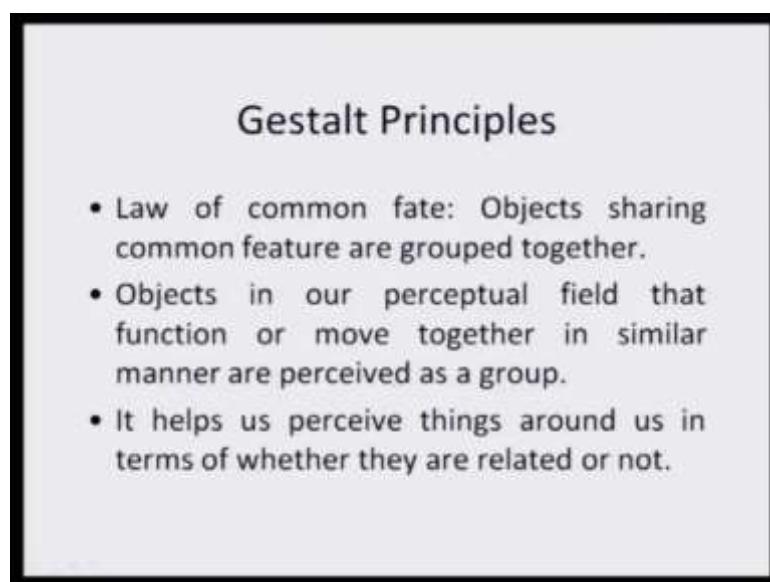
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This is the logo of CSC which basically shows you how beautifully the law of symmetry can be used to, represent usually, represent one of the forms.

The next law of gestalt principle is the Law of Common fate. Law of common fate says that objects which share common features, they are grouped together.

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So objects in our perceptual field that function or move together in similar manner, they will always be perceived together. Now what is the important of this very law basically it helps us perceive things around us in terms of whether they are related or not.

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You must have seen these beautiful images in our Republic Day Parade. Look at this very video, which basically tells you, when different aircrafts which you basically know that these are different aircrafts but when they make a formation, they are then perceived together because they perform similar function, they move together and therefore, even though they are separate aircrafts they are not viewed so.

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Attention

- Selection of certain inputs and retaining them in the conscious experience.
- In this process our field of experience is divided into focus and margin.

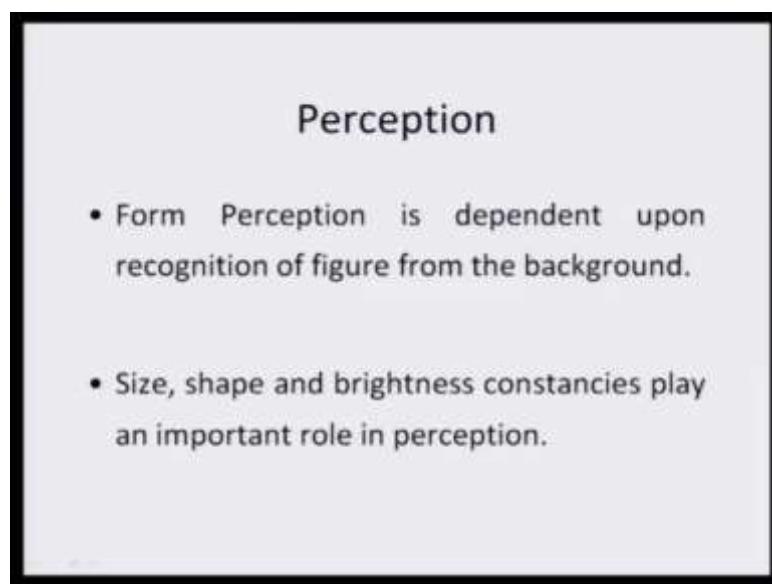
Now, given the fact that based on the quality of their stimuli, based on our individual preparedness and preferences and also based on the laws that govern our perceptual principles, we provide meaning to what we have sensed from the world. Now based on what we have sensed from world and depending on the appropriateness of the meaning that we have provided ,we many a times tend to select certain inputs and retain them in our conscious experience for little longer period of time. So, what we do, we tend to divide things into what would be in our focus and what we would now keep it on the margin. This is what is called as Attention. Because we have limited duration assigned for this very course. So, we would not go into the details of attention, but I must tell you that in the recommended book if you go through that you will find whole end up description of the process related to attention.

Introduction to Psychology
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Lecture - 09
Perception: Form Perception

Now, let us talk about Form Perception. Now, Form Perception basically is dependent upon reorganization of figure from the background.

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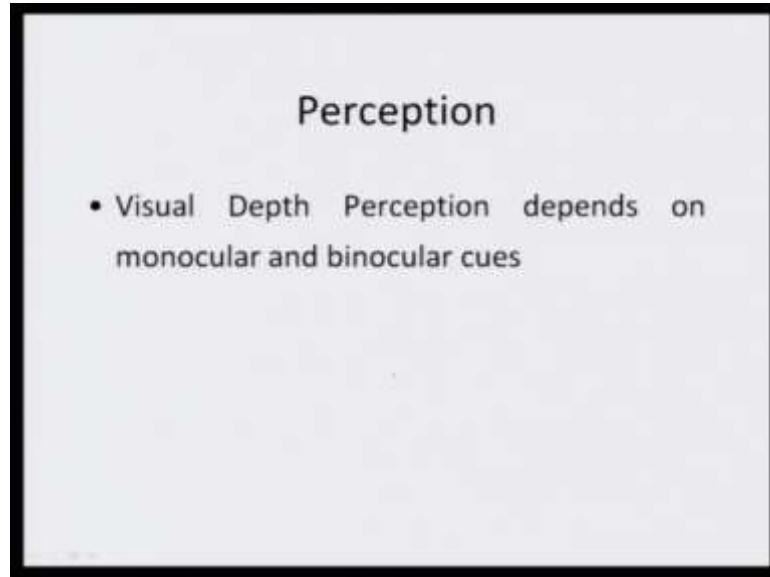
Perception

- Form Perception is dependent upon recognition of figure from the background.
- Size, shape and brightness constancies play an important role in perception.

And this basically would mean that certain type of constancies will work – size, shape and brightness. That would mean we would come through it in few seconds from now, that depending on the situation the size of the object might change, the shape of the object might change, the brightness, the contrast, effect might change, but then we have a tendency as human being to maintain mentally degree of constancy in terms of shape, size and brightness and that helps us perceive situation much better.

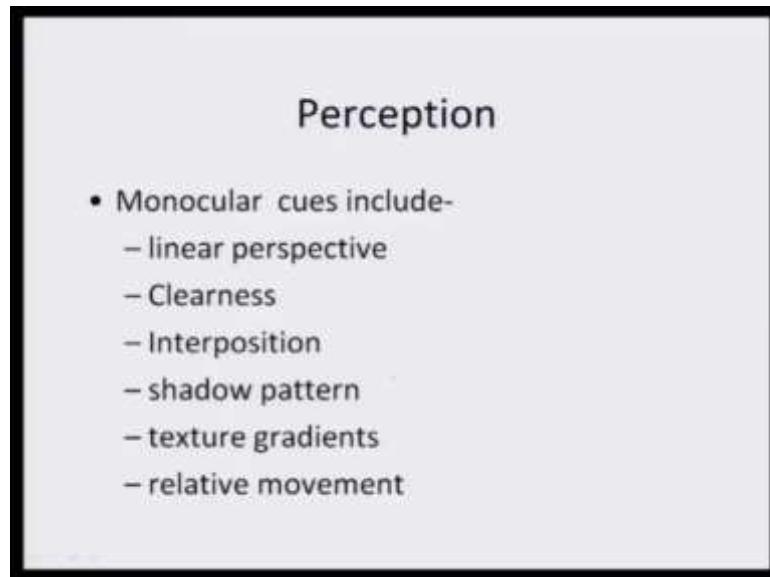
Now, in terms of depth, in terms of height, we always have the monocular and the binocular cues inputs coming from only one eye is the monocular cue and input that comes from both the eyes they constitute the binocular cues.

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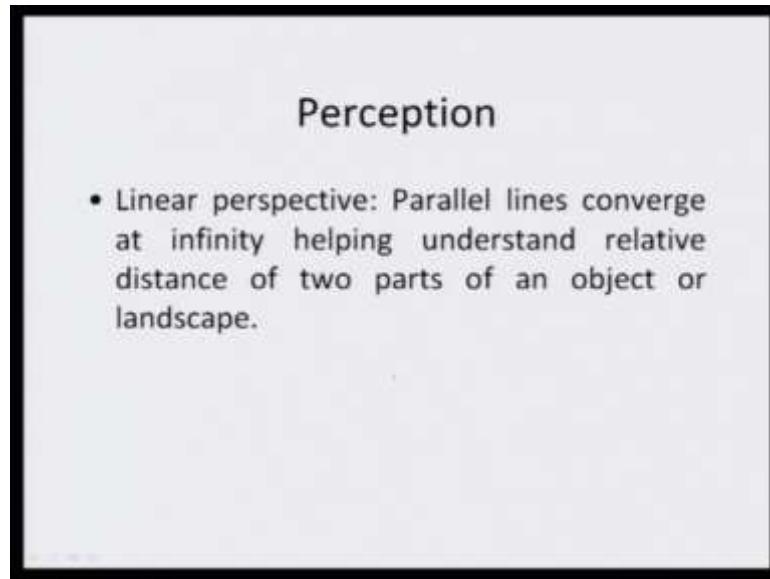
Now monocular cues they basically depends on linear perspective, clarity, interposition, the pattern of shadow, texture and the relative motion.

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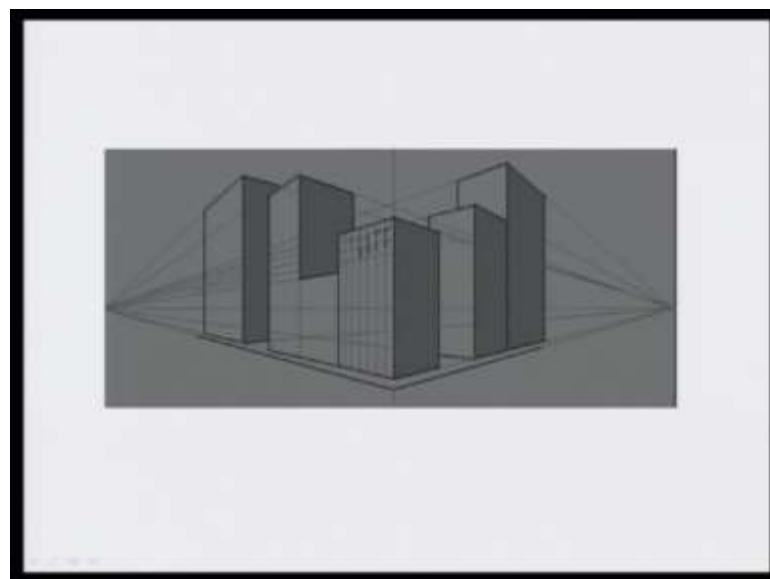
What we would do now is that all these 6 important ingredients of monocular cues; we will talk to them one by one, trying to take possibly the best example.

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So, let us come to Linear Perspective when parallel lines they converge at infinity they help us understand the relative distance of two parts of an object or they even help us understand the whole landscape. Look at now this very image.

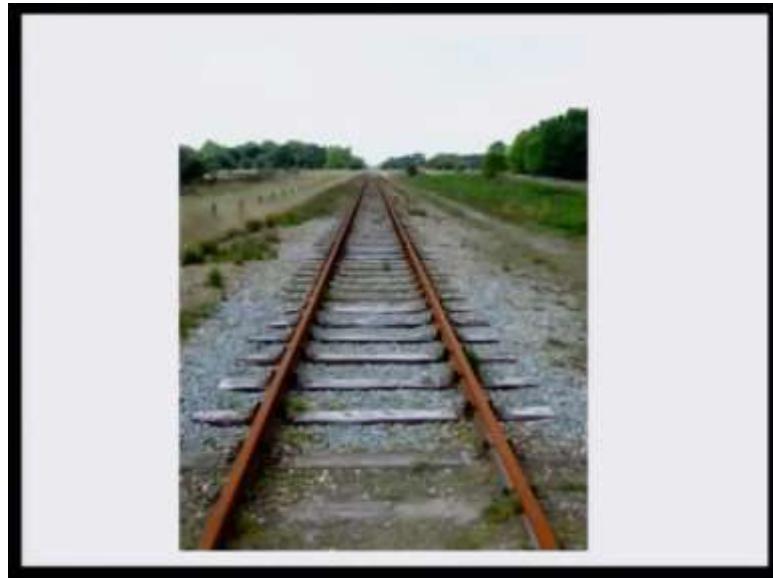
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Now imagine the point where now the straight lines converge, you are standing at that very point and you are looking at the urban landscape this is what is the meant by linear perspective. So, what actually happens you have the convergence of the lines and this convergence of the lines helps you understand your position and the position of the

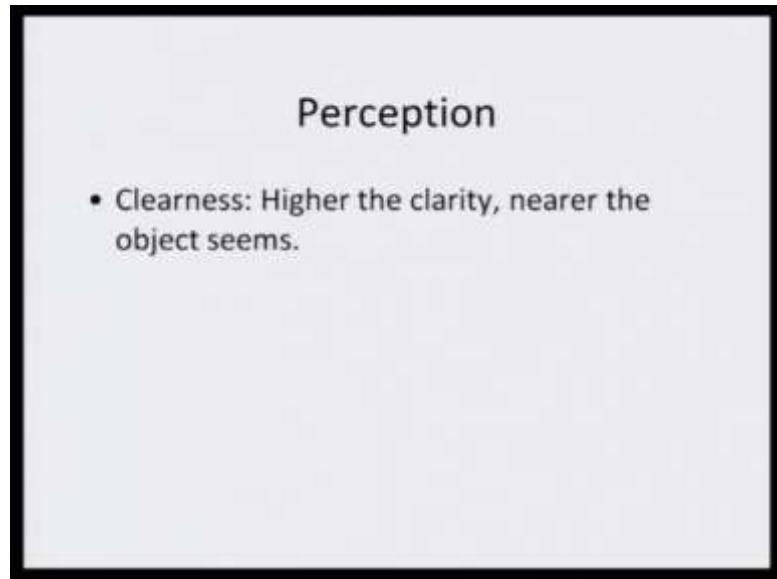
objects in your landscape and accordingly these monocular cues they help you understand the shape, the size and of course, depending on brightness and contrast you even can make out about the distance of the object from yourself.

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Now, look at this very image. Now this is a very usual railway track that we have been seeing right from our childhood days. Now what happens when you look at the two parallel bars, the two tracks you stand in the center then you realize that they are wide apart they are separated apart, but then when you look at it at a distance you gradually realize as if the distance between the parallel bars they somehow tend to converge, they tend to come closer to each other. Now based on the monocular cues what we have been saying is that when you look at the object where you are and whether the parallel lines they converge or not that decides what you are looking and how you perceive the world around you. The first was the example of the urban landscape; the second is the example of again a modern infrastructure that is a railway track.

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Now, we come to Clarity. If you are looking at an external environment and the more and more clearer things are - you always tend to realize that those things are near to you, things which are very far off from you will compromise on the degree of clarity.

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Look at this very image now and you compare both of them. The first is where you see the structure and you see the structure with much more clarity and you can sense that the object is much more nearer to you; the structure is much more nearer to you. In the other case of course, you realize that the clarity is compromised with and with the compromise

in the clarity you will realize that the image on the right tells you that the structure is nearer to you, the image on the left tells you that the that the structure is far off from you. So, in terms of monocular cues how clearer is the image that is generated that would tell you how far or how nearer you are to the object.

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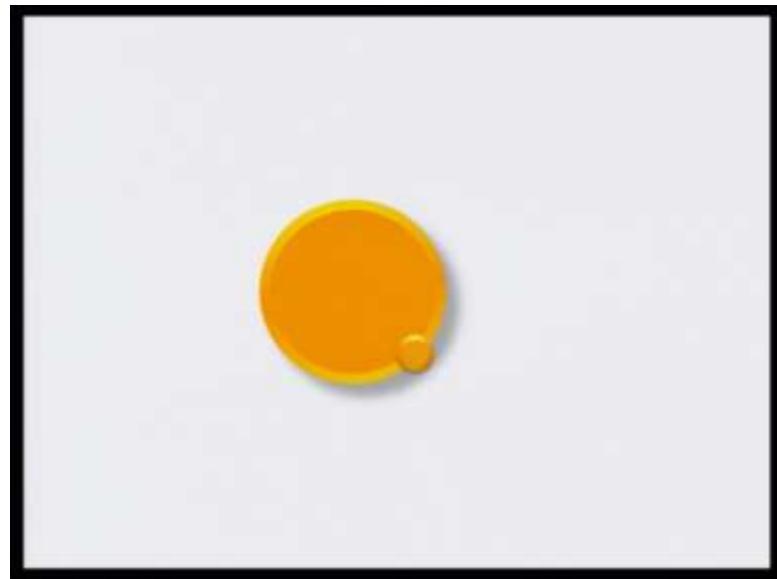
Perception

- Interposition: An object obstructing the view of another object seems nearer.

The third is the Interposition, Interposition is when you have two or more objects in the same visual field and one object obstructs the view of the other one.

Now, the object which looks very nearer to you would be the one which will block the clearer perception of object at the back.

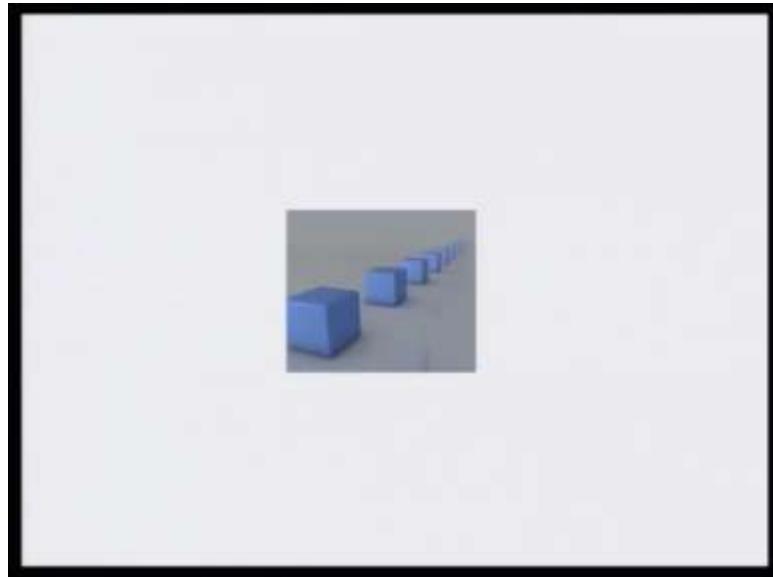
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Now look at these two circles if I ask you how distant you are from these two circles it is very difficult for you, you will perhaps say that I am at an equidistance. Now look at the movement pattern, now if I ask you which is nearer to you, you can very easily say the one which is the smaller is nearer to me, why is it nearer to you? Because monocular cue tells you that this colored disk is nearer to you is the one which blocks a part of the disk which is at the back. That means, unless this very object will be now nearer to me it cannot now work as interference in a clearer perception of the object at the back. So, this is interposition. Now the position of the object which is nearer to you is also the one which blocks clear perception of the object at the back.

Same is the situation here.

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Now, we come to the Shadow pattern.

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Perception

- Shadow pattern: Luminance and contrast helps in depth perception.

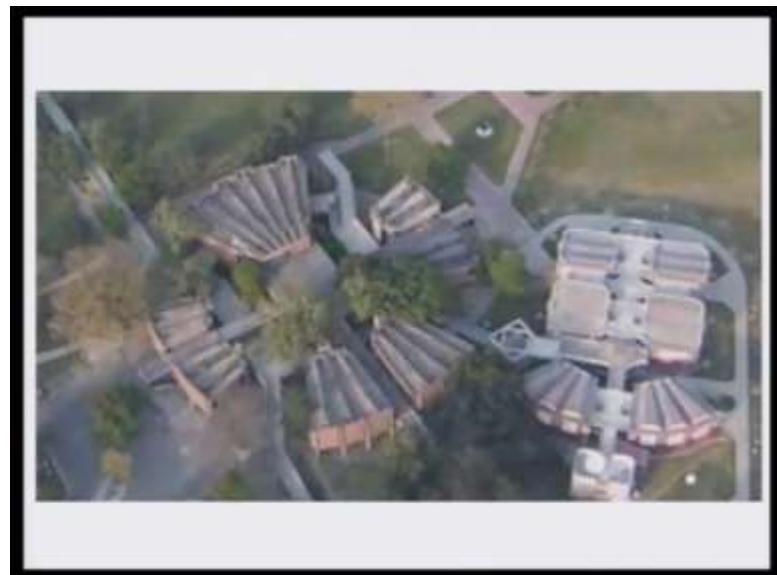
Shadow, you know wherever you have light you will always have shadow if an object is put there. So, luminance and contrast they help us understand the depth and because it helps us understand the depth. So, if you inverse the phenomena you can say that this also helps us understand the height of the object.

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Now, look at this very video. This is the aerial image of IIT, Kanpur. Now this video did show you the aerial image of various structures of IIT, Kanpur campus.

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And right now when you look at the lecture hall complex of the IIT Kanpur, because at a certain height you see that one structure creates or casts a shadow of a type; this change in the luminance pattern it tells you that find this object is little above the background and if it is above the background this means this would have particular height. So, it is basically the pattern of shadow, the luminance, the whiter area and the shadow the darker

area the contrasts that you are able to establish that will help you understand how high is the building that you saw right now when you were looking at the aerial view of IIT Kanpur campus.

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Perception

- Texture gradients: A continuous change.
- Objects closer to you have coarse texture with details.
- With increasing distance texture becomes finer.

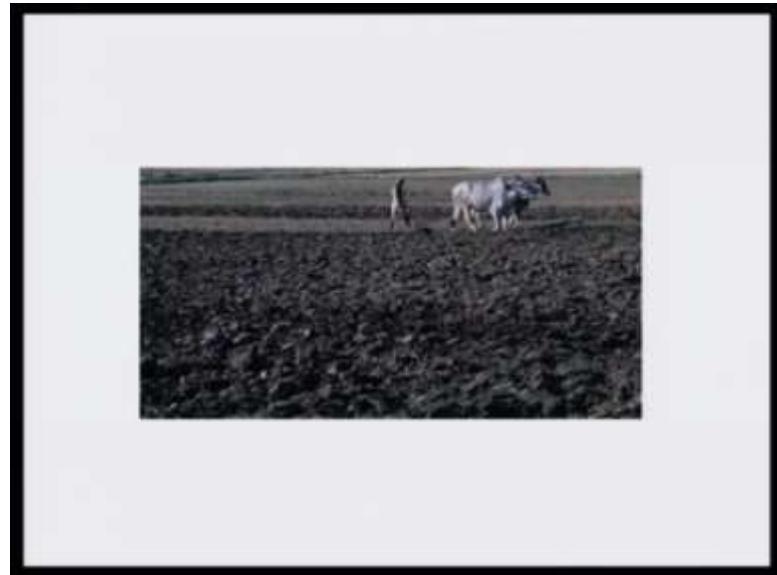
Another interesting feature that is part of the monocular cue that helps us understand the world is Texture gradient. Now texture gradient basically is supposed to have a continuous change, the objects which are closer to us will have a coarse texture with much more details and if the distance increases the texture becomes finer. Look at this very image now.

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Now the object at the bottom if you look at it, it has much more clarity. The texture has all the coarse details and you can very easily say that this is nearer to me, whereas if you move upwards you realize that it is not so nearer to me, now the distance has increased a bit.

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Look at this vary situation, you have a farmer ploughing the field and when you look at the pattern of soil there you would realize that things which are nearer to you if you are standing at the start of that very point, the starting point you realize that the coarse

texture is very very clearer to you. But when you move at a distance where the farmer and the bulls are you realize that it becomes more finer and this gives you a feel that well things which are nearer to me in terms of texture gradient, you would realize that things which are nearer will have much more coarse texture details. Whereas, things which are at distance there you do not have that, the texture does not have that coarse details and therefore, you realize that the texture becomes more and more finer.

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Perception

- Relative movement: During movement, objects in the visual field move relative to the person as well as to one another.
- Objects near to you move in opposite direction.

We now come to relative movement. Now movement you all understand relative movement basically means that during movement when you look at objects in the visual field, you look at your position and the relative position of other things in the environment. Now look at this very video.

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Here you have the iron bars and the vertical bar which is too close to the car to the one who is looking at another objects that are nearer and far off, you find that they seem to cross you very fast compared to you now the objects the field and the objects in the field and the background where you see the hill and the trees. All of these vertical iron bars seem to cross much faster, whereas the remaining part of the back ground seems as if they move very very slow. So, this is what was being explained right now.

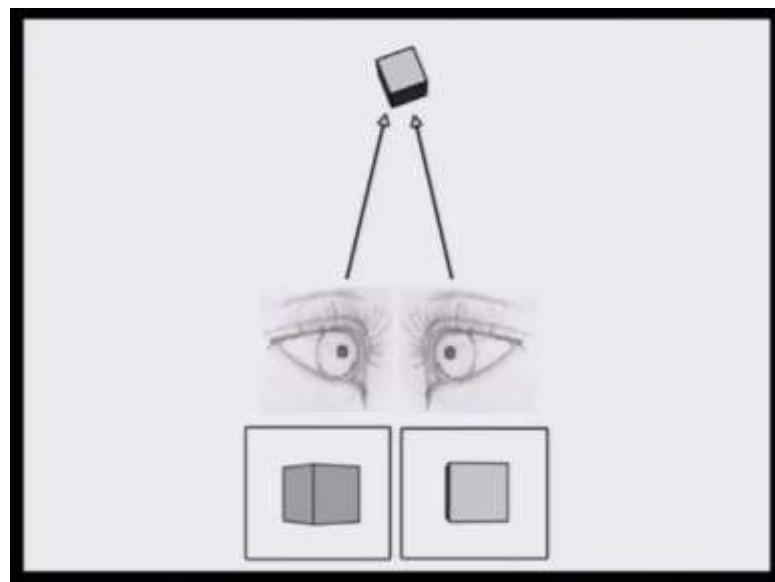
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Perception

- Binocular cues
- The image of an object in the two eyes are not exactly the same.
 - retinal disparity

Having discussed monocular cues let us now look at the binocular cues. Now a binocular cue basically is a situation where cues come from both the eyes. So, the image of an object now that falls on both the eyes the left and the right eyes they are not the same. You remember right on the very first day when we were looking at the visual pathway, even there when the child was looking at the colored disk the two hemispheres of the brain did not have the full representation of the colored disk, there was a division left right division. So, that clearly means that right from the level of the eye till the level of the brain the signal that goes to the left side of the eye and the brain is not equivalent to the signal that goes to the right eye and the right side of the brain, the right hemisphere. And because the image of the object that falls on the two eyes they are not the same it creates certain degree of disparity and this is called as the retinal disparity because there is a disparity at the level of retina the image that is generated on the retina.

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So, if you are looking at a cube you can sense, right now on the top you have the cube the left and the right eyes and what the left and the right retina creates the image of that cube you can see line sketch demonstrating it, this is what is meant by retinal disparity.

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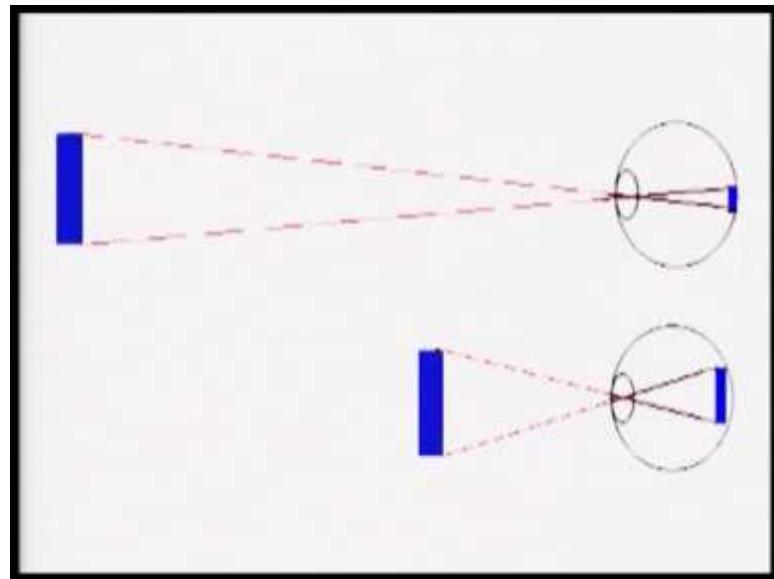
Perceptual Constancy

- Size constancy: Object is perceived to have the same size irrespective of change of distance, rotation, perspective, and so forth.
- With increase in distance, the size of image on the retina reduces.

Now, despite this retinal disparity what is very interesting is that we do have the ability as a human being to maintain certain degree of perceptual constancy. Constancy in terms of size of the object, constancy in terms of shape of the object, and constancy also in terms of brightness of the object, and this helps us commit less and less number of errors even though things are dynamic in our world. So, let us first look at size constancy.

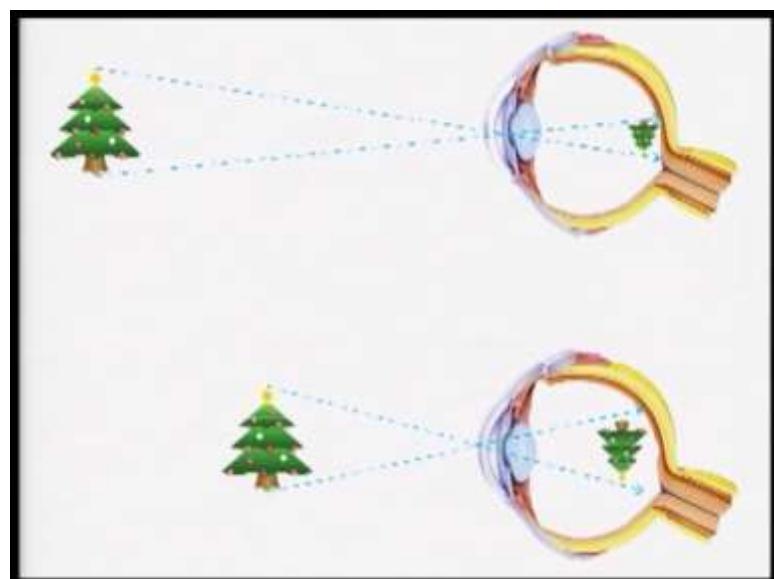
Now, objects are perceived to have same size irrespective of the change in distance, rotation and perspective. So, with increase in distance the size of the image on retina reduces.

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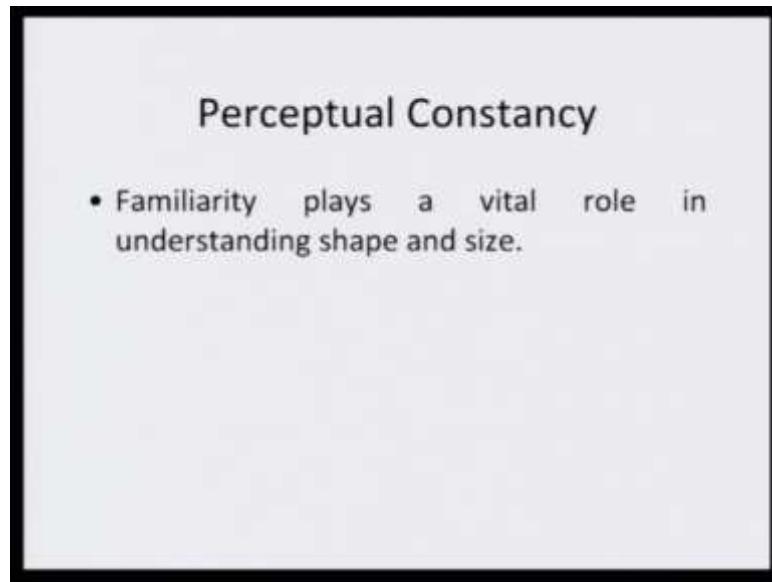
With increase in distance the size of image on the retina always reduces. So, you can see here the two objects that you see now they are of the same size, the blue blocks that you see on your screen they are of the same size, but when the image gets casted on the retina you see a change. For blue block which is far off from you from the eye here shown on the top you find it that the image that is generated on the retina is smaller compared to the image of the object that is very near to you.

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So, nearer objects will have bigger images on the retina, far off objects will always have a shorter image on the retina, but then the beauty of human perception is that we still maintain the size of the objects that we see and remember this will be always be true for familiar objects, if you are not familiar with the object, if you have never seen this object this is a novel thing for you then, you will get rid of this size constancy.

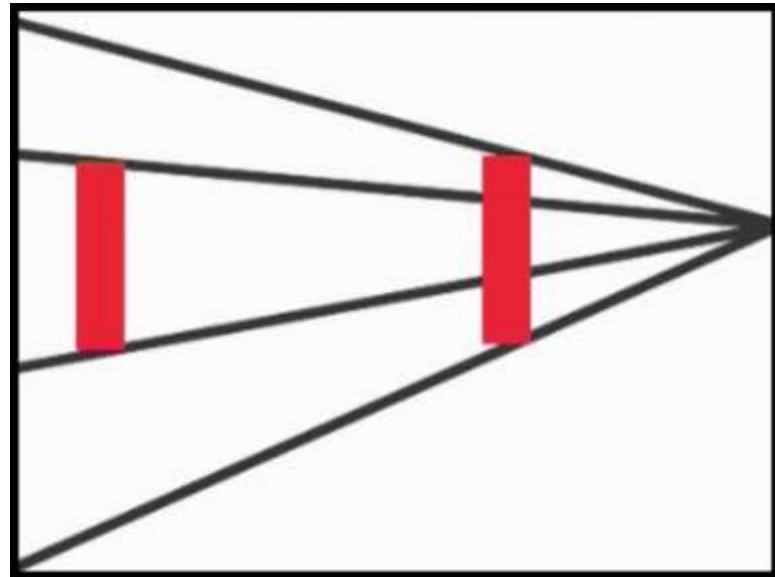
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Now, in terms of perceptual constancy familiarity plays a very very important role. So, if you are familiar with an object you know what would be the shape and size of this very object and therefore, despite the fact that in reality the shape and the size varies you always maintain a constant shape of that very object.

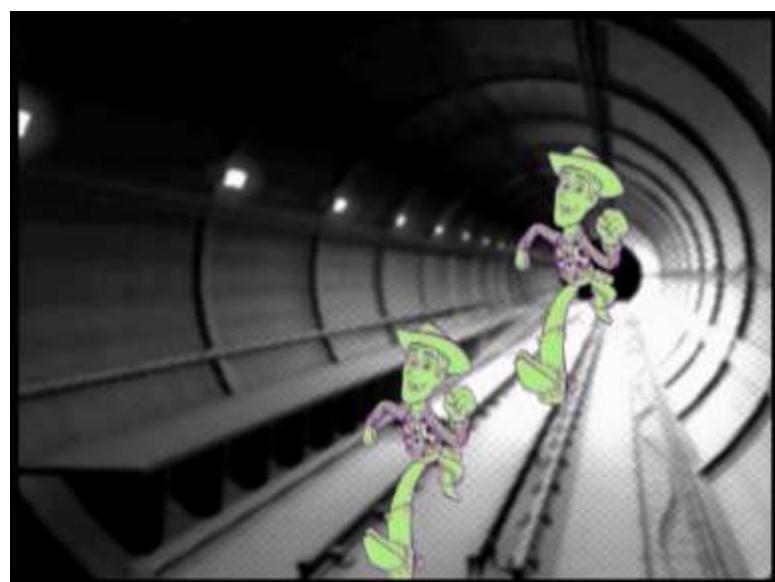
Look at this video now. You will find how the shape changes, how from the varying distance the entire thing that is actually available now that you are eyes sees changes, but then in our real life we do not consider these changes to be significant and therefore, we always maintain the size constancy.

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Look at your screen now you see a red bar. Now another red bar has come exactly out of this earlier one, both bars are of the same size the moment you put these lines now. The right red bar which is close to this line of convergence of the black ones seems bigger compared to the red bar which is on the extreme left hand side. Now in reality although we know, right now we have seen now that these two bars are of the same size if you replay it this is what you saw both bars are of the same size, but then the moment now you add the perspective here you realize now that they are not the same. Let us take another example.

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Look at the human sketch here and you again just like the red bar here the same image is taken out, but the moment you have the added background there you realize now with respect to the perspective that the man running in the front seems to be smaller compared to the man at the back. So, this is now the interesting dynamics of understanding the whole process. Familiarity plays a vital role in understanding the shape and the size.

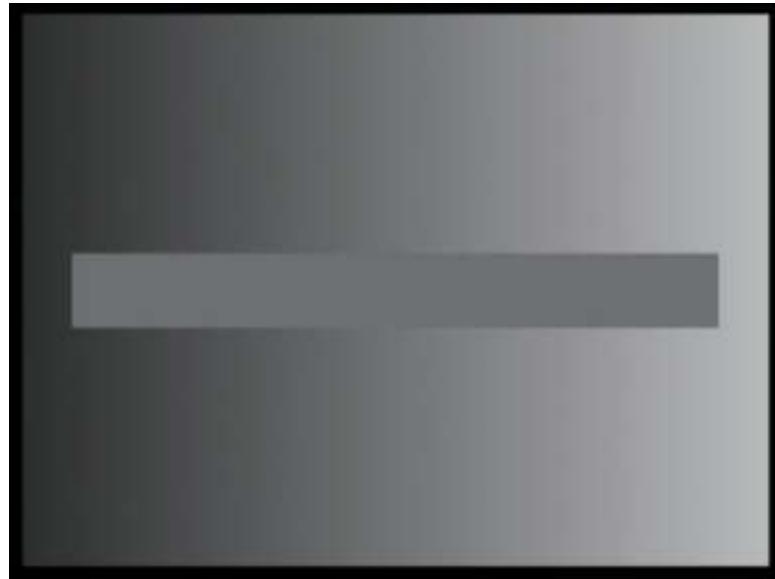
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Perceptual Constancy

- Brightness constancy: Whiteness, grayness, and blackness appears constant despite variation in the reflected physical energy from the object.
- Coal looks black in bright sunlight; snow looks white at night.

We now come to brightness constancy. Now whiteness, grayness and blackness they appear constant despite variation in the reflected physical energy from the object, this is an interesting truth of the world and therefore, when you look at coal which is black in a bright sun it looks more black compared to when the light is dim. And similarly if you look at snow in the night hours it looks much more white compared to daylight condition this is the truth, but when we look at coal and snow or for that matter any object which is you are familiar with we tend to maintain constancy in terms of whiteness, grayness and the blackness of that very object.

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Now, look at this various strip if I ask you what color do you see here on the center of the screen and you will say gray if I ask you is this a uniform pattern, answer is likely to be yes. Now if I change the background, now look at this background now suddenly you realize that the spread of gray is not uniform across this screen and this is not uniform because the background has changed. Similar example was being coated right now, that the coal is black, but the coal is far more black if the you look at it in a bright sunlight condition and similarly snow is little more white if you look at it in a dark condition.

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Now, look at these two colored circles if I ask you what is the color of these two circles and you say this is gray, exactly like the strip that you saw. Now the moment I change the background and I change the brightness level now, the whiteness, the grayness and the blackness has been tampered with and this gives you a feel as if this you are looking at a three dimensional object. Remember this screen is two dimensional, the sketch is two dimensional, our retina gets a two dimensional image, but when we mentally construe it we perceive as if we are looking at the third dimension as well.

Designers, all artists, they create similar type of situations to give you a feel of depth and height. You just see here on the figure on the left you can have a depth perception, you feel as if now piece has been taken out of it, a cavity is there, on the other side you see a bump - one that gives you the feel of depth the other which gives you feel of height. So, this is now depth perception and height perception which basically depends on the whiteness, grayness and the blackness in the situation. Remember one thing that this has been deliberately done, if this is not done then we as human beings have a tendency to maintain constancy and therefore, irrespective of change in the degree of light emitted back from the object we try to maintain constancy. Things which are brighter to us will always remain brighter things which are darker to us will always remain darker and that does not allow us to commit big blunders.

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Perceptual Constancy

- Shape constancy: Irrespective of the change in slant or orientation of the object, invariance in the perception of shape of the object.
- Movement of performer during gymnastics

Similarly, the third constancy which is again important is constancy in terms of shape. Now irrespective of the change in slant or orientation of the object, we always perceive them to be of the same size. So, if I take an object in my hand for instance I take this object in my hand the size that you see right now the moment I change the slant the size, the shape will not remain the same.

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But then as human beings what we do is we know that this is the actual size of the object, a cell phone will be of this dimension the length, the width, the thickness and that is it.

Now, you keep on changing the slant, you keep changing the orientation, the mobile phone will remain mobile phone. The visual perception will not vary. The best example of this is when you look at the field of sports, when you look at the movement of a performer during gymnastics his body position constantly changes at a very fast pace, the slant, the orientation, everything changes, but then you know that this athlete is say for instance 5 feet 7 inches tall that's it. The shape and the size constancy will be maintained. Look at this very video, these are some of the finest movements that human beings are capable of performing, all these requires extreme degree of coordination.

Key words - perception, monocular cues, binocular cues, perceptual constancy

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Lecture - 10
Perception Role of Culture in Perception

Till now we have been talking more with the respective to the external environment. We have not yet known gone to the cultural aspect. So, now, let us talk about the role of culture in perception.

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Culture & Perception

- There are cultural differences in colour naming.
- This difference is based on physiological difference in colour vision.

So, we would be now factoring in the cultural factors, very interestingly you would realize that there are cultural differences even in terms of giving name to certain colors, and this difference is based on the physiological difference in terms of color vision.

Now, look at the visual spectrum, you are looking at the visual spectrum, you can clearly see the blue and the red ends of this spectrum, but this is not true for every culture.

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Culture & Perception

- Some languages spoken in cultures near to the equator fail naming colours at the blue end of the spectrum.
- Green & blue, blue & black, or green, blue and black are not given different names.

Be surprised to know that some languages which are spoken in culture in near to the equator, they fail naming colors at the blue end of the spectrum, the green and blue, blue and black or green blue and black, usually they are not given different names in culture near to the equator and this is an interesting dimension no? So, depending on where exactly you are placed on the globe and the cultural context to which you belong to the perception changes. Now physiologically these people they have increased inter ocular yellow pigmentation and this leads to decreased sensitivity for the blue end of the spectrum, reason is physiological here.

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Culture & Perception

- Physiologically, these people have increased interocular yellow pigmentation and this leads to decreased sensitivity for the blue end of the spectrum.

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Pictorial Perception

- In pictures, the three-dimensional world is represented in two-dimensions.
- Members of different cultures perceive pictures differently.
- For example, African tribal children and adults have been found to have difficulty in depth perception in the pictures.

Now, in pictures, the 3 dimensional worlds is represented in 2 dimensions. Now members of different culture they perceive pictures differently, for instance African tribal children and adults have been found to have difficulty in depth perception in pictures.

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Pictorial Perception

- The accuracy of pictorial perception depends upon the identification of the depicted objects as well as the spatial and dynamic relations among the objects.

The accuracy of pictorial perception depends on the identification of the depicted object as well as the spatial and dynamic relation among the objects. Many a times, we fail to provide exact meaning to what we sense, and such distortions are called illusions.

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Visual Illusions

- Many times we fail to provide exact meaning to what we sense.
- Such distortions are called illusions.
- Although illusions might occur with several senses, visual illusions are too common.

In case of perception, sensation is complete, we assign appropriate meaning and then we say that because the meaning is appropriate therefore it is perception, if we commit error in that sense then it is called illusion.

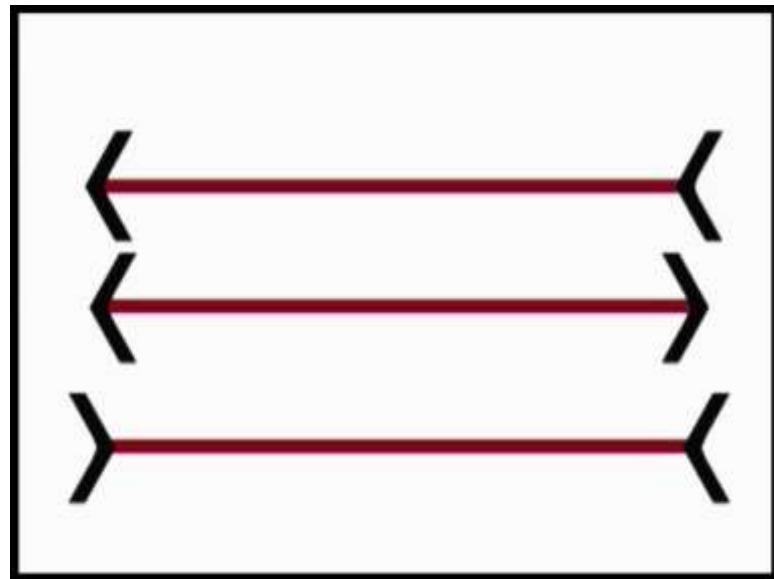
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Müller-Lyer Illusion

- The length of feather-headed segment is overestimated as compared to the length of arrow-headed segment.

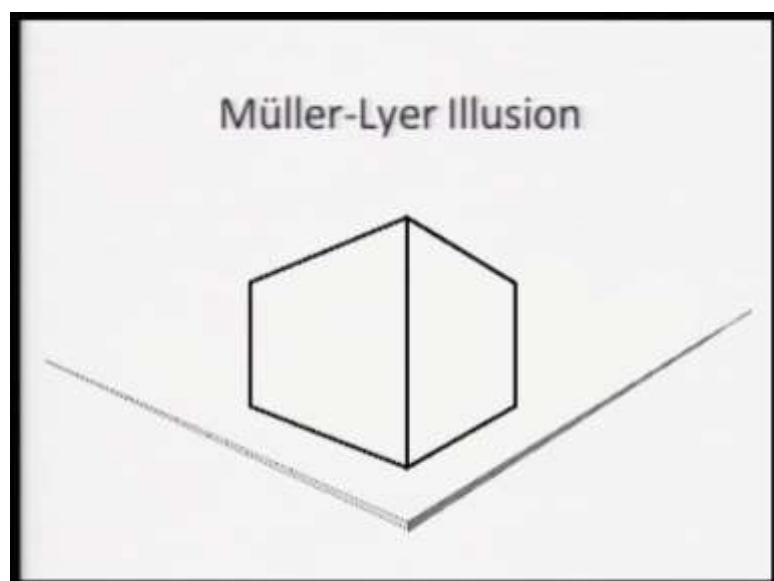
Now although illusions might occur with several senses, visual illusions are most common and the most common of the illusion is what is called as Muller Lyer Illusion. Here the length of feather headed segment is overestimated as compared to the length of the arrow headed segment.

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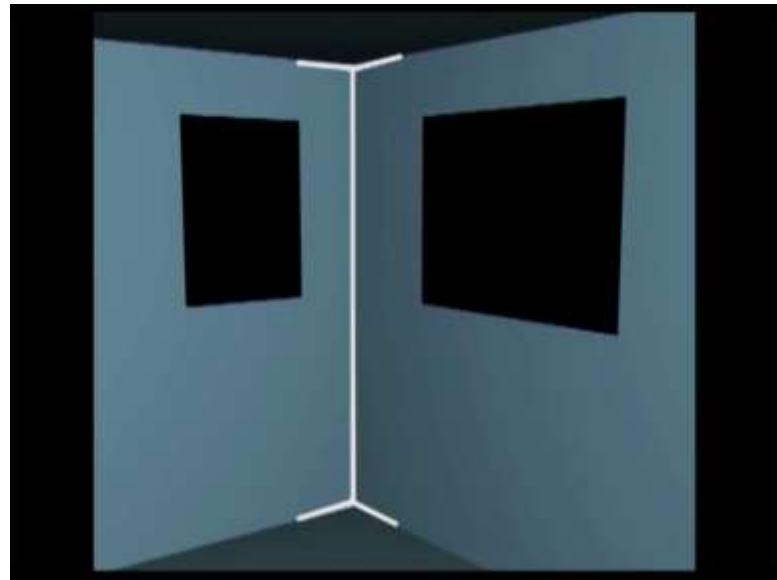
Look at this straight line the left side of the line has now become arrow headed where as the right side has become feather headed, are they equal? Let us look at it little differently this is an arrow headed line, another line drops down from it and becomes double arrow headed line, now a third line drops down and become a feather headed line are they equal? You know that the answer is yes, but when you look at them the third line which is feather headed line seems bigger, the arrow headed line on the top looks smaller compared to this feather headed line and this is called Muller Lyer Illusion.

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Now, where do we actually have Muller Lyer Illusion in our real life? Imagine you are walking on the pavement you are crossing straight, you take a turn the building that you see on the corner you see a building on the corner here. Now you can very easily see this Muller Lyer Illusion. So, some part of the building looks to you as if it has an arrow headed line.

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Have a look at this; you now see the arrow headed line. Now if you just try to move in, what will happen? Let us have a look at it. Now, you are inside the room and what you are actually looking at is an arrow headed line now seems as a feather headed line and this is known; Muller Lyer Illusion. We all know that the size of the 2 walls are the same, but then depending on from which side you are looking at that agent once you have the you feel it this is taller and other case you considered this is smaller and in all the cases you know always have this Muller Lyer Illusion.

Now, that we have understood now that the length of the arrow headed line and the length of the feather headed line, they are not perceived equal, what has been realized is that the magnitude of Muller Lyer Illusion it decreases with age, studies show that a comparison among Eastern, Western and Southern African, Philippines and United States, when people from these areas are taken from these areas the studies show that Muller Lyer Illusion was greater for children and it was not greater for adults.

Now, cultural difference with the respect to susceptibility of illusion is very interesting. One of the study show that the magnitude of Muller Lyer Illusion in the residence of Papua and Great Britain and what they found as that although both groups had illusion the magnitude of Muller Lyer Illusion was higher among the British subject. So, people who are exposed to them urban modern lifestyle they had more of this Muller Lyer Illusion. The earlier comparison among Eastern, Western and Southern African Philippines and United States that we had seen right now, showed that the Muller Lyer Illusion was higher in American and South African Europeans as compared to the non western participants in this very study. This was the study by Segal and his collaborators.

Another type of illusion is Ponzo illusion. Ponzo illusion is a case where, the length of the upper horizontal line is over estimated as compared to the lower horizontal line. We saw the example of railway track not at with the respect to perspective.

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Ponzo Illusion

- The length of upper horizontal line is overestimated as compared to the lower horizontal line.

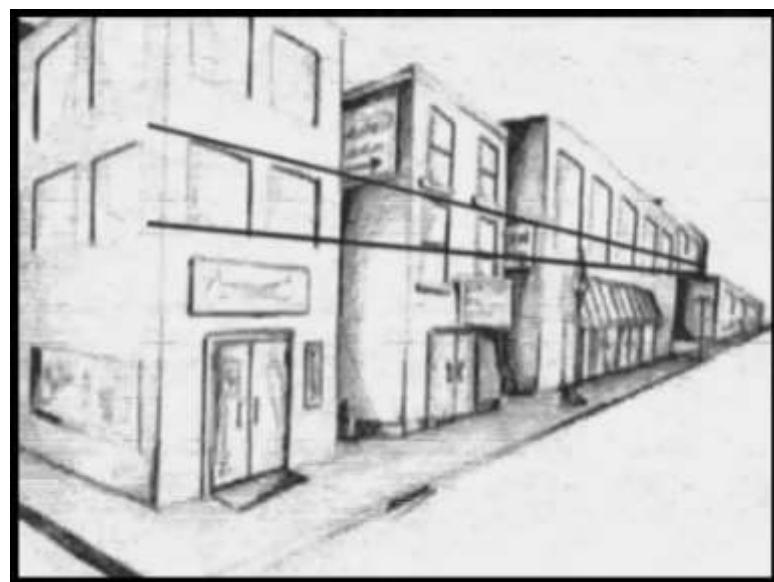
Right now we are trying to understand it in terms of Ponzo illusion. Let us take example of Ponzo illusion, now in case of Ponzo illusion the length of the upper horizontal line is overestimated when one compares it with the lower horizontal line, we have taking the example of the railway track in the past.

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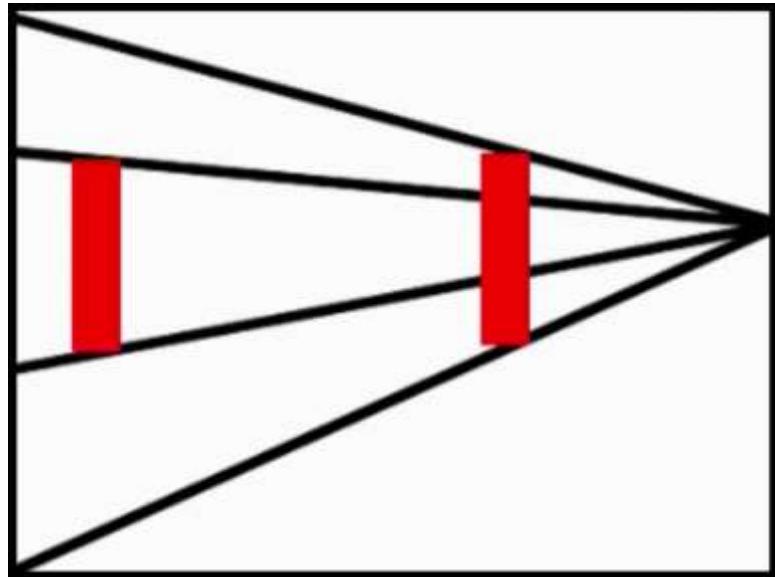
So, when you look at the slippers that connects the 2 tracks you realized that the slippers which are nearer to you and the slippers that are at a distance they are not considered as having the same length.

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When you look at the parallel line stretching across the buildings here it seems that it is wider in the beginning and gradually it becomes narrow.

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Let us take another example, you see a bold red line here, another line same size comes out of it, but when you look at them after the black lines have been drawn the red line on the right seems bigger than the one on the left. If you consider yourself standing at the point where all the black lines originates, then the red bar nearer to you will look bigger as compared to the one which is at a distance.

Look at another example here if you replace the lines with human beings you will still perceive the same here you see that the 2 human figures are actually replica and hence are of the same size, but the moment context is added one becomes bigger compared to the other one. Now with the respect to the magnitude of Ponzo illusion it has been realized that with increase in age the magnitude of Ponzo illusion also increases.

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Ponzo Illusion

- The magnitude of Ponzo illusion increases with age.

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Ponzo Illusion

- Context containing distance information-
- A figure representing Ponzo illusion was superimposed on a photograph of a field.
- The uneducated Ugandan village residents did not have any illusion.
- The magnitude of illusion increased in Ugandan and American college students.

Now, context that contains the distance information is of importance, a figure representing Ponzo illusion was superimposed by one of the researcher on a photograph of a field.

Now, the uneducated Ugandan village residence they did not have any illusion, that horizontal vertical illusion where as the magnitude of the illusion increased in the Ugandan and American college going students.

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Horizontal-Vertical Illusion

- Overestimation of the vertical line with respect to the horizontal line.

Now this basically means that the cultural context in which you have been living that affects the degree of illusion that one would experience. Now horizontal vertical illusion if you look at there is always the overestimation of the vertical line with the respect to the horizontal line.

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Horizontal-Vertical Illusion

- In horizontal-vertical illusion, the vertical line is perceived extending away from the viewer.
- Rather than rectangular shapes, the open vistas in the environment is pertinent for this illusion.

In horizontal-vertical illusion, the vertical line is perceived extending away from the viewer rather than rectangular shapes, the open vistas in the environment are pertinent for this illusion the horizontal vertical illusion.

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Trapezoidal Window Illusion

- When you look at the window of a house from a certain angle, it looks like a trapezoid.



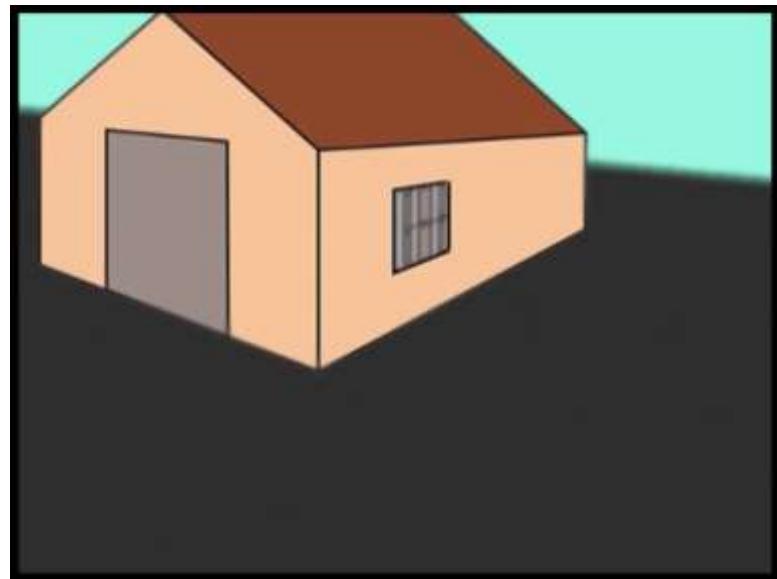
Now, take this very example of trapezoidal window when you look at the window of a house from a certain angle it is specifically looks like a trapezoid.

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Trapezoidal Window Illusion

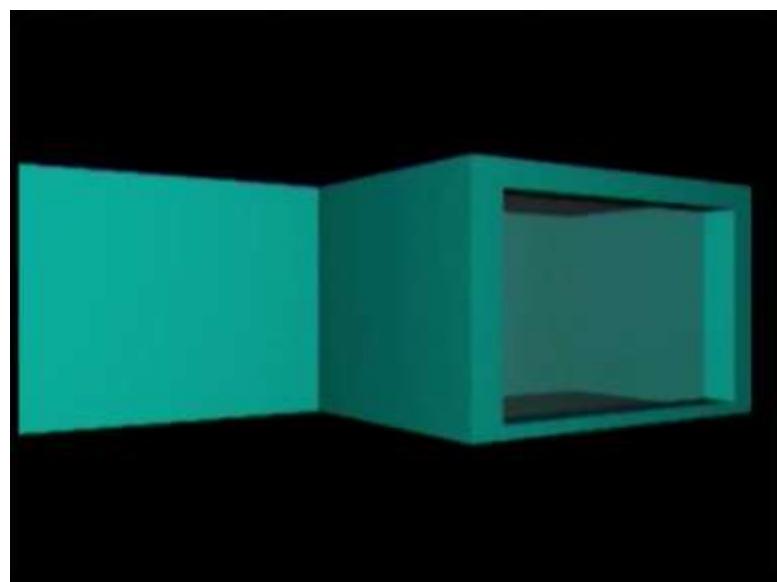
- A rotating trapezoid window is perceived as an oscillating window.

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Now, a rotating trapezoid window is perceived as if it is oscillating. So, the window looks like oscillating window. Right now you saw a house and then you had a just rectangular window there, to give you sense that fine, from particulars orientation when you look at the house, look at the walls of it, the window that it has which is actually rectangular you precede that it is trapezoid. Now look at this very animation.

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Now, instead of rotating window that you saw in the previous animation see the animation here it is of course, full window only that gets projected here and then you

have a rotating window. The interesting part in trapezoidal window illusion is that the moment know you start focusing on this rotating trapezoid, it actually starts giving a feel that it is oscillating.

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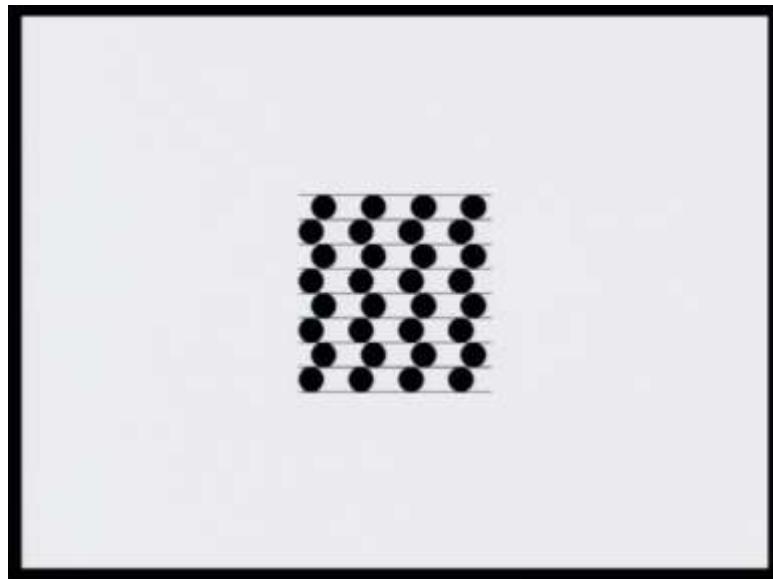
Zulu Children Study

- Rural Zulu (in Natal) setting contains very few rectangular objects.
- Zulu language has absence of words for window, square, or rectangle.

This is now called at trapezoidal window illusion. It is very interesting to know perhaps that the rural Zulu setup; they contain very few rectangular objects. So, their environment does not have too many rectangular objects and therefore, if you look at the Zulu language also, it has absence of words for windows squares or rectangles these words are not there.

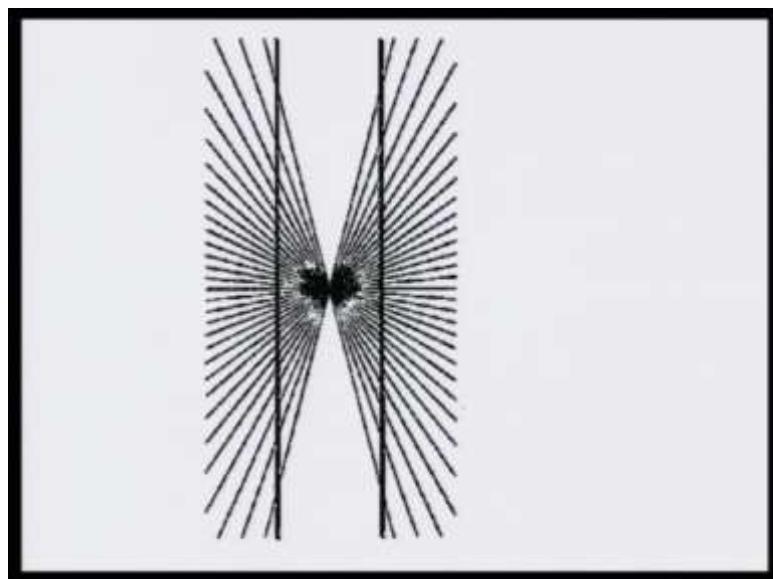
Now, in an interesting study, a comparison was done of rural and the urban Zulu children. The rural Zulu children had less illusion compared to their urban counterparts to the level of 60 percent know and most rural Zulu children did not report any illusion. Now if you do not have rectangular objects in your environment, if you do not have words representing them, you also do not have the degree of illusion. So, that is an interesting what you call effect of culture on illusions.

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Now, look at these very lines, all these lines looks as if they are very straight lines and they are parallel to each other the moment you insert colored circles here

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now the line does not look as if it is straight know it looks as if it is bent between 2 black spots. Similarly two vertical lines and the moment you had the lines starting at a common originate, you realized that the two vertical lines it seems as if they are not straight but they are rather bent at the center. So, these are very typical type of visual illusions that we all experienced.

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Perceptual Constancy

- West African adults demonstrated greater shape and size constancy as compared to the British adults.
- African culture provide few opportunities to learn geometric forms.
- Bantu language lacked words allowing clear shape distinctions.

Now, West African adults they demonstrated greater shape and size constancy in one of the studies as compared to the British adults and African culture basically provide few opportunities to learn the geometric forms. The bantu language one of the language spoken in that very area of the world, lacked words allowing clear shape distinctions and that is considered as one of the important factors that influences visual perception especially optical illusion, when it comes to defining the meaning of the external word and then you realize that the cultural factors they play extremely important role there.

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Spatial Orientation

- Spatial orientations such as left-right, up-down assume more significance in some cultures.
- Geographic features such as mountains and shores affect local reference systems. This, in turn, affects perception of spatial orientation.

Now, having talked about these many issues in perception now that we are know towards the end of our discussion on perception, let us talk about the importance of spatial orientation. Now spatial orientation, such as left right or up down ha has it is own importance in certain cultures. So, for instance there are certain type of rituals which are supposed to be performed only by the right hand, certain type of rituals which are supposed to you performed only with the left hand in certain cases know you are suppose to be on the left side in this face in some cases you are supposed to be on the right side of this face. So, it has it is own cultural importance.

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Spatial Orientation

- Sailors navigation strategies
- Habits of local sea birds
- Change in colour of water
- Change in wave formation
- Feel of boat in a wave of a particular course
- Star patterns

Interestingly the geographic features now such as, mountains and shores they also affect our local reference system and this in turns affect our spatial orientation. Now importance of spatial orientation can be seen in especially in the sailors who are in the ocean and all they see on all their sides is only the blue water, nothing more than that. Now many of these sailors they uses specific navigation strategies for instance in certain locality in the oceans they look at the habit of the local seabirds, certain type of birds they are habits and it tells them where actually they are in the ocean. Many of the season sailors will also tell you that they look at the change in the color of the water and depending on the color of the water, they can very easily make out which ocean they are in especially when, they are supposed to move from one to the other .Many of them, the experts can even look at the pattern of the wave formation and looking at the wave they

can tell you that fine they are in this very ocean, Indian ocean or they are in pacific and so forth.

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Motion Perception

- Perceived motion might occur in the absence of energy across sensory receptor.
- Constancy effect
- Apparent motion
 - Stroboscopic effect
 - Autokinetic effect
 - Induced motion

Now, we come to the perception of motion now perceived motions it might occur in the absence of energy across the sensory receptor and remember one thing that the constancy effect works here also. But in case of motion perception one is of course, you are moving the external world is releases static the other is when you are a static the external world is moving, but what is for more important and very, very interesting is the apparent motion. Three types of apparent motions we would be talking about the stroboscopic effect, the auto kinetic effect and the induced motion.

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Motion Perception

- When eye moves with respect to spatial set-up, objects in the space seem to move at different rate.
- This rate depends on the relative distance.
- Objects closer to us seem to move faster compared to those which are away.
- Greater the distance of the object, smaller move it makes.

Now, when eye moves with the respect to spatial setup objects in the space they seem to move at different rate and this rate depends on the relative distance objects which are closer to us they seem to move faster compared to objects which are away from us.

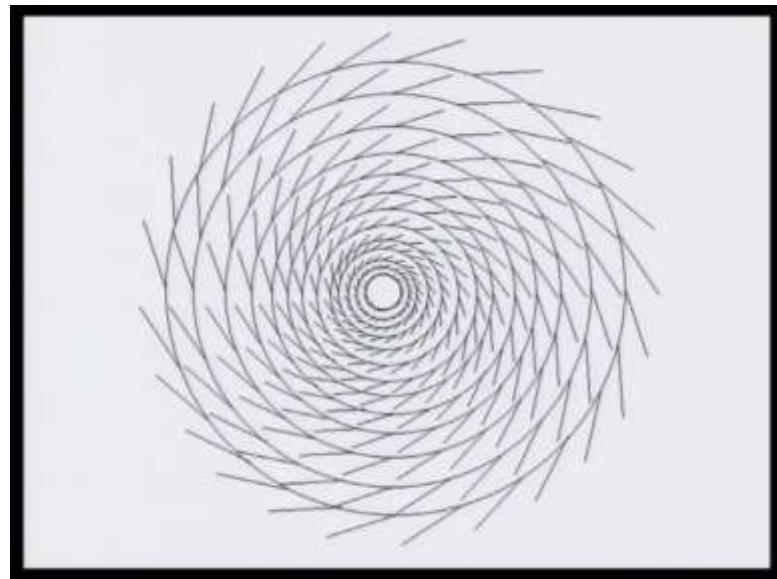
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Motion Perception

- The lens of our eyes accommodate by changing its curvature to focus on objects.
- The lens become more curved when the object is nearer.
- It becomes relatively flat when the object is too far.

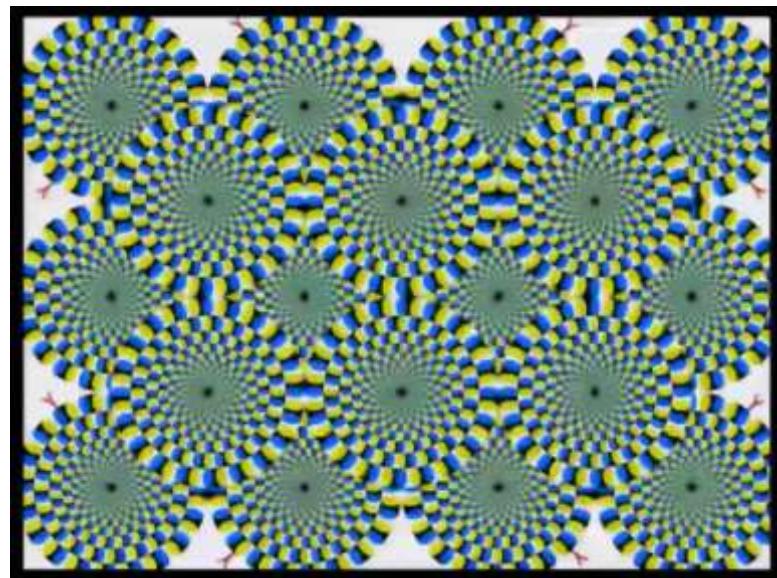
Greater the distance of the object smaller the movement, it makes the lens of our eyes they accommodate by changing its curvature to focus on objects the lens become more curved when the object is nearer it becomes relatively flat when the object is too far.

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Now look at this very image the fact that you have independent circles and then there are small straight lines which are put all across these circles you sense as if something is starting at the center and there it is expanding in a circular order it is expanding and the diameter looks as if it is increasing.

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Look at your screen now, when you look at these static images it does not look static to you, if you feel as if they are making clockwise movement and the movement you sense that it is making a clockwise movement you might get a feel that the colored disc on the

apparent perhaps make an anticlockwise movement although the screen is static, the image is a static the movement you focus at it you get a feel as if it is moving.

Let us come to a stroboscopic effect. Stroboscopic effect basically means that you perceive a running or a static sensation in a given type of a situation.

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Look at this very video. When you look at this fan, you know that now the fan is rotating, but this movement is not perceived, you feel as if it is static.

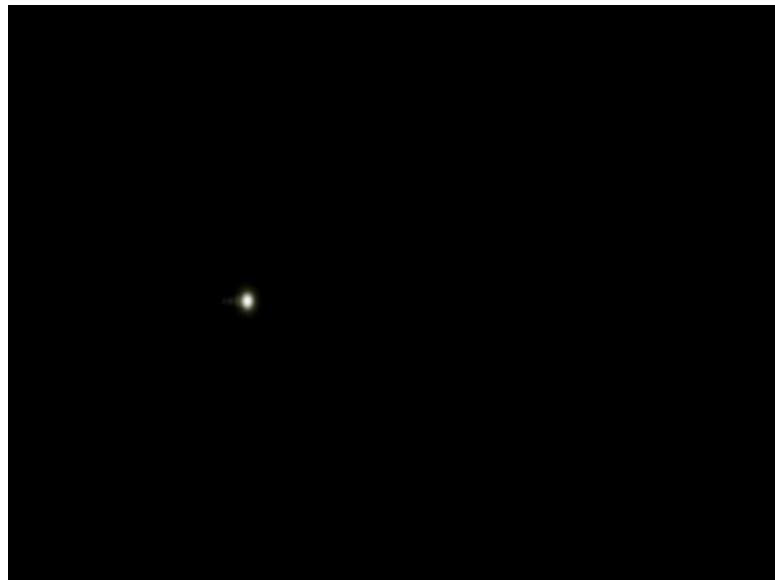
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Motion Perception

- Autokinetic effect: If one fixates at a spot of light in a dark room, the spot appear to be moving.

Now the other type of apparent motion is what is called as auto kinetic effect. Now if you fix it at a spot in dark room you suddenly realize as if the spot is moving. So, room is absolutely dark you are looking at spot of lights you fixate at it and the movement you fix it, appears as if that light is moving on the right side look at this very video.

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If you fixate at a spot of light in dark room, that spot appears to move. You have a dark background now. You have a spot of light here. Now, it is actually static, but if I ask you to know focus on it is a dark room just focus on it you start getting a feel as if this now white dot is gradually moving this is now called auto kinetic effect it is of course, an animation to help you understand of course, the light want appear to move so fast and of course, it won't have so many trails left behind, but then this is actually what happens you focus on it and then you feel as if it is now moving gradually of course, not at the rate at which you see here on the screen right now. But you can try it out know in your own house.

Another aspect in apparent motion is induced motion now static objects they are perceived to move when the frame or the background moves. So, it is like say I remain static and the background against which you are looking at that starts moving the movement you see there you realize as if there is a sense of movement. Look at this very animation.

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Now look at this animation now you know that this man is not now cycling here he had just now his puts on the pedal the background is moving, but when you see that the background is moving the impression that you get is that find this man is cycling fast. This is actually induced motion.

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Set & Perception

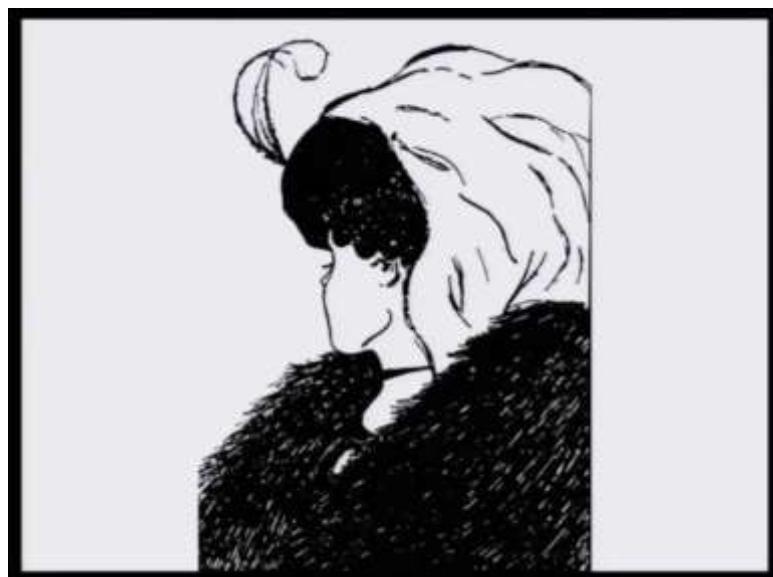
- The readiness of an individual for certain kind of stimuli.
- In such condition one does not consider all possible contingencies; instead, only a narrow range of possibilities are considered.
- Example: a mother towards the baby cry

. And now at the end we come to the importance of set in perception set basically means your readiness to certain kind of is stimuli. You remember in the beginning we did talk about the properties know of the stimuli the strength of the signal and then, we also said

that it is the user especially if you remember we were talking when we were looking at the radar warning system that it is the readiness of the operator to look at the signal and he has to make a distinction between the appearance the presence of the signal absence of the signal and whether it is and so forth. Now in reality, what actually you want to see what is your degree you preparedness, what is your preference. That is considered as set. So, set basically represents your readiness to look for certain kind of a stimuli and that is considered to be one of the important factors when it comes to perception.

Now, in such conditions where you have a preference to look at certain kind of a stimuli one does not consider all possible contingencies rather only narrow range of possibilities are considered.

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Look at this very example, what do you see here ? There are 2 possibilities possibility one where you look at an old lady, this is the side profile of an old lady and look at the change close to the hairs you see the protruding nose and the eyelash and that gives you a sense that you are looking at the fear the side profile of a baby, a young baby versus an old lady. This is the distinction it is basically change in this very region that makes you realize whether you would basically we perceiving an old women in this very image or you would we looking at a young baby.

So, this is considered the importance of your readiness, your degree of preparedness, what actually you are keen looking at and with this what we have done till now is that we

have tried to understand that fine, there is mechanism biological mechanism that we all are end out with which helps us use our sense modalities to receive signal from the external world these signals are sent to the brain, the brain assigns accurate meaning to these sensations, if we are successful assigning meaning to it this is called perception.

Perception will depend on the strength of the signal perception will depend on the preparedness, the willingness, the mental set of the respondent the individual then there are certain conditions such as constancies that we talked about certain apparent type of things that happens that gets induced in us and there could be possibility when we do not succeed assigning accurate meaning to what we have sensed. If we fail assigning accurate meaning this is what is called as illusion. So, with this we complete our discussion on perceptual processes.

Now, that I have seen things in the external world, how do I learn it? So the next segment would be a series of lectures on learning.

Introduction to Psychology
Prof. Braj Bhushan
Department of Humanities and Social Sciences
Indian Institute of Technology, Kanpur

Lecture – 17
Memory Models of Memory

Till now what we have done? We have looked at how information is brought to the brain? How the brain assigns a meaning to it, based on our experiences that come to us how do we learn certain things now we are moving to the next step. That is once the information comes to us and we realize that there is a need for us to store it for little longer time for future usage.

Future usage could be say couple of seconds from now or it could be no even in the lifetime sometime. So, future is quite broad in that sense. So, when you realize that I need to store this information for little longer, I can use it in may be couple of seconds couple of minutes from now, or I might need this information much later in my life which is valuable for me. Then we try to store it and if we have successfully stored it then whenever needed we will like to retrieve it, if the process of storage works well if we succeed retrieving it from the storage this is what is called as memory, and in this third week we would exclusively focusing on the concepts that has to do with human memory processes.

Now, memory is basically studied in terms of mental processes that are involved in the storing and retrieving information. Now remember before memory we have talked about learning. The distinction between the two is that learning basically emphasizes on acquisition where as memory basically focuses on the retention and the retrieval of the information. So, if you acquire information that is what learning looks at. If you are more interested in terms of retaining the information and retrieving it wherever you need it then this is the part of memory. So, storage retrieval these are two important constructs that we would be looking at.

Now, memory system it stores information acquired through our sense modalities how the sense modalities they help our brain in terms of perceiving things that we have already discussed in the first week. Now this informations which come to the brain might qualify to be stored for relatively longer time and therefore, memory consists of many

systems, arranging from storage duration and buffer storage which primarily will take the information to long term storage. So, depending on the fraction of second to lifetime duration of a storage we will further classify memory into different sub types that exercise we will continue doing till the end. Therefore, memory basically is our cognitive system which is used for storing and retrieving the information.

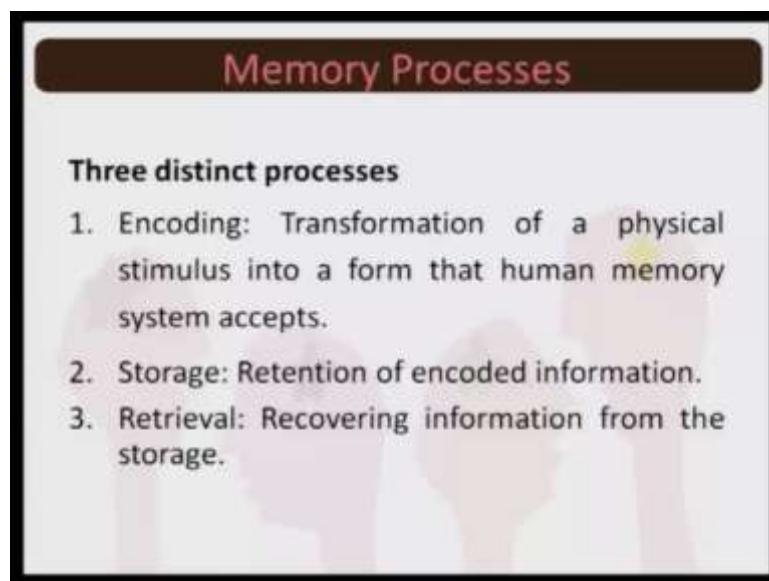
With this basic information about memory, let us understand what actually we are going to do as part of this very discussion deliberation for this full week we would be trying to understand what memory is, we would be looking at some of the dominant theories which tries to explain how human storage system works how the retrieval process works then we would be trying to understand that why is it important for human beings to memorize information? Why memory plays that important role and given the fact that memory plays such important role, How many types of know retrieval and storage processes are there one is of course, based on the timeline whether you store the information for few seconds, little longer or much more longer or depending on how you truncate it. You have the information which runs for certain duration of time and then depending on certain qualities you truncate it.

So, this would lead to know all types of storage of information the strategies that we use and then we will come to the reverse of memory reverse of memory would basically be the process called forgetting. If you commit error in terms of storing information or you have stored the information, but then you commit an error in terms of retrieving it, think of something like this, you are searching for a paper that you have filed in your cabinet your filing cabinet has that the specific paper that you are searching for that you are very sure about, but when you are search for it. You have all types of problems may be that people some people give proper file names way where they will put such type of documents. So, they would only look for those file names once they find the file name they will turn the pages and identify the paper this could be one.

The other situation could be that you make a random search and even in memory, we will see that random search actually does not work, some people might even go for ordering things putting things in certain orders in certain hierarchy that also works very well. Then you also might file the document based on it's relevance whether you would need it in the coming days, you whether you need it ,in longer duration ,papers which you think are redundant you will never need it depending on your classificatory scheme.

You will put the paper accordingly same is the story with the memory processes also life experiences all the information that comes to you depending on several parameters we try to give it code, we try to store it and the coding is needed because the brain understands a particular type of language storage again you need to store it for longer time and also you need to give it a proper file name. So, that when you want to retrieve this information you can just search for that specific file name and get the information. So, from that perspective, if you look at the memory process memory has three distinct processes encoding storage and retrieval.

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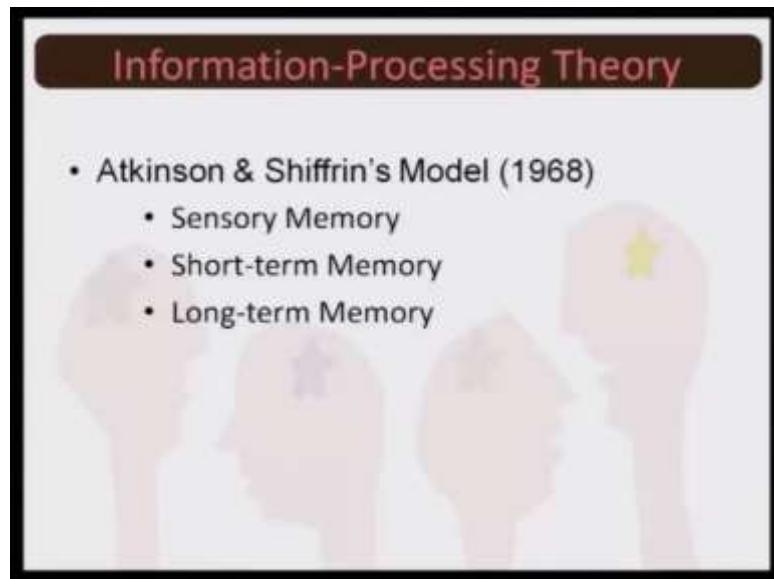
Now, encoding basically is the process of transformation of a physical stimulus in a form that human memory accepts. Now if I am looking at the camera right now there is certain form and I perhaps have some idea of what type of function this form performs and based on this utility or based on this form I create an impression, I know that if I see an object like this what this should be called I know that if I want a function like this to be performed what is the instrument that I would need.

So, this is the process of encoding the storage of course, is the process of retention the encoded information is reach the brain and now that encoded piece of information the brain will retain it with itself remember the storage would require a specific file name it is just like, we save files in our computers say for instance, if I have to deliver a lecture on memory and if I make powerpoint presentation I might love to give it a name the file

name memory because this will help me a lot in terms of know making search for where exactly is my PPT presentation that I have to use today. If I have say 126 power point presentations with me making random search will make my life hell. So, how you encode the information and how precisely how nicely how customize the file name you provide to the information that you have stored that plays a very crucial role and this crucial role comes into play when you try to recover the information that you have stored.

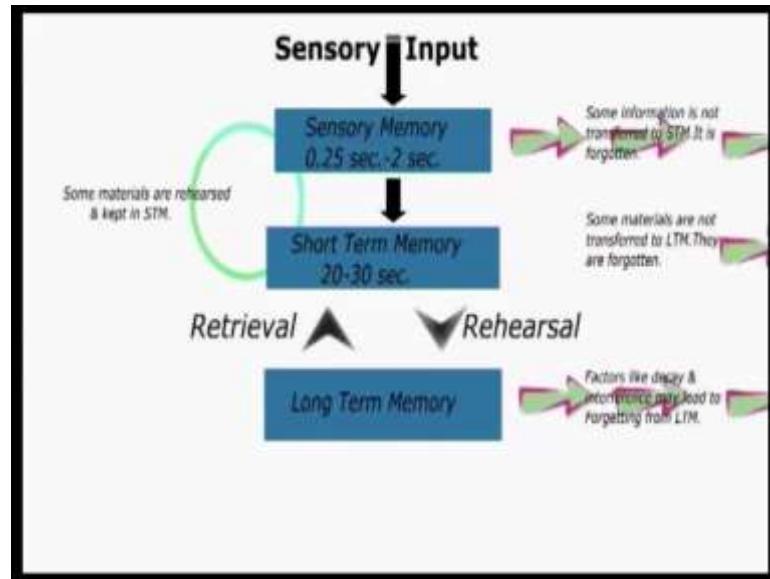
So, encoding storage and retrieval are three distinct processes which are of extreme relevance to memory processes two models.

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We would discuss one the Atkinson and Shiffrin's model that was proposed in 1968, which tried to explain memory in trifurcated format saying that we have sensory memory short term memory and long term memory.

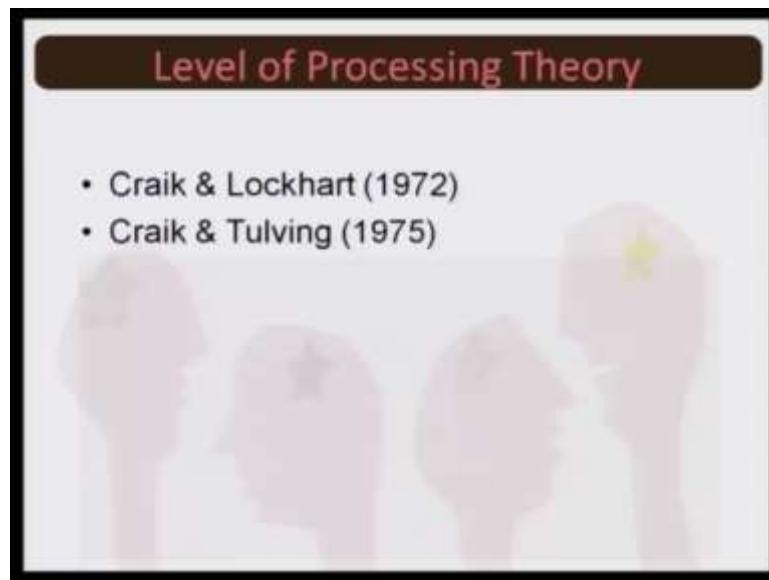
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Memory starts with a sensory input received from the environment this input is retained for a very brief time ranging from 0.25 seconds to 2 seconds, some of these inputs are attended and rehearsed such input pass on to short term memory the unattended inputs are not transferred to short term memory and are forgotten the inputs can be held in the short term memory for 20 to 30 seconds. If they are further rehearsed they pass on to long term memory the unrehearsed once are forgotten the inputs moving to the long term memory as organized into categories they may remain here for days months or even lifelong and can be retrieved as and when needed decay and interference are some of the factors that lead to loss of information from a long term storage.

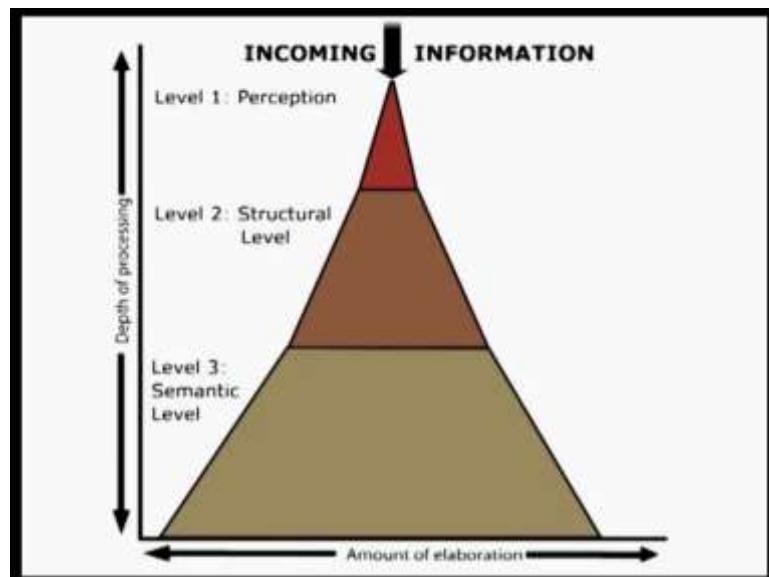
Because that Atkinson and Shiffrin's model they talked about the trifurcated structure of memory, just looking at it from a temporal point of view sensory short term and long term another theory was proposed by Craik and Lockhart in 1972.

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Which further got revised by Tulving and Craik and Tulving came forward with a revised version in 1975.

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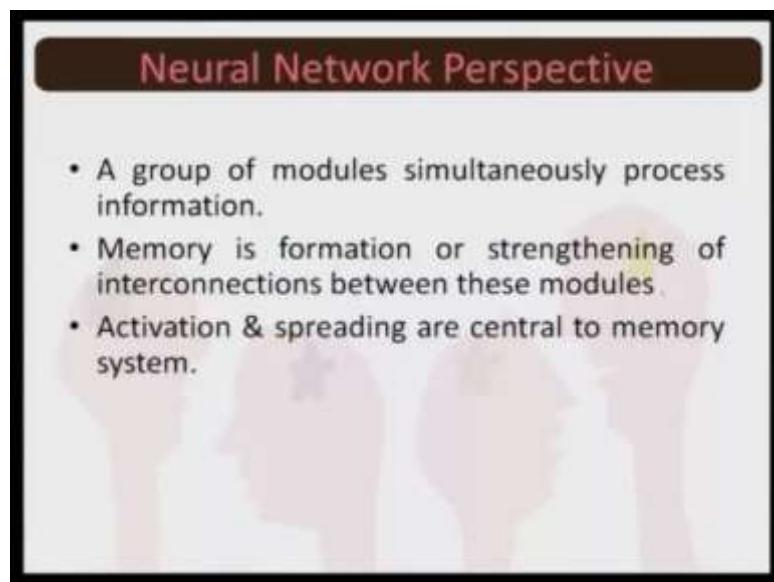
According to this model the incoming information can be processed at three different levels; perceptual level, structural level and semantic level. At perceptual level one becomes aware of the immediate environment. Structural level is somewhat deeper compared to the perceptual level. Here one emphasizes the structural features of the information. The deepest level of processing is the semantic level. Here one derives

profound meaning of the information, this model explicates that deeper the processing more is the elaboration, in other words deeper and meaningful analysis leads to durable memory of the information. Higher the elaboration more are the chances that the newly derived meaning integrates with the existing memories.

Now, you have seen the difference between the two models the first model which try to look at memory in terms of the three types of structures based on it is temporal programming, the second model which was more looking in terms of the elaboration process, whether you look at the information only from a perceptual point of view, whether you look at the information from a structural point of view or whether you go for an extensive elaboration there by suggesting that the more and more you elaborate perhaps you understand things better and if you have more if you have more of semantic meaningfulness driven type of a memory you will store it better.

The third perspective on memory is what is called as the neural network perspective. Now neural network basically talks about know the groups of modules. So, it says that there are various modules which form a group and these modules basically they help perform simultaneous functions memory is nothing according to the neural network perspective.

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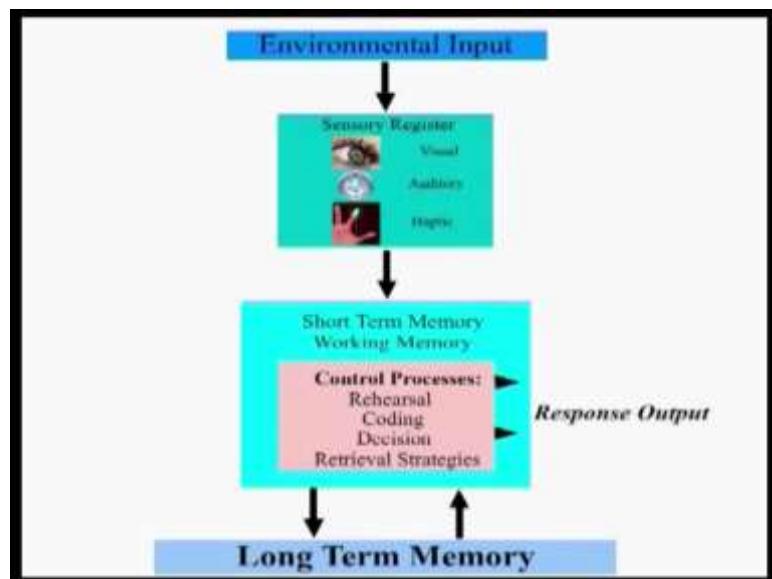


But it is formation or strengthening of these interconnections which get formed between different modules, now the activation and the spreading they are the two central

components from the neural network perspective related to memory. So, what happens you get the information from the external environment you encode the information, you have modules which would be entertaining those encoded information and ones the traces are formed when you repeat it the second time, and it gets the strengthened. Now two or more modules they get inter connected and this formation if it is repeated it gets strengthened when you activate it you are able to store the information now more and more is the formation of the module more and more is the connectivity between different modules. The more spreading takes place you have better memory. So, there is a spread of this strengthened associations the stronger the association, the more wider the network better would be the memory and when you activate it, this is how the memory system gets operationalized this is the neural network perspective.

Now, that we have discussed three important concepts ,the model given by the Atkinson and Shiffrins the model given by Craik and Lockhart, which further got revised in collaboration by Tulving and the neural network perspective, if we combine all these information and try to evolve a comprehensive model of memory. So, what is memory all about, how does our memory function? This is how we would explain it.

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This is what you get if you summarize the existing knowledge on memory system, then our sensory register mostly gets information from the visual auditory and the Haptic senses, the rehearse information then moves to the short term memory system those

encoded and rehearsed further move to the long term memory system. Depending on our decision to respond to the environment we use certain retrieval strategies to get the desired information from the long term storage, the response outputs are mediated by our working memory.

Now, let us go back to our first week, what we discussed there was that visual kinesthetic, somesthetic, vestibular, auditory, olfactory all these channels they are basically meant to provide information to the brain, given the fact that the brain receives stimulus from all these sensations, one can think that if memory is guided by the information that comes to the brain then ideally it should store all type of information.

Now, let me give you an example say if your mother for instance just comes and know keeps her palm on your shoulder without hesitation within fractions, you would arrive at a conclusion that it is my mother this recollection you are you have not looked at your mother, it is only the touch of the mother which made you identify, make a correct identification that it is our mother. Where as if somebody else touches you are not able to provide the correct meaning to it why and this gives you a feel that fine a touch based memory could also exist.

Previously I was telling you that, if I look at a camera and I know this is called camera the structure the form the function both. So, next time if I see this structure I know this is camera and if I needed something to be recorded I know which instrument can perform this function and then I will say I need a camera. So, it is the visual part it is the understanding of the mechanism and now imagine another situation you are somewhere who close to a railway track you are not able to see a train, but you hear the sound of a moving train, just with the help of this auditory input you can sense that fine this the source of this very sound is a moving train which perhaps is at certain distance from me.

Now, one sound how does it make you understand that this comes from the train again there must be something that the brain has stored based on the auditory process say somebody gives you something to taste you put it on the tip of your tongue. Yes I remember there is something else also which resembles to this taste or this taste is equivalent to something that you and the person with whom you are sharing this experience also is aware of then you realized that there could be a taste based memory also.

So, what I am basically trying to tell you is that because the brain receives inputs from all sense modalities you can assume situations and you can very easily identify cases from the real world situation where your own experience will tell you that this part of my memory is basically guided by the input, which has come from a given sense modality having said this let me confess that research in psychology has largely been conducted only using two sense modalities the visual processes and the auditory processes. So, eye and the ear these are the only two sense modalities through which how the information is captured how it is processed how it is stored whole lot of research has gone into it and the third set of research which is not as comparable as the visually or auditarily guided research in memory is the touch based memory.

Rest of the sense modalities they have not been examined as thoroughly as the first two and then the third one, therefore, we will for our understanding of sensory memory will focus on only three types of memories.

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Sensory Memory

- We have already discussed the visual, hearing, smell, taste, and somesthetic processes.
- Although we receive sensation from all these sensory modules, visual and auditory system based memory processes have been studied most.
- Studies are also available on the haptic sensation based memory.
- Hence, here we will go into the details of visual (iconic) and auditory (echoic) memory.

the sensory memory which has to do with vision that is the iconic memory sensory memory that has to do with auditory process that is the echoic memory and the sensory memory that has to do with Haptic sensation the touch based sensation, but because largely research has been guided by the iconic and the echoic memory. So, for this very module ten hour brief module we would be no talking exclusively with respect to the iconic and the echoic memory.

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The slide has a dark red header bar with the title "Sensory Memory" in white. Below the header is a white content area with a black border. The content area contains the following bullet points:

- The iconic and echoic memory store visual and auditory information as part of processes involved in perception.
- Both these sense modalities are distinctive as they allow the initial stimulus to be prolonged.
- This ensures the probability of processing at a later stage.

Iconic and the echoic memory basically, they store visual and auditory information as part of the process involved in perception. So, eye and ears both are responsible for the process of perception they are the first source the biological entity in our body which receives the signal from the external world. Now both these sense modalities are distinctive because they allow the initial stimulus to be prolonged this means that when the eyes they get activated because the light falls on the retina you remember in perception we had said that the cis state converts into the trans state and again gets back to the cis state because it has to be ready enough to receive the second set of single.

Now, this very transformation the at the level of retina the rod cells and cone cells the light falls and the cis configuration becomes in the trans state the time that, it will take to get itself back to the cis state is the time which basically the eye gives to it gives to itself to retain the information for certain period of time. So, the visual information although it has crossed to the optic track till this know information till this chemical configuration realigns, the information is stored at the level of eyes this is iconic memory, now recollect what we have discussed about the auditory mechanism what we discussed was that the sound wave it enters to the middle ear, it goes to the inner ear where in the cochlea we have the fluid and the wall of the cochlea which is the hair follicles this fluid starts shaking there by making movement in the hair follicles these hair follicles in turn triggers current in the nerve circle this neural circuit.

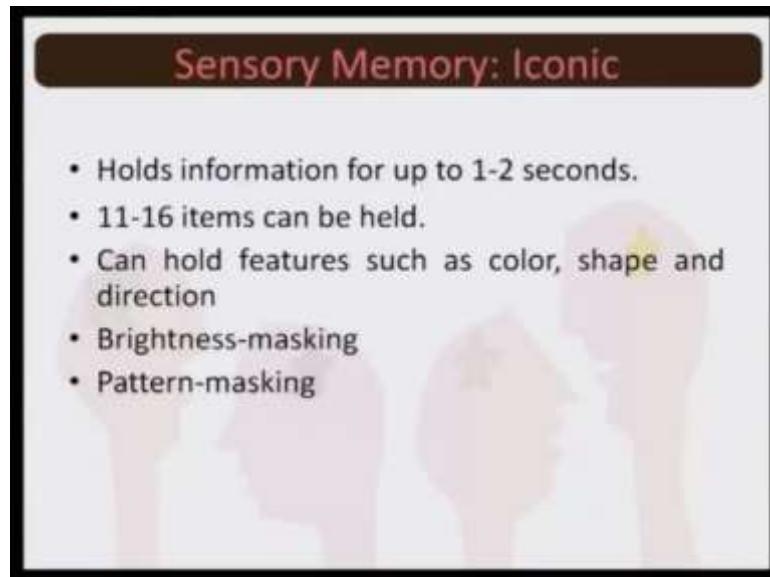
Finally, is perceived by the brain assigned the meaning and thereby we hear meaningful things in the world, but recollect your other experience of throwing a piece of stone in a still water or if you do not have that experience recollect the experience of know collecting water in a bucket that falls from the tap, you close the tap and one or two drop still falls in the buckets and you realize that the ripples create in the water it takes certain time for the ripple to settle down.

Now, convert this to the working mechanism of the ears the cochlea has the fluid the fluid shakes. So, once the shaking has begun it will take time to slow down and then gradually get stabilize. So, that would been that till the fluid in the cochlea now moves then, hair follicles will also move and till the hair follicle moves ear is capable of retaining the auditory information and this the source of echoic memory. So, what happens? Eyes and ears both are now capable of storing the information for shorter period of time to ensure or to allow you the probability of processing this information at a little later stage and these are the biological foundation of sensory memory specially remembers we are only with reference to iconic and echoic memory.

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Sensory Memory: Iconic

- Holds information for up to 1-2 seconds.
- 11-16 items can be held.
- Can hold features such as color, shape and direction
- Brightness-masking
- Pattern-masking



Now, iconic memory that has to do with the eyes can hold information for up to 1 to 2 seconds. Remember when you will come to the echoic memory you would realize that ears are able to store information for little longer period of time compared to eyes why that question we will take up when we come to echoic memory. Now what happens in

the case of iconic memory shorter period of time just 1 to 2 seconds, but then you have longer piece of information 11 to 16, items can be held right at the level of eye for 1 to 2 seconds you can imagine the capacity of iconic memory further what is far more interesting is to understand the fact that features which are extremely important for us to perceive the world such as color such as shape, such as direction you remember Muller Iyer illusion example that we took, it had arrow-headed line feather-headed line. So, direction was there different lines had different colors entire Gestalt principle ,bubbles that used to come as examples all of them were colored.

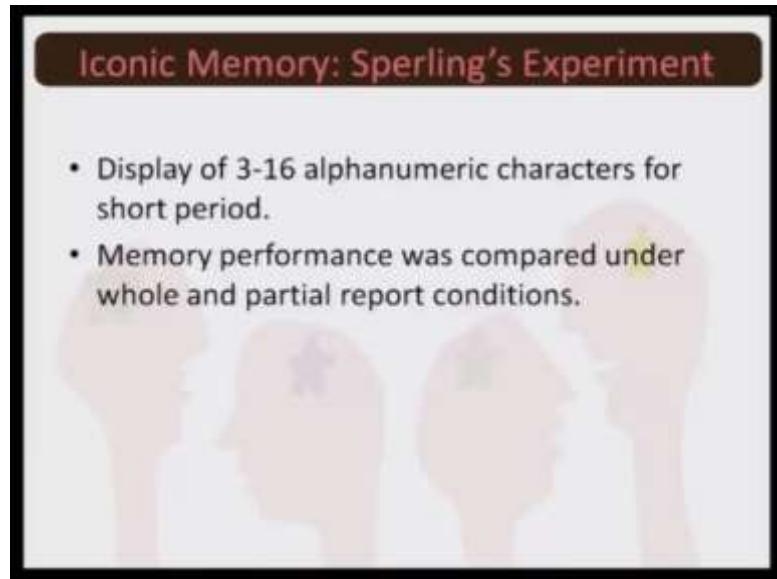
So, the shape color the direction all these features can be stored and eleven such information 11 to 16 such information can be stored right at the level of eye what would this mean this would mean that, when you saw examples whether it was a line whether it was horizontal whether it was vertical whether it was a bubble whether it expanded. Whether it moved in what you call vertical direction diagonally horizontally everything you could store right at the level of the eyes, multiple information up to two seconds this is what happens at the level of eyes and this is called iconic memory; however, our iconic memory has 2 limitations first. If you vary the brightness level once you now change the brightness then, you realize that you now some degree of masking has taken place right now the level of brightness was this much you add one more glowing light or you switch off one more light and you realize that the brightness pattern has changed because in perception also we have discussed this based on the balance between white gray and black the perception quality changes.

Therefore 2 information can get masked it can interfere. So, this is called brightness masking similarly we can have pattern masking more than one pattern, if it super imposes one gets overlaid over the other and you get a combined image of the two. This will be called as patterned masking. So, in terms of efficiency we know 11 to 16 items color shape direction all such important features for up to 2 seconds that is the capability of the iconic memory limitation it know has it's limitation. When you tamper the brightness level and if you vary the pattern then also it has certain limitations with respect to iconic memory let us also discuss one of the interesting experiments done by Sperling.

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Iconic Memory: Sperling's Experiment

- Display of 3-16 alphanumeric characters for short period.
- Memory performance was compared under whole and partial report conditions.

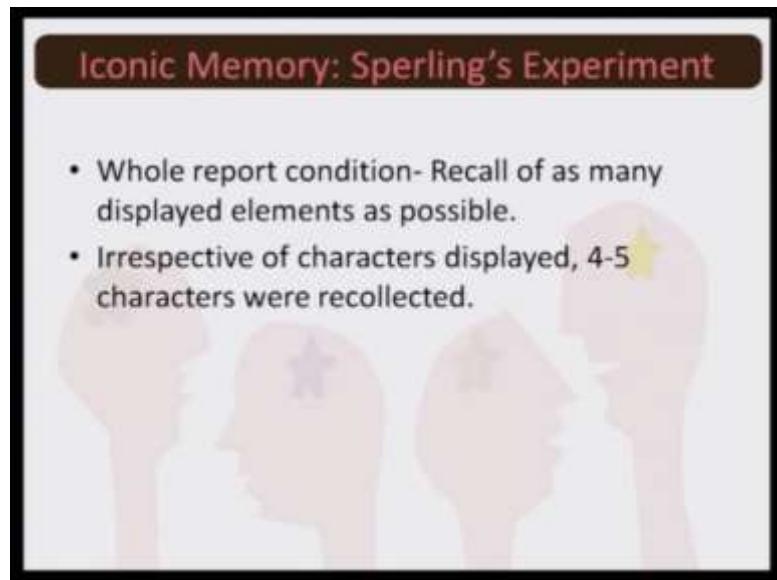


Now, three to 16 alpha numeric characters were displayed for shorter period of time and performance in terms of memory was compared under two conditions the whole report condition and the part report condition.

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Iconic Memory: Sperling's Experiment

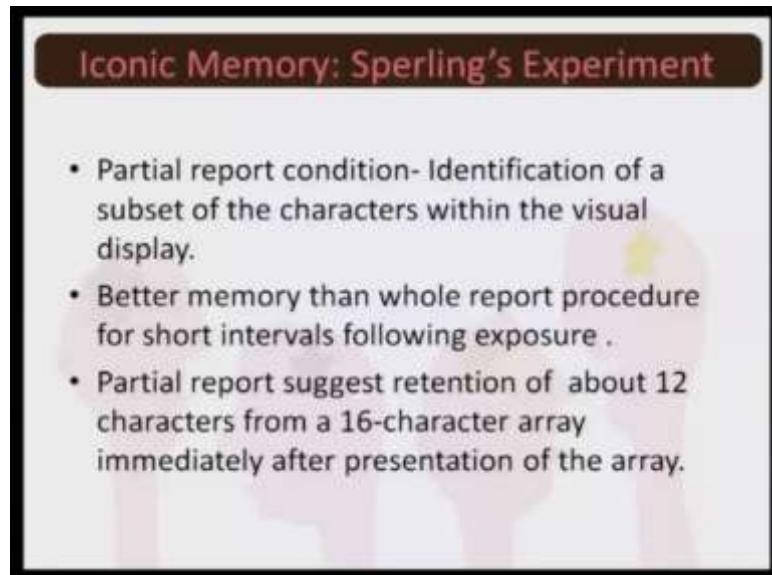
- Whole report condition- Recall of as many displayed elements as possible.
- Irrespective of characters displayed, 4-5 characters were recollected.



Now, in the whole report condition recall was basically suppose to be done with respect to as many information as many elements of information, it was initially presented how much the participant is able to recollect now irrespective of that characters displayed it was realized that only 4 to 5 characters were recollected this was the whole report

condition where the recall was suppose to be of maximum possible number of elements what happened in the case of partial reporting condition.

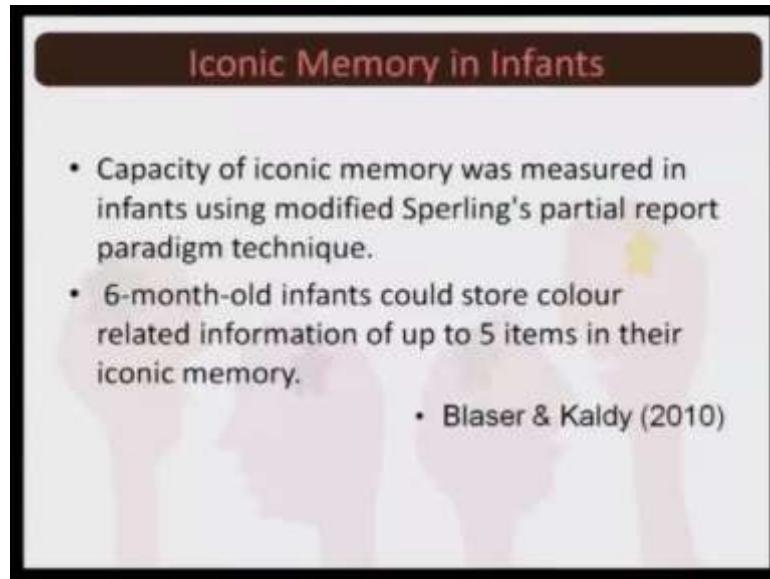
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In the partial reporting condition the participant was basically suppose to identify the subset of the characters within the visual display and it was realized that memory was better in this case. So, better memory compared to whole report procedure and partial report also suggested that retention is possible for about twelve characters from a 16 character array. So, if this alpha numeric character there was 16 alpha numeric characters 12 at least could be recollected in the partial report condition suggesting that, if you are allowed this freedom to go for a partial recall this is a better condition compared to the whole recall condition.

Another interesting information of research not so very old conducted in 2010 which tried to modify, Sperlings partial report paradigm technique and tried to find out if iconic memory works in the case of infants also because whatever we were discussing had to do with adults.

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The slide has a dark red header bar with the title "Iconic Memory in Infants" in white. The main content area is white with a black border. It contains two bullet points and a citation:

- Capacity of iconic memory was measured in infants using modified Sperling's partial report paradigm technique.
- 6-month-old infants could store colour related information of up to 5 items in their iconic memory.

• Blaser & Kaldy (2010)

Now in infants this very study found that and even for human children who were just 6 months old they could also store color related information and up to 5 items were known stored at the level of iconic memory. So, you can visualize that right from very early stage in our life iconic memory vision based memory which basically serves us for a very brief period of time not more than 2 seconds, time plays an important role when we meet tomorrow we would be talking about echoic memory.

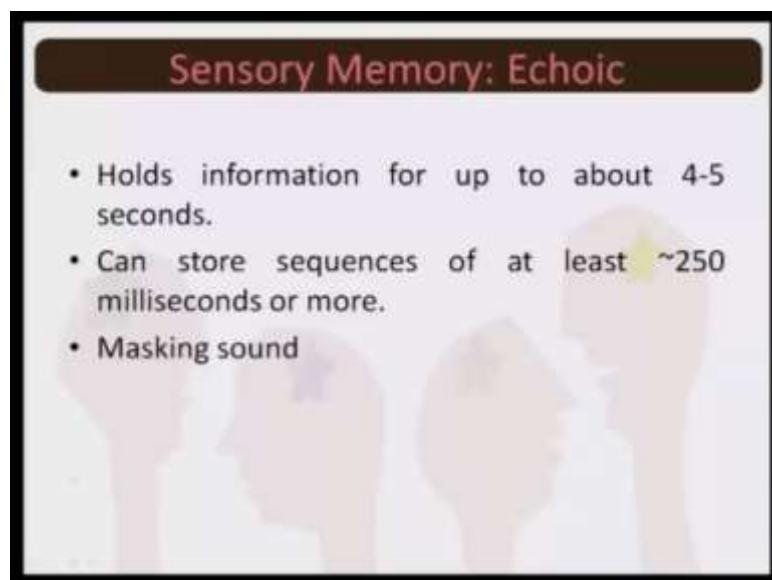
Key words - memory processes, sensory, iconic, echoic, encoding, storage, retrieval

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Lecture – 18
Memory Short Term Memory – Storage and Retention

Till now we have talked about iconic memory. Let us now move to the other form of sensory memory that is echoic memory. In case of iconic memory, we discussed that the total amount of information that can be retained is little more, but in terms of duration it had relatively shorter period compared to echoic memory because echoic memory can hold information up to 4 to 5 seconds.

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And furthermore it can also store the sequence of at least 250 milliseconds or more. Now recollect what we talked about in the previous lecture and this has done with the way we have talked about issues in case of sensation. We said that ear, specially the inner ear which has the fluid filled in the cochlea has the nerve endings and because the ripples that are created it takes little longer time to settle down. Therefore by default the amount of information that will be held at right at the level of the sensory modality will be little longer. Because in the previous case, in the case of eyes it was basically the sis to the trans configuration and back to the sis configuration, which was now basically facilitating the storage of information.

Where as in the case of echoic memory, it is the settling down of the ripples that is created in the cochlea and therefore we realize that in terms of the auditory impulse that we receive from the external world, the amount of information even though it might be less, compare to what we retained at the level of eyes, but in terms of duration we have much more longer life compared to iconic memory for auditory information, but the problem is because both of them have very limited period of time, Iconic memory for 1 to 2 seconds, Echoic memory for at max 4 to 5 seconds, the chances are that if you have a stimulus of the same intensity that enters the ear then there would be a muscle. You remember even in the case of iconic memory we say that brightness and pattern masking are possible even at the level of the sensory modality.

Similarly, here in the case of echoic memory the sound masking can take place and this becomes a barrier. Because it will not allow you to listen to what you call the purest form of the auditory impulse and retain it for a maximum of 5 seconds. Having discussed echoic and iconic memory, let us just now make comparison between the two. Iconic memory, in terms of duration it just 1 to 2 seconds, whereas echoic memory in terms of duration it is 4 to 5 seconds.

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Sensory Memory	
Iconic Memory	Echoic Memory
<ul style="list-style-type: none">• Holds information for up to 1-2 seconds.	<ul style="list-style-type: none">• Holds information for up to about 4-5 seconds.
<ul style="list-style-type: none">• 11-16 items can be hold.	

So the life of echoic memory is little longer compared to iconic memory, but the advantage in the case of iconic memory is that, it can store, it can retain relatively longer amount of bit of information.

So, approximately somewhere between 11 to 16 items can be held in terms of iconic retention. Echoic retention the moment you have now two sounds of equal intensity masculine will take place. Now having talked about sensory memory, let us now go to the other form of memory that is the short term storage, the short term memory. Now in terms of life short term has much more longer life compared to the sensory memory.

Iconic just 1 to 2 seconds, echoic just 4 to 5 seconds, but short term can store information for approximately 30 seconds. So, 20 to 30 seconds is the elastic time limit for which information can be stored in the short term memory. This would mean get after end of 30th second, either the information which is at the level of the short term memory would trickle down go to the long term storage or it will be basically replaced, it will be flushed out by the incoming information and we saw in the comprehensive model of memory that loss of information takes place from all the 3 channels.

So, sensory memory, short term memory, long term memory from everywhere we have now loss of information, but in case of short term storage either the information moves on to long term storage or the information is lost and replaced by that incoming information, but you also interesting about short term memory is that the information that comes to short term storage is encoded.

In acoustic format say speech, sound, visual images, words they constitute, the code that is retained by the short term memory. Because these are meaningful things, speech has its meaning, sounds might have meaning, visual images would represent something and words which is again not nonsense syllables.

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The slide has a dark brown header bar with the title "Short-Term Memory" in white. Below the header is a light gray background area containing a bulleted list of five points:

- Information held for 20-30 seconds; thereafter it is displaced by incoming information.
- Information encoded in STM is acoustic in nature (Speech, Sounds, Visual Images & Words).
- It is semantic in nature.
- Meaningful words may be stored easily as compared to nonsense syllables.

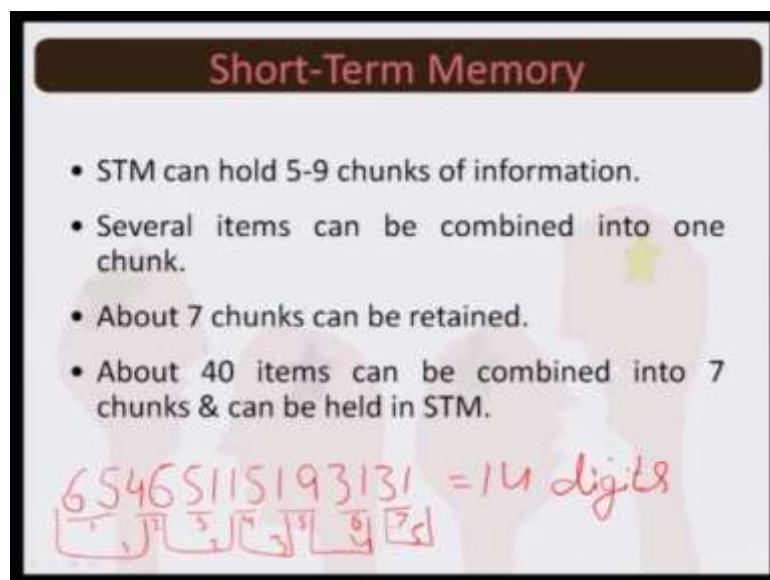
So, because it is word therefore, it would carry some meaning therefore, the information that comes to short term memory, it is largely semantic in nature, it is meaningful in nature and because meaningful words, meaningful symbols, meaningful sounds, allows you to process it in a different way compared to when you have nonsense syllables or you have thinks which are completely devoid of meaning. So, the movement you start elaborating it, you remember the (Refer Time: 06:36) know. So, perceptual level of analysis, structural level of analysis, semantic level of analysis, all of them had different impact on memory. So, if we go for meaningfulness then by default you elaborate the information, because you elaborate the information therefore, semantic things meaningful things will have a longer life compared to meaningless things.

There are the whole lot of research in psychology comparing meaningful words with nonsense syllables and there it has been uniformly realized, that meaningful words, they have stronger storage compare to the nonsense syllables. This thing is you know pretty obvious say for instance, if you are told rose, it is much easier for you to have a mental image of rose and there by remembrance of the word rose will be little longer compared to let us say XTPY which is nothing but four distinct alphabets that have been a temporally presented very neck to neck, because it has been pronounced altogether therefore, you might try your best recollect it, hold it for little longer, but then it is extremely difficult if such information, such set of nonsense syllables are presented to you in a sequence. What has further been realized in case of short term memory is, that if

you have a longer piece of information then the possibility is that you might break it into smaller chunks.

Now, think of a situation, you are given a number, a number which is, it has long-long chain of numerals. Let me show you this example and then I will come back to the discussion on (Refer Time: 08:40)

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Now look at your screen, I am writing certain numbers. If I ask you to memorize this number and retain it at least for 30 seconds because that is the duration of short term memory. Now if you start now memorizing each of them, you have longer chain now. So, you have total 14 digits here. Now if you want to memorize it as 14 different set of information, you are putting your short term storage in a big problem. Usually what has been realized that most of us either form chunks of 2 or 3 bits of information.

So, those who would form chunks of 2, would do something like this 6 5, 4 6, 5 1, 1 5, 1 1, 3 1, 3 1 now this 14 basically becomes 1 2 3 4 5 6 and 7. So, simple 7 chunks now this is something that very easily your brain can store. You would realize that there are people who form chunks of 3. So, they would do something like this. So now you have one two three four and just five chunks life becomes much simpler. So, if I have to recollect the number it becomes very easy for me. Why it becomes easy for me? Because I am now trying to now memorize the number in terms of chunks.

So, I say 6 5 4 6 5 1 1 5 1 9 3 1 3 1 it is much easier. You would realize, that say for instance take when you have to recollect the mobile number which is a ten digit number in our country. If you have to memorize that number how do we do that and you would realize that even if you take your own example perhaps you do not remember more than three four mobile numbers. You remember mobile numbers of only those which matters to you, parents, siblings, best friends, something like that. Now what we do that if we have a longer set of information, we break it into pieces and these smaller forms of information, which is either I said know you can combine two of them or you can make a chunk of 3 bits of information, 4 bits practically you will not find people using 4 bits.

Now, things become much easier and therefore, it has been realized that somewhere between 5 to 9 chunks can very easily be stored in short term storage. So, 9 chunks may will primarily mean that 9 into 3, if you are making a chunk of 3. So, 27 bits of information you are basically able to store for approximately 30 seconds. Similarly in children say if the minimum span is going to be 5, then 5 3's are 18. So, 18 bits of information a child can also store and then in terms of say if the number of items, now that we are extending that say there could be possibility of forming chunks of 4 then you realize that approximately research is show the 40 items can be stored forty discrete items broken into chunks an accordingly the chunked information when you recollect it when you store it, you realize that 40 distinct item can be stored right at the level of short term memory.

So, if you compare iconic versus echoic. So, the maximum that sensory memory could provide was at the level of iconic memory with eleven to 16 items, here is short term memory we go up to 40 items. So, this is the huge jump now, both in terms of pieces of information and also in terms of that temporal duration of the stay of information.

Now two things are very interesting in short term memory, say for instance if you are given a list, a list which has say 20 names of people who can be your friends, you are told the list, you here it and then you are told to remember the nomenclature say for example, I Ramkumar, Vishwakarma, Pradeep Kumar Sinha, Arun Kumar Singh, Vishwanath Kumar Sharma, I keep on telling you names or the way the psychologists have done in terms of their experimental work.

That they have taken alphabets combination of meaningful and then nonsense syllables both in increasing order of difficulty, for examples h e he these are two alphabets he is a pronoun, s h e she three alphabets, but it has a meaning. So, the difficulty level has changed, from two alphabets he two, she three alphabets, then I say h o m e home; so 1 2 3 4 alphabets, so 2 alphabets, 3 alphabets, 4 alphabets.

So, with increasing degree in the list you also increase one alphabets therefore, this is called as a hierarchical difficulty level. Similarly if I make nonsense syllables I just put alphabets which has no meaning x t two alphabets and I compare h e he versus x t, the second alphabet was say the second word was she, now s h e and I say x t p, the third word was home which had four alphabets and I say x l z p. It has been realized whether you use meaningful words or you use nonsense syllables, two effects will very interestingly come forward and these effects combined they are called as serial position effect.

So, the position of the meaningful word or the nonsense syllable in the series, this is called serial position effect and serial position effect will have two things, primacy effect and the recency effect. Primacy effect the effect the recall of the items, which are presented in the primary stage in the initial stage that is the primacy effect if I start with the he-she home and go up to knowledge government statistics, the longer ones then you realize that the words which are spoken in the beginning they have a better recollection why they have a better recollection because you were mentally ready for the test, you knew that certain words will be presented to you and you will be asked to reproduce it.

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Short-Term Memory

Serial-Position Effect

- Primacy Effect: Better recall of items at the beginning of the list.
- Recency Effect: Items encountered most recently are remembered well.

Then the words that come in the center, they have known the adverse effect in terms of recollection, but then the words which came towards the end, before the test terminated in your asked to recall the word those words also have a better probability you are being recalled and that is called Recency effect. Why? Because these were the item that you encountered most recently and because it was encountered very recently therefore, the chances of it being recollected is very high fine.

So, primacy and recency effects, these two are known very much dominantly found in short term storage. In the combined order, both these effects are called as serial position effect.

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Short-Term Memory

- Primacy effect is observed during delayed recall because the initial items get time to be put into LTM during the presentation of stimuli.

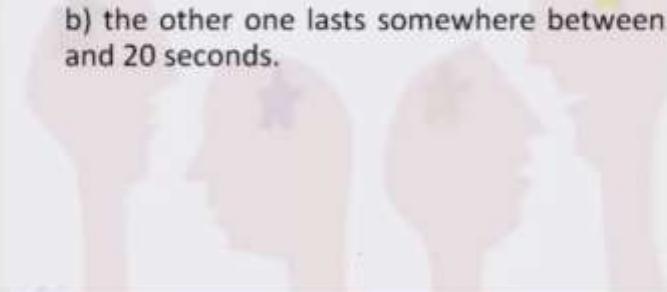


Now, primacy effect is observed during delayed recall because the initial items they get time to be put in the long term during the presentation of the stimuli. So, there is a possibility that although we say that this is something that you find in the short term storage there is a possibility that the information might trickle down to the long term storage as well. In terms of short term auditory memory there are now evidence for two short term auditory storage.

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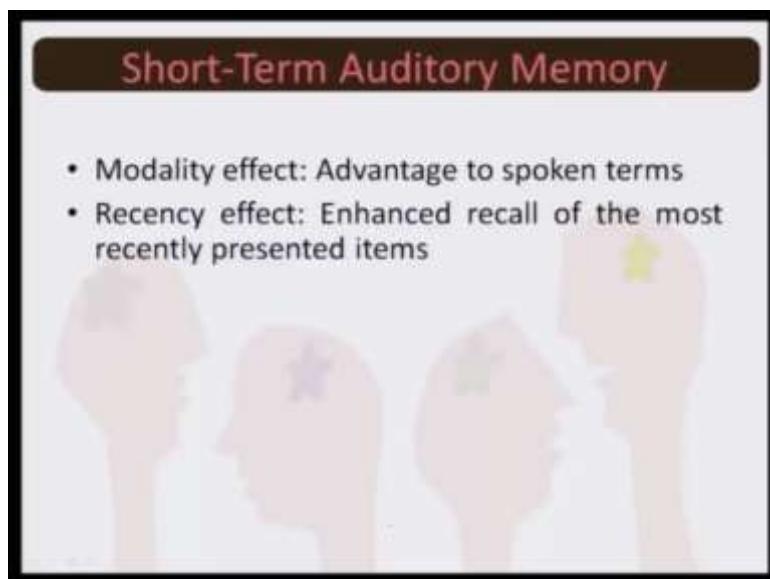
Short-Term Auditory Memory

- Evidence for two short-term auditory stores-
 - a) one operates over a timescale of 150-350 milliseconds
 - b) the other one lasts somewhere between 2 and 20 seconds.



One which operates over a time scale of 150 to 350 milliseconds and the second one which basically lasts somewhere between 2 to 20 seconds, again you find that even though it is now more acoustic in nature, there could be a possibility, that there could be two different auditory storage system that is working, but remember one thing because we are on an introductory course we are also on a brief introduction to this very course. Therefore we will not venture into the details of all these things. There is also something called modality effect and recency - effect recency we have already discussed,

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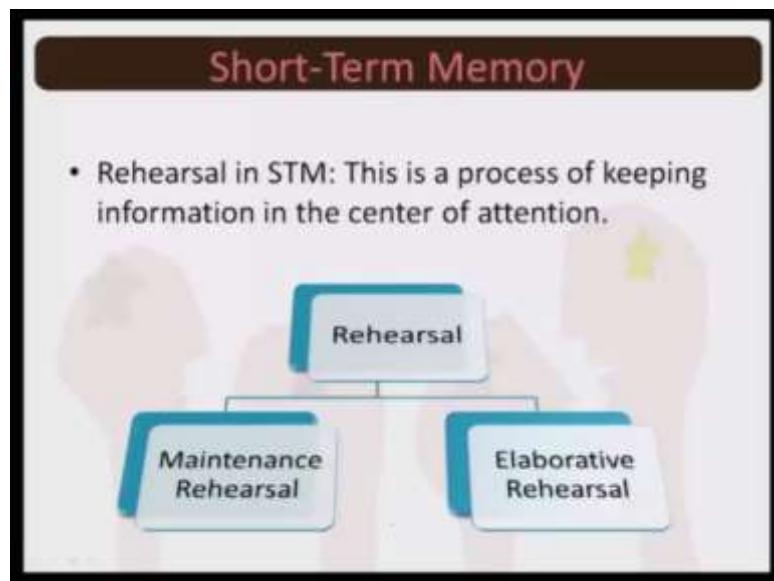
But in terms of auditory memory there are also advantage to the spoken words know. So, the modality that has been used for inducing the information, for sending the information to short term storage and the nature of that very single is something that also places it is role in terms of short term auditory memory. Now what is very interesting in short terms storage is that there could be a possibility of rehearsing the information. Why there is the possibility of rehearsal? Because the information has come and unlike the sensory storage, you have the possibility of storing the information for approximately somewhere up to 30 seconds.

Now, before you understand what rehearsal means and what the two different types of rehearsal are, understand this information by recollecting one of your past experiences. I am just trying to state a situation and you try to recollect something that you had experienced in the past. Say you look at telephone number in the directory 2 5 9 7 0 2 4

that is the number that you read in the telephone directory and then you start moving towards your say drawing room, where the handset is kept. The telephone directory was put somewhere else the telephone handset is put somewhere else and what you have to do is to remember this number till you dial it. So, what we do usually we remember 2542592592597024 - what are we doing remember we are chunking the information.

So, 259 forms one chunk, 7024 forms the other chunk and then once you come to that handset and you dial 2597024 the moment you have completed the dialing you forget the number that you have tried to store for that period. You knew that the significance of this storage is only till you successfully dial the number. You were rehearsing the number, but what you are actually doing? You were rehearsing because you wanted to retain information only till you could successfully dial it. This is called Maintenance Rehearsal.

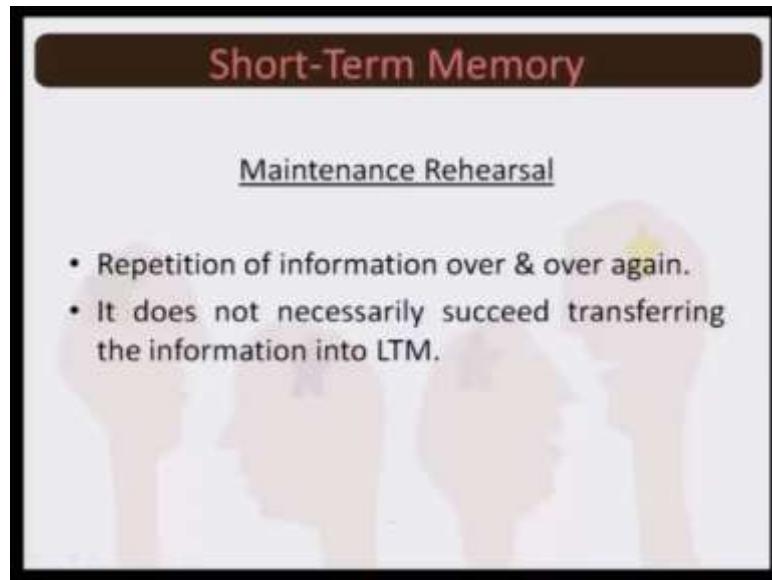
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You are maintaining the information till the goal is achieved the goal is to dial this number, that is it. The second set of rehearsal would be when you go for more and more of elaborative expansion of it. So, you receive the information and then you start elaborating it. So, while rehearsing it you try to understand who this man is and in what way is he related to my father? Why is he is that my father has asked me to convey this to him over phone? His name is exactly the name of a neighbor of mine who have also been a good friend of my father. He was we are now stretching that information know. This rehearsal now is becoming elaborative in nature.

Therefore in short term there is a possibility of a rehearsal, which could either be maintenance oriented or it could be elaborative in nature. If it is elaborative in nature we say it is elaborative rehearsal. If it is only for given period of time then it is called Maintenance rehearsal and rehearsal plays an extremely important role in short term storage.

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Now, in maintenance rehearsal the repetition of information is seen over and over again, but it does not necessarily succeed transferring the information to long term memory. Whereas, in elaborative rehearsal there are chances that the information will be transferred to long term storage. Compared to maintenance rehearsal in the case of elaborative rehearsal, the organization is done of the given material in terms of providing meaning to it while it is being rehearsed?

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Short-Term Memory

Elaborative Rehearsal

- Organizing the given material & giving meaning to it as it is being rehearsed.
- This helps in fitting it with the existing organized LTM.

So, you are rehearsing it, but you are also trying to give meaning to it and therefore because meaning is being assigned, therefore it helps in fitting this very information. Get the information that already exists in our long term storage. Because the information is now put in hierarchy it is put in a meaningful order therefore, it resembles to the pattern that suite to the long term storage. Therefore elaborative rehearsal is bound to push the information towards long term storage. Pushing information towards longer storage memory means that the information will now be available to you even after the lapse of 30 seconds duration.

The concept of chunk that we talked about 7 plus minus 2; 7 minus 2 will be 5 and 7 plus 2 will be 9 you remember in chunk, we said 5 to 9 chunks can be stored. So, this is basically the outcome of 7 plus minus 2 this is called Magic number, because this allows the information to be ordered in the form chunks and this chunk, combination of it can be stored with us for a relatively longer period. So up to 30 seconds maximum of 9 chunks and if you combine them together, then this helps us a lot in terms of arriving at a decision.

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Short-Term Memory

- 7 ± 2 Chunks of memory can be kept in mind at a time and combined to make a decision.
- The size of the chunk varies greatly between experts and novices.
- Experts can combine many memory units to a whole (e.g.- master chess players retain a series of moves)

Now, the size of the chunk varies greatly between experts and novices . Especially if you compare now let us say children, then they try to memorize number, telephone number, the ten digit mobile number for instance, they usually do not show the tendency of now making chunks of 3 or making chunks of 4, but gradually with little more experience we all start doing that, even children start doing that, but even though we might have grown up, if you take adults, who are not say chess players and compare with say chess masters, you would realize that chess masters have much better memory and then use span of memory like anything because they have to retain a series of moves.

So, you need a very good storage system that helps you recollect what was the step that your opponents had taken in a series and this will help you anticipate what could the probable movement of your opponent if you make this type of move and again studies show that experts can combine many memory units into a whole if they are master of that very field compared to if somebody is just beginner.

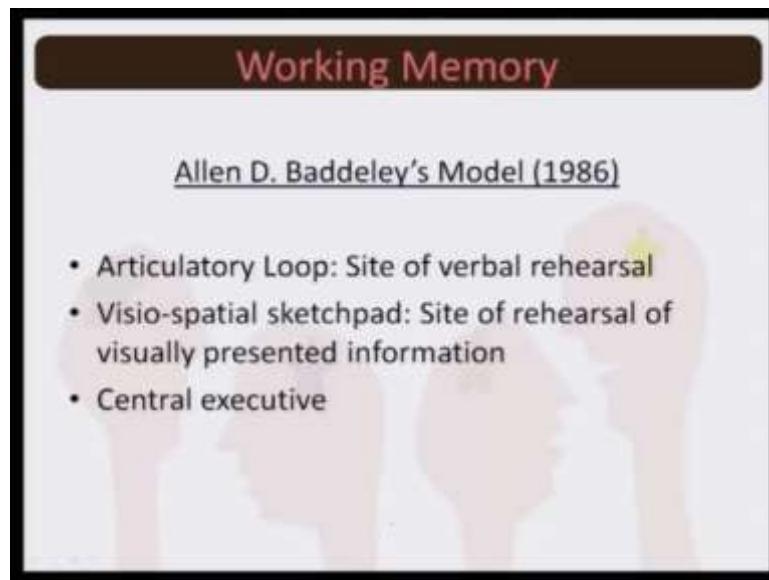
Another interesting concept that was introduced to short term memory was the concept of working memory given by Allen Baddeleys Model. Allen Baddeleys model talks about 3 things - Articulatory Loop, The Visio-spatial sketchpad and the Central executive.

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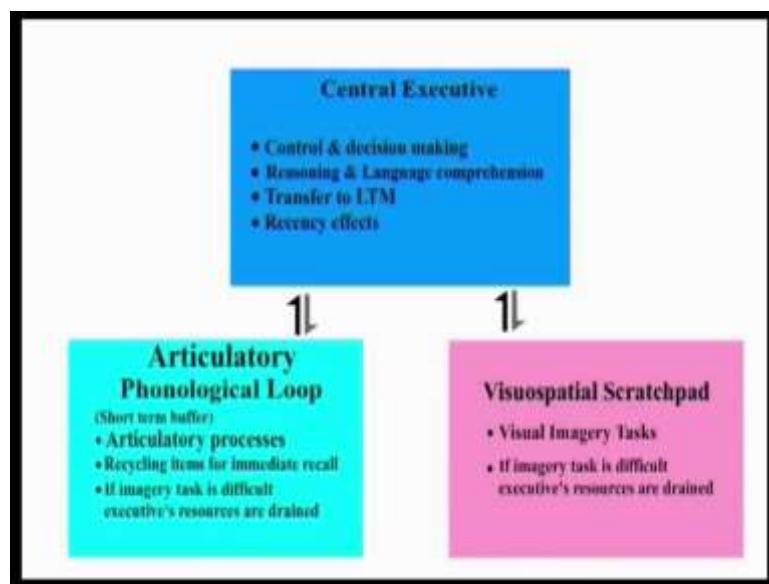
Working Memory

Allen D. Baddeley's Model (1986)

- Articulatory Loop: Site of verbal rehearsal
- Visuo-spatial sketchpad: Site of rehearsal of visually presented information
- Central executive



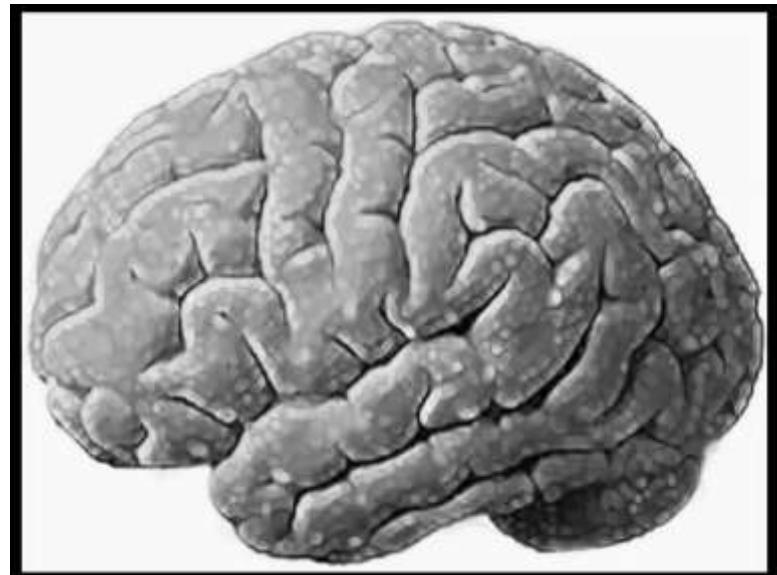
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Allen Baddeley's model of working memory comprises of 3 things, Central executive, Articulatory loop and Visuo-spatial sketchpad. The central executive as a control over things and plays role in decision making, Reasoning, language comprehension and transfer of information to long term memory are the tasks that it controls. Recency effect also a function of the central executive. The central executive depends upon articulatory loop it is also known as phonological loop. It is the short buffer where verbal rehearsal takes place. The articulatory loop recycles items to facilitate immediate recall. The central executive also depends upon Visuo-spatial sketchpad, it is also known as Visuo-

spatial sketchpad as I told you and it has do with the rehearsal of visually presented information.

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This animation shows you the location of working memory in the brain. This is the area twelve of the brain and is responsible for object related working memory. Close to it is area 47 which is responsible for face working memory and this is area 46 and it is responsible for special working memory.

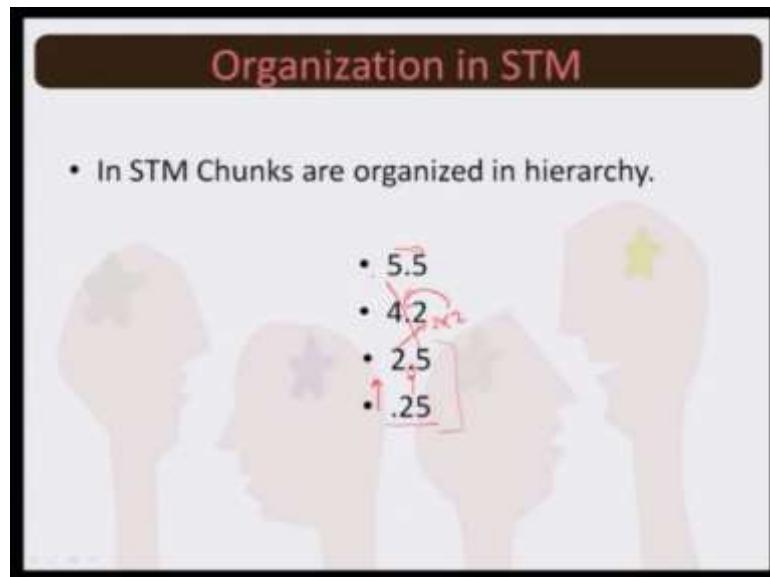
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Working Memory

- Working memory consists of several subsystems for various types of tasks rather than a single general capacity.
- Working memory in a specific skilled activity increases as one aspect of acquired skill.

Now, working memory basically consists of several sub systems of various types of tasks rather than single general capacity. A working memory in a specific skilled activity increases as one aspect of acquired skill.

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What is also very interesting to know is that the information the chunks that we form, they are organized in hierarchy in the short term memory. If you try to disorganize it then storage becomes problematic.

Now, you see your screen. You see 0.5. 5 the moment you go up, you realize that the decimal place has changed now it becomes 2.5. Now you can use different strategies to memorize this information, but one interesting thing could be that you realized that the first number was 0.25, then you realize that this moved up and the decimal position changed. So, basically you remember only one set with repositioning of the decimal point and then you say that this very information, this is how it moves. So, 2 moved to the third position it became 2 into 2 which was 4 and this 5 moved to the top and this was repeated. Now you just organize things like that and then you realize that remembering this information is not at all difficult, but if you do not organize information in the hierarchical order recollecting it becomes very difficult, retaining it becomes difficult.

So, whether it is elaborative rehearsal whether it is maintenance, both will have problem. Maintenance of course, you will have problem because the numbers are not, what we

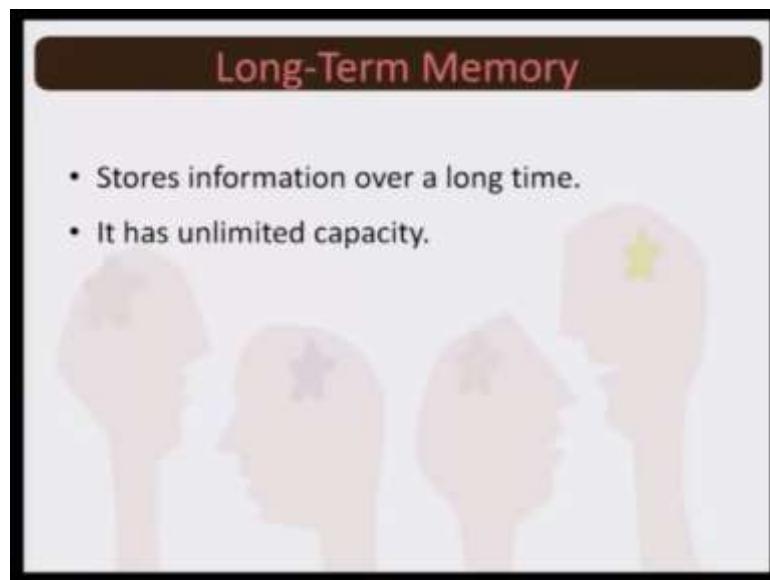
call arranged in hierarchy rather they are more random based. If you go for elaboration then elaboration by default when it try to make it little more meaningful thereby try to arrange it in hierarchy.

So, with this we have completed our discussion on short term storage when we meet next in our third lecture we would be talking about long term memory.

Lecture - 19
Memory Long term Memory – Episodic Memory

Now that we have discussed sensory and short term memory we would now exclusively focus on long term memory.

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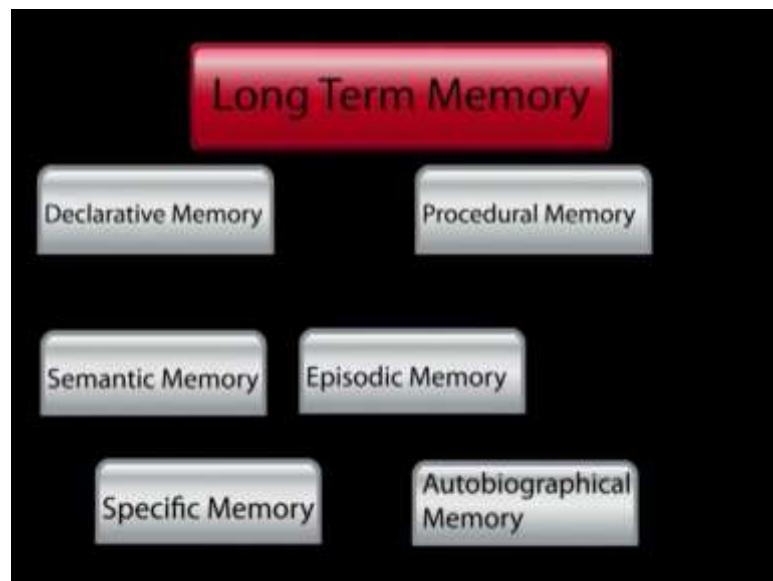


Long term memory basically refers to the fact that the information is stored for very very long period of time. Remember the terminal duration for short term memory was 30 seconds. So, if you are able to store the information and retrieve it even after lapse of 30 seconds time that means, the information has now traveled to long term storage. In terms of sensory memory and short term memory we did talk about the capacity what would be the maximum capacity of this specific memory type. We said 11 to 16 items in the case of iconic memory, similarly we said that fine even if you try to chunk the information at maximum of 40 bits of information can be stored in short term storage.

In terms of long term storage there is nothing like the maximum possible limit of the

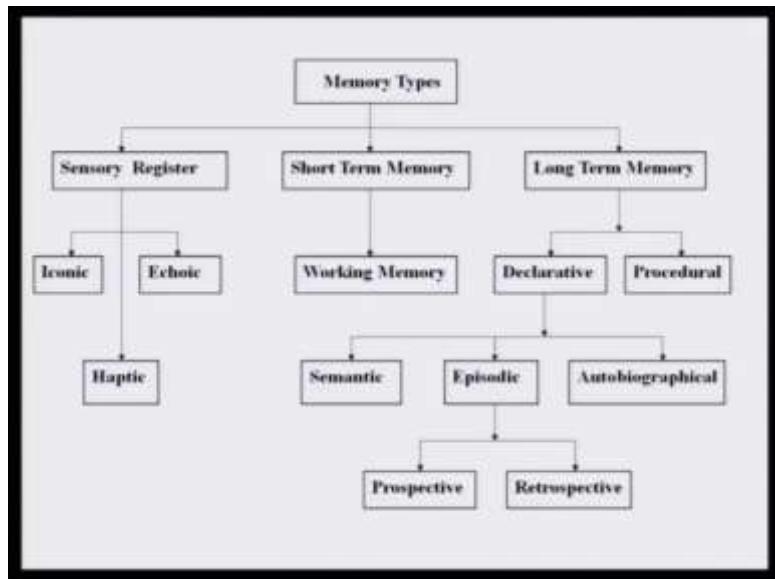
long term storage, unlimited storage for any period of time that is the most vital thing about long term storage, long term memory.

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Now long term memory can be of two types' of declarative memory and procedural memory. And declarative memory can also be divided into semantic and episodic memory. And further episodic memory can be specified as specific memory and autobiographical memory. Based on the discussion that we had till now and if you add little more to what you saw right now.

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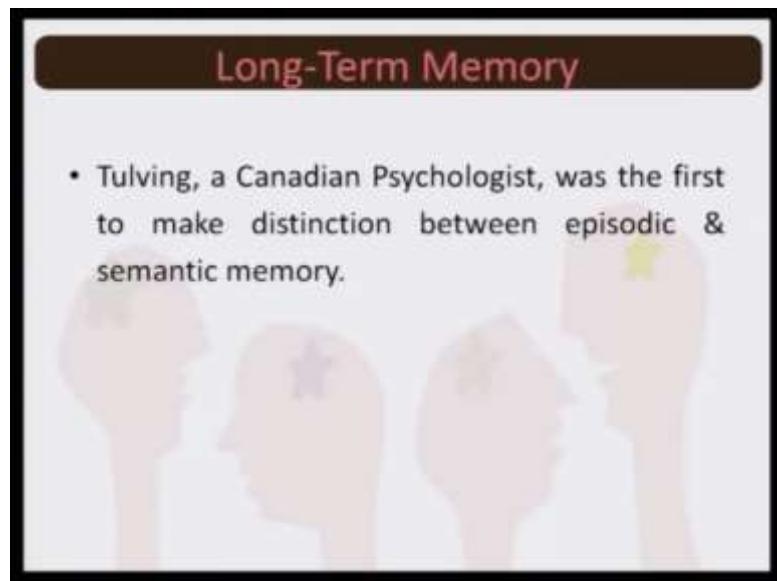
We primarily divide memory into sensory register short term storage and long term storage. Sensory memory we talked about iconic and echoic memory. And we did refer to haptic memory saying that now mostly iconic and echoic memory that has been researched well and therefore we talked about it at length. Within short term memory we also had the discussion about the working memory.

Now, long term memory you can divide it into declarative and procedural memory this we will come to it little later. The other when you look at memory in terms of semantic memory, episodic memory and autobiographical memory. Further, episodic memory can be divided into prospective and retrospective memory. What we would do right know is that we will start with episodic memory and then we will know move towards different different other types of long term memory that we are looking at in the chart right now.

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Long-Term Memory

- Tulving, a Canadian Psychologist, was the first to make distinction between episodic & semantic memory.

A faint, semi-transparent image of a human brain is visible in the background of the slide.

Canadian psychologist, Tulving was the first to make distinction between episodic memory and semantic memory.

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Long-Term Auditory Memory

- **Memory for language:** Meaning are stored rather than sound.
- **Memory for music:** Information pertaining to contour and pitch interval, both are retained.
- **Memory for voices:** Reasonably good voice recognition of familiar person compared to strangers.

A faint, semi-transparent image of a human brain is visible in the background of the slide.

Now, if you look at the way information is stored and the way the information is recollected you will find very interesting thing about human beings. We have very good

memory for language, we have very good memory for music, and we also have very good memory for voice.

Now, memory of language would primarily mean the storage of the meaning rather than the sound. In term of music information pertaining to contours and pitch interval both are found to be retained in our long term storage. In terms of voice reasonably good voice recognition is possible for us. When we come across familiar people, but for strangers we do not have such good voice memory. Say for instance, if you hear the calling sound of your parents, if you hear the calling sound of one of your siblings, you would very easily find out recognize just on the basis of voice that this is the calling sound of my father or my mother or my brother or my sister, because we have very good memory for voice of familiar people. Listen to this very music.

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Look at the clip to see and actual attempt by a child to memorize a poem. The video that you saw right now presented mother making her child learn to sing a nursery rhyme. Now child was basically picking up the contours and he was trying to copy the melody even though the exact word was not known to him and this was of course meaningful for the mother, but it had no meaning for child except for he was enjoying the music the rhythm that he was trying to imitate.

Now, after the lapse of this episode when the child was grown and mother was asked to narrate some of the significant moments that she remembers about her own child, she could exactly remember the words that this child used to use. She especially had a recollection about this very episode wherein she said that how the child used to sing and what type of words he used to use and how he is used to repeat imitate the rhyme.

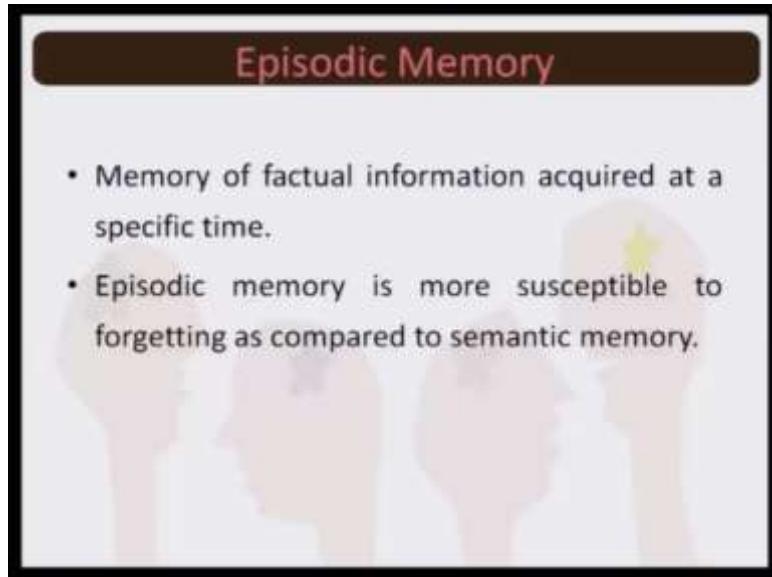
So, this is fantastic thing about the human memory system. We have very good recollection of the voices, the music, the language and depending on the personal significance of this issues our memory become very very very good for this episodes. Now episodic memory represents experiences and it is basically a memory of events, but these event are recollected in a serial from. It is just like a television serial which is broken into several episodes. So, we have the record of our past experience and all these daily experiences of the past they are broken into episodes. Therefore, it is called as episodic memory.

So, when you recollect you say I still remember my first day in school. I still remember when I delivered the first lecture on camera; these are episodic memory.

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Episodic Memory

- Memory of factual information acquired at a specific time.
- Episodic memory is more susceptible to forgetting as compared to semantic memory.



Episodic memory basically also is the factual information that is acquired at a specific

time. So, remember time plays an important role here, it becomes an anchor here. Therefore episodic memory is more susceptible to forgetting as compared to semantic memory, because in the case of semantic memory it is meaningfulness that is given utmost importance, whereas in the case of episodic memory it is the fact at specific time that is given importance.

Therefore, even in terms of recollection we do commit certain errors. Right now we will see one of the those examples; if one is asked to recollect and reproduce fact related to particular event that had happened at a specific time period we do go ahead with distorting it. So, part of it is recollection but we realize that whole lot of distortion does take place in recollection of episodic memory.

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Eyewitness Memory

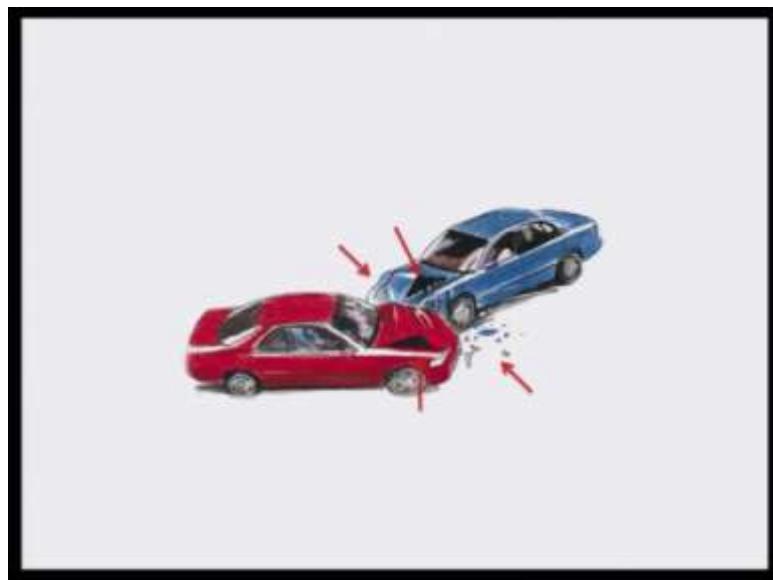
- A form of episodic memory pertaining to specific event.
- Is of forensic importance
- Vulnerable to distortion
- Verbal report of event might interfere with visual recall of the event.

One form of episodic memory is called eyewitness memory, it is called eyewitness because it has forensic importance. You must have heard this word there is somebody who acts as a witness in the court of law. So, you provide evidence, you endorse of the happening of something therefore it is called that you are testifying it you are becoming a witness to it. So, when recollection of information which is basically an episode at a specific time period if it serve the forensic purpose then it is called Eyewitness Memory. And of course, it is because one of the forms of episodic memory so it is also vulnerable

to distortion.

Usually, the verbal report of event might even interfere with visual recall of the event. So, what you usually recall when you replay the event the sequence and you verbal translate it to report it there could be little bit of a interference effect there itself

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Look at this very image on your screen, image you are standing at one of the locations on the road and you see collision between two cars. Usually, if two cars are moving at a very high speed the overall time that the entire process of collision takes place would be fraction of seconds not even one second would be complete when this car will come and hit each other and whatever would had to happen would happen.

Now, imagine yourself that you are standing at a specific location from where you saw this accident. So Focus yourself on this screen right now, see what actually gets distorted. After the lapse of certain period of time you are asked to recollect what you actually saw. Now you see, when you construct when you mentally replay the story what you saw was this but when you mentally replay it you add certain flavor to it. Now all this arrows show this are the addition that you have made so as to suit the recollection make it much more accurate, but while trying your best to make this story far more

accurate actually what you have done is that you have distorted it. This is an interesting aspect of eyewitness memory.

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November 26, 2008 would always be remembered in the history of India because of what is called as Mumbai attack or 26/11. When hotel Taj one of the sites in Bombay became the target of terrorist attack.

November 26 2008; now, that this episode took place in hotel Taj let us look at this event from two viewpoints; an NSG commando who participated in this event in the anti terrorist movement operation that was held in hotel Taj, how he recollects the information. And somebody who was part of it and got a chance to come out of the hotel, how he recollects the information. This is pure demonstration of episodic memory. That specific time when you were in hotel Taj performing the commando operation, what happened to you listen to this.

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Mr. Amit the manager of Shamiyana restaurant in hotel Taj also was a witness of this episode. His episodic recollection varies from recollection of the commando whom you heard right now, because although time was the same the episode that was taking place for Amit was different from what took place for the commando. Listen to what Amit had to say later on.

Besides hotel Taj CST station in Bombay also was one of the sites where the terrorist had attacked and killed lot many innocent people. Sebastian De souza the photo journalist was available at that time, he was present there he clicked numerous photographs and it was through the lens of Sabestian Dsouza that next morning whole lot of Indians they realized what actually happened at the CST station. Now when Sebastian Dsouza was taken back to CST station and was asked to recollect the episode that took place that evening this is what he had to say.

We are taking lot many examples because we want to understand how episodic memory works. Remember one thing we have discussed that it is time specific, two we have discussed that it event specific. So, event anchored to a given time and then you store it because of the significance that you attribute to it. These are all rare examples, the example of terrorist attack that you took all of them where rare.

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One such rare experience I will also like to show it to you on 22nd May 2010 6:30 in the morning Air India Express flight 812 from Dubai to Mangalore met an accident at Mangalore International Airport. Only eight passengers survived; two of them later on recollected their experience look at this.

Now, what actually you saw here was amazing. The way two passengers who had a very narrow escape who defeated death could actually recollect the tilt of the flight, the jerk that they felt when the flight did hit the ground and what actually happened. They were sitting inside the flight, and they visualized, they recreated the whole sequence of events what actually could have happened there. These are the examples of episodic memory. And of course, these were all examples we all know because they were historic events from the history point of view.

But you recollect your own life experience and you would realize that you would have thousands and thousands of such episodic recollections, because you provide certain specific significance to it. Therefore the whole lot of factors affects episodic memory. First one, of course the significance of the events; besides that amount and space of practice, how much amount of practice has actually gone into storing this very information. If you have practice something more and more the chances are that you

would recollect it better. If there are competing events temporarily two event significant events take place at the same time, what is the temporal gap between first and second event that would also play a role. If both are equally significant and temporarily there is not much of the difference there could be interference. If there is distribution pattern, one event took place at this time and other event took place little later then you get time and space to practice this information and reserve it in the episodic memory.

Second very important thing is the type of processing. You heard Mr. Amit right now when he said towards the end of his interview that life after 26/11 is a grace period for him, this is how he interprets. So, how do you process the experience that is important? The way he process will decide how much of recollection you will have and the level of accuracy with which you will be recollect the information.

Three and more important is also the fact that how do you cue the information that you are storing. It is equivalent to something like giving a file name when you save file in your PC. Say for example, if I have an event today's date I give it as a file and I know that my search will be always be using the date. So, if I have to find out what happened at this point in time I just search for the file name that has to do with this date, there could be a situation if I give a file name not by date, but by event. If I have a seminar, whether I have a class, whether I am going for some other invited talk give different file names.

Similarly, say I am sure when you store photographs on your PC you create a folder and you give name to the folder. For example, if you have gone to say any tourist place, say you went to Agra you make a folder named Agra. You came to Kanpur and give a folder name Kanpur. Photographs of Agra are stored in or the folder Agra, photographs of Kanpur are stored in the folder named Kanpur. And this is relevant cue that you are giving to yourself because next time if you have to look at the photographs that you clicked in Agra you will go for the folder which has the name Agra.

All episodes whether it is the code that you give is the time and you say I remember when I was at CST station in the evening at this time waiting for this very train which has the departure time at say 6 o clock and 5:58 was the time when this accident took

place, when this episode took place. So, this walks as a retrieval cue. Better and more efficient the retrieval cue far more the better it would be and convenient it would be for you to recollect the event. Also information the recollection will be very very accurate because retrieval cue is correct.

Of course, we have been talking about significance. So, episodic memory is bound to be context dependent. In which context did this happen. So, when you recollect the information in what context are you trying to recollect the information? So, if there is a match in the context, in which it was stored and in which you are trying to retrieve. More and more is the match between the context; higher is the probability that you would recollect it better. And of course, besides context it is also the state which plays a role. So, retrieval of state memory is also the state dependent.

In what mood state you are when you experience this. So, you were at a given point in time on the station when the terrorist attack took place and when you recollect the experience it is also the state in which you are. The emotional arousal that you experience at that time later on when you are about to you are told to recollect your emotional arousal also plays an important role. Experience, the emotional experience at that time the emotional experience at this point in time; how charged you were there at that point in time and how charged you are at this point in time. If these two overlaps, it will work as a fantastic retrieval cue.

So, what we have discussed, event specific time specific; so event at a given time recollected as one segment forms the episodic memory. We have seen good number of examples of episodic memory. The time of practice, the space between two events that take place, how much of processing, how we try to store the information the file name that we try to give and of course the state and the context in which event happen and in which the recollection is being made. So, these are the prominent factors that affect episodic memory.

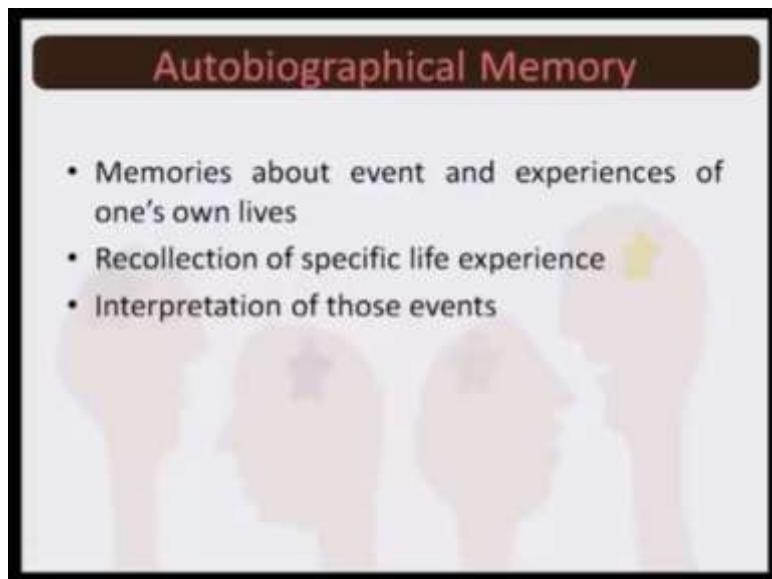
Key words - long term memory, episodic, eyewitness, semantic

Introduction to Psychology
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Lecture - 20
Memory Long Term memory- Autobiographical & Semantic Memory

Let us now, come to another form of episodic memory, what is called as autobiographical memory as the name itself suggests autobiographical memory has to do with events or experiences of one's own life.

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So, what happens when we have certain recollection of a specific life experiences, when you interpret them and you considered these are the events and experiences that defines you your life. So, it somewhere like your personal life narrative that constitutes the autobiographical memory.

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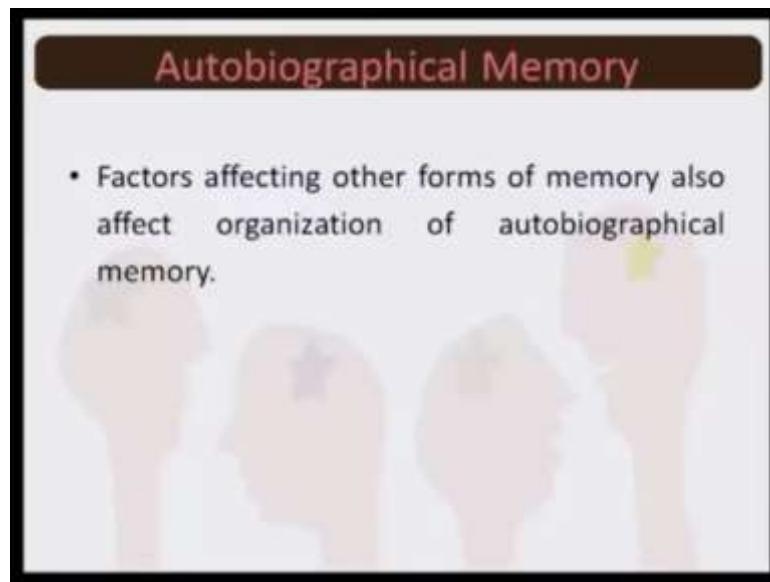


Usually autobiographical memory has the imaged based personal memory of unrepeated events of the life of the individual, but there is also a possibility that it might have facts similar to the personal memory; however, in this case it would be not imaged based and therefore, the generic personal memory of the repeated events that can also become a part of autobiographical memory.

So, one, we have the un repeated personal events something that happened only ones, but it was extremely significant for the individual concern and you have a very clear image based personal memory of it one single event highly personally relevant, and you know that such events will not be repeated in life likelihood is very little because of it, uniqueness still we have the image based personal memory of it the second aspect what we discussed was that there could be non image based memory also of facts that are similar to personal memory.

And third we also discussed there could be repeated events of the generic personal memory and therefore, when I remember my name, the name of my parents other members of family, friends, their family members and many of those things which has connection to the self they are considered as part of autobiographical memory.

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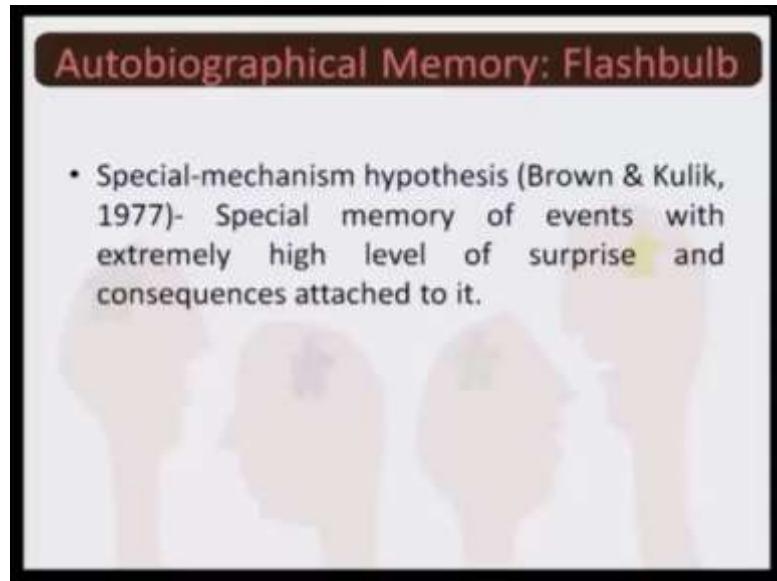


And therefore, the factors that affect other forms of memory they are also suppose to affect the organizational process of autobiographical memory one interesting thing you will find in autobiographical memory what is called as infantile amnesia. Amnesia Of course is not the normal sequence of forgetting of events it is a disorder, but infantile amnesia is considered to be perfectly normal what happens in this case.

Let us take of our life event and then try to understand what actually this means, if I ask you to go back to your earlier periods of life and recollect event, significant events till whatever period you can go back to and usually majority of us will have a recollection of some of the significant events say when you are 5 years old 4 years old, but only significant one's many day to day experiences will not to be recollected simply because we have cross substantial period of time from that various stage.

Therefore, the life events in the first few years usually up to 3 years the chances are we as human beings we forget we completely forget and even there after although we have a memory of it we have re-collection of only significant events not everything this very inability of us not to be able to remember of events of the first 2, 3 years of life is called infantile amnesia because it has to do with the earlier period of life. Therefore, it is called infantile amnesia is of course, forgetfulness, but remember in infantile amnesia is not at all considered to be abnormal it not a pathology although we find a word amnesia.

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And interesting aspect of autobiographical memory is what is called as flash bulb memory there is you know a mechanism is called special mechanism hypothesis is brown and Kulik brown and Kulik they proposed hypotheses called a special mechanism hypotheses which says a that special memory of events which has extremely high degree of surprise and consequences attached to it, they have a better memory.

So, if there is something which has heightened degree of surprising embedment to it or the consequence was something that is unforgettable the chances are let we will remember that is specific movement and that is called as flashbulb memory now flashbulb memory is basically just one type of autobiographical memory.

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Autobiographical Memory: Flashbulb

- One type of autobiographical memory.
- Recall of location, date, time, and imagery.
- Vivid snapshots of moments and consequences.

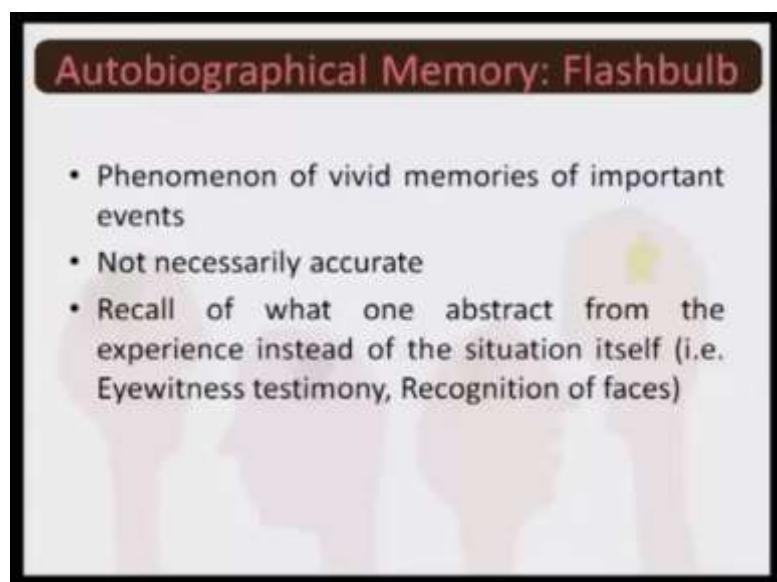


Now unlike the episodic memory that we discussed especially the eye witness memory in flash bulb memory it is basically recall of location date time and imagery and what do you have we have a vivid snapshots of the moments and consequences. So, surprise has to be there the consequences has to be there and therefore, where did it happen what time what was the date and the image which is base on snapshots of the sequence of the event that what constitutes flashbulb memory.

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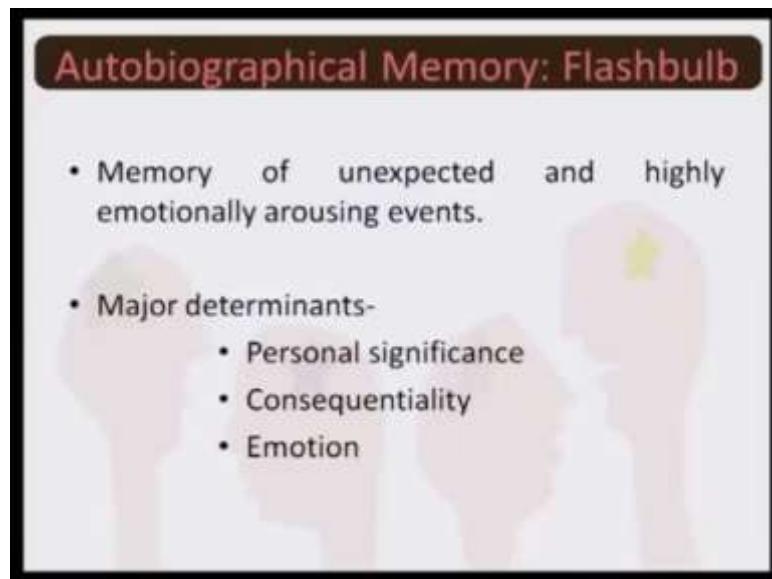
Autobiographical Memory: Flashbulb

- Phenomenon of vivid memories of important events
- Not necessarily accurate
- Recall of what one abstract from the experience instead of the situation itself (i.e. Eyewitness testimony, Recognition of faces)



Therefore flashbulb memory as phenomenon of vivid memories of important events, but once again just similar to eye witness memory, it is also proven to distortion therefore, need not be accurate in nature.

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Usually in flashbulb memory it is expected that you will always have memory of something which was unexpected therefore, there is an element of surprise here and because surprise is one of the basic emotions therefore, the unexpected surprise come into that very event also emotionally arouses you. So, therefore, the event has high degree of emotional arousal attached to it and therefore, it becomes a part of flashbulb memory.

Three things are important for flash bulb memory one the significance of the event how the personally significant the event is to you 2, what was the consequence. So, more dire the consequences the higher the chances will be remember why because things which as higher consequences dire consequences will you know induce a high tend of degree emotional arousal within you. So, these three things becomes major determinates for flashbulb memory.

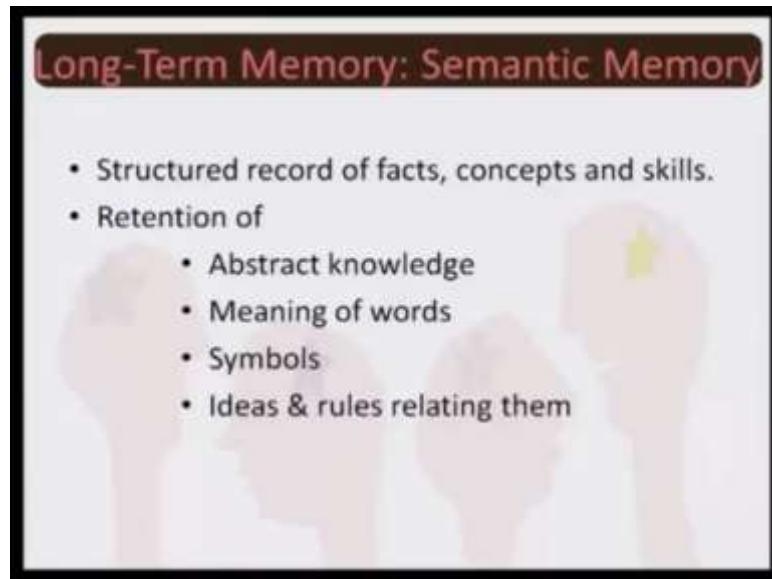
Look at this sick lady who experienced violence twice in her life once, in nineteen forty seven she was young and India was divided into two-half's India and Pakistan and again in nineteen eighty four when the anti-sikh riot took place in India [FL]. One of the national geographic programs, one Vietnam war photographer is introduced he was

shown his own photographs and asked to recollect rethink years after the passage of the war what actually was taken place what happens to him. Look in this video.

I feel it. So, how pretty sad make this pictures is very difficult when you took this pictures and do you have this pictures [FL] [FL] this is a heart hitting picture [FL]. Now if you look at these two videos in the first case the women in at position to recollect her experience what time of the day what did the police men say and making a comparison between the two experience of communal violence.

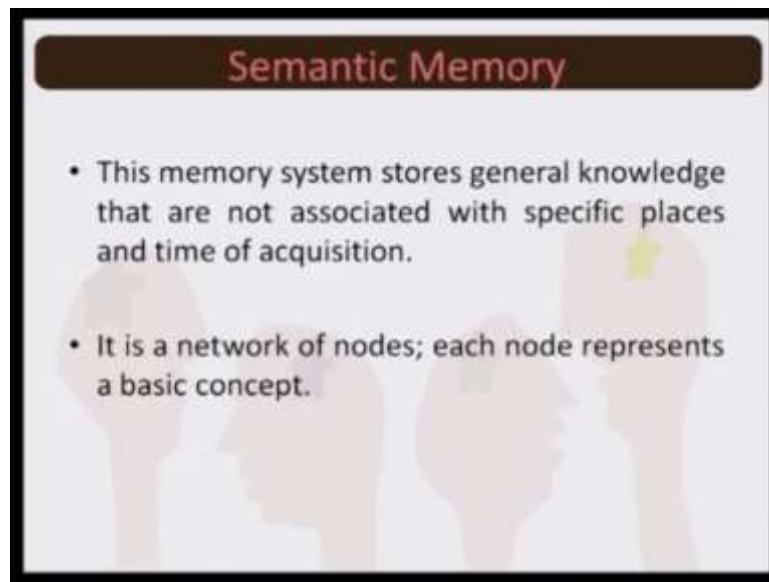
In the second event, although this photographer considered the event to be significant event to recollect when he reexposed to his own photographs the consequence of the war the emotions over powers his memory. Therefore, the three things which we discussed right now the personal significance of the event the consequence of the event and then the emotional arousal attached to the memory of the event, these three things become extremely important as far as flashbulb memory is concerned. Having discussed episodic memory the flash bulb and testimony, we shall now discuss semantic memory semantic as we referring to it means meaning fullness therefore, the structured record of facts the concepts the skills these constitute the semantic memory.

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So, it is basically the retention of the abstract knowledge meaning of the words symbols ideas and rules that govern there.

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So, this memory system basically stores the general knowledge that are not associated with specific places and time of acquisition remember in the case of episodic memory time of the event a consequence the location these were important parameters on the bases of which the whole sequence of which event was broken into episodes. Given what you call that association with personal significance and with the forensic significance we further divided into sorry with eye witness and flash bulb memory whereas because semantic memory as to do more with the concepts the rules that are governed the words that are represent them. Therefore, they are supposed to be basically free from the time of acquisition and the place, the location in which you learned this.

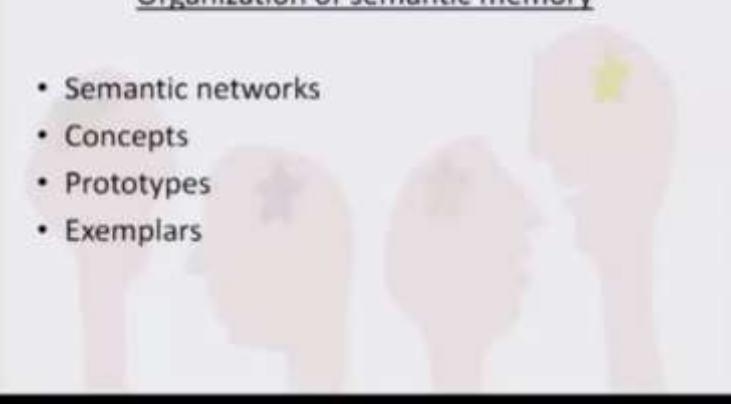
Therefore basically what happens here you have a network of nodes and each of the nodes, they represent the basic concept the more and more you spread the network higher and better is your semantic memory, the much better is the understanding of yours with respect to that specific concept.

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Semantic Memory

Organization of semantic memory

- Semantic networks
- Concepts
- Prototypes
- Exemplars



There are four important things in semantic memory, they play important role in organizing the content first is the semantic network we talked about nodes and network that is formed we will talk it about again. So, semantic network concepts, the prototypes and the exemplars. So, we will talk about all four of them 1 by 1.

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Semantic Memory

- Semantic networks: It is the knowledge representing meaningful relationship among concepts.

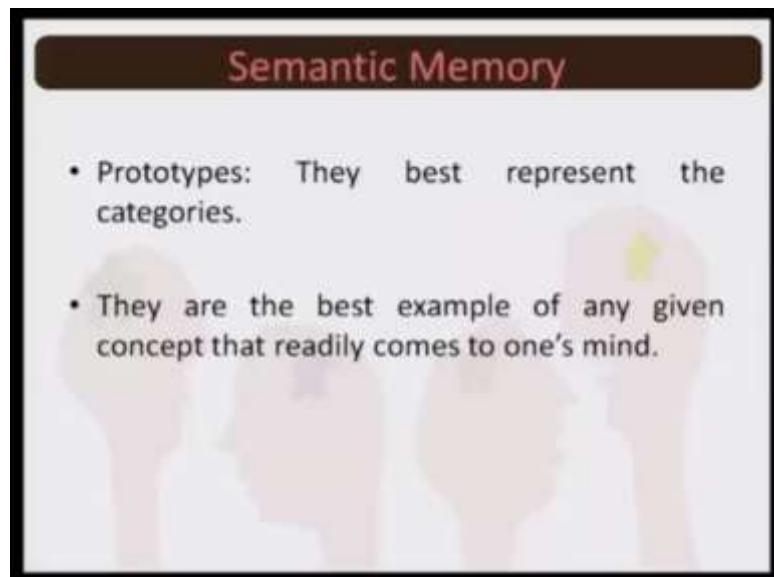


Now, semantic network is nothing but it is basically knowledge representing meaningful relationship among concepts. So, when you think of an animal, the moment you think of animal you consider at animal by default means let it would be living because we have

understood to classify world in terms of living and non living creatures. Now you think if it is say, living then it will definitely which could be a mammal you think of one good example of a mammal, which is an animal, you think of sheep the moment you think of sheep you think it has fur the moment you think of you think other animals also have furs. For instance you think polar bear you connect polar bear is also a mammal which is also animal and the leaving creature polar bear the live on. So, this is how the network expands you have nodes, each node representing an important concept and then you start spreading the network the more and more holistic is the network that you derive and the interconnection let you establish between the different notes the more and more better is your semantic memory.

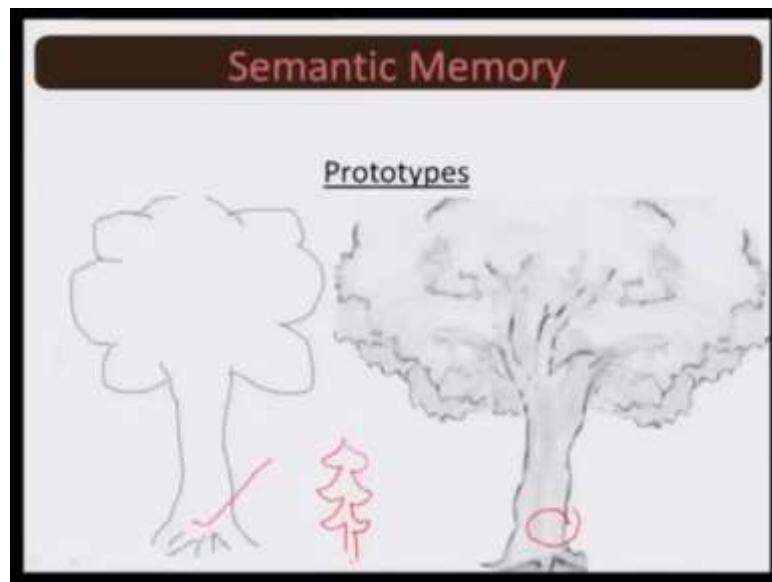
What are concepts? These are nothing, but simple mental categories that are used in organizing the objects or events. So, you think of an object you think of an event and therefore you form a mental category, that is called concept.

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Now, prototypes are the best representatives of these categories. So, they are basically the best examples of any concept that comes to your mind the moment you think of that every concept. Think for instance you are told a word tree, the moment you hear the word tree a representation comes to your mind a mental representation.

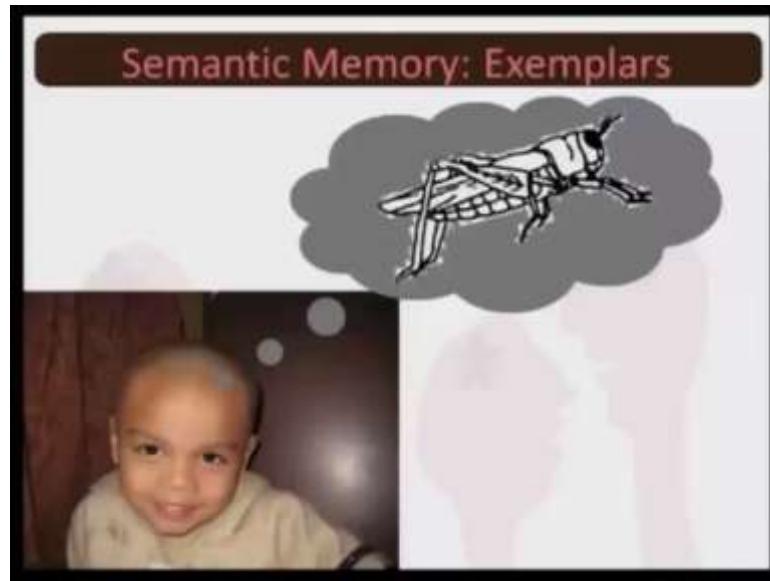
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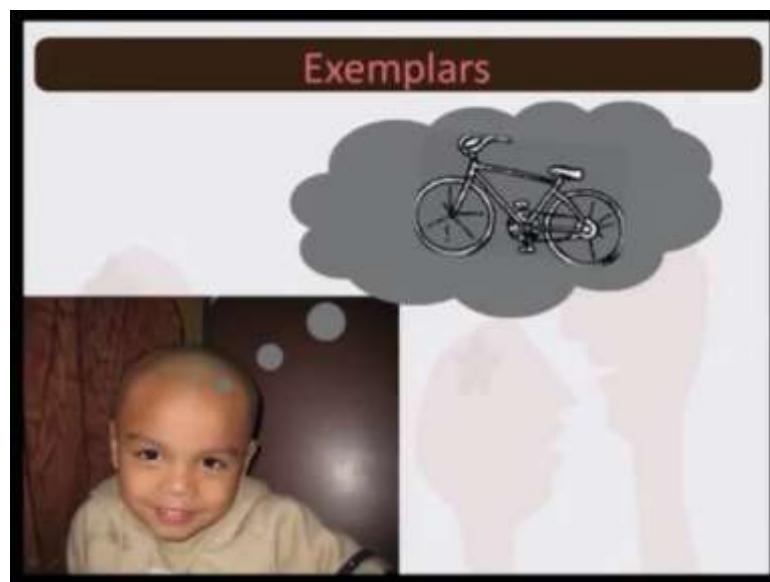
Now, look at your screen in mostly likely wood the line driving at your see of your tree is perhaps the image that you have draw. I have performed this exercise several times in the class room and let me share one thing with you most of the students in the class where I have tried this example who are from northern part of India they usually have know the representation of tree like this actually you have something like this, this very example, but then some of the students who are from the extreme northern side, the mountain area they usually know the they have something like this. So, depending on what type of exposure you have, what type of experience you have of a tree you will have the readymade example the image of that very concept. So, what is called as prototype. The category is told to you and the best example that come to your mind that represents that very category.

Now, tree could be of any thing banyan tree, pine tree, mango tree any type of tree, but depending on the mostly visible tree in your locality, you develop an example mental image that is a prototype [FL].

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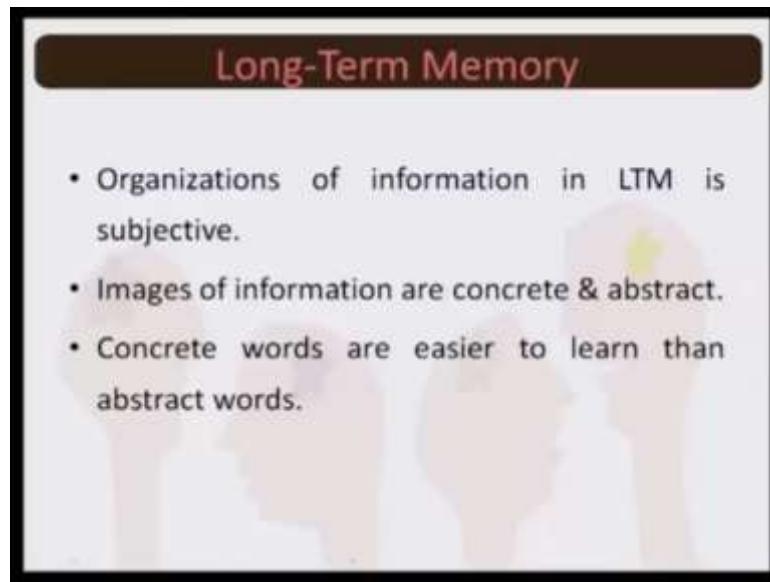
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Now, we come to exemplars, you think of an insect and you have a grasshopper in your mind. So, you think of a bicycle, a mode of transport and something comes to your mind. So, these are again the best example of the exemplars, what happens in the case of exemplars these are once again the best examples that would come to your mind. Now what we have discussed we have the nodes that represents the concepts each of these concepts are interconnected to several other concepts which basically helps you form a network to represent a concept we have a prototype and we have the best example that would try to explain the concept for yourself so that when you look at certain

phenomenon in the world using your semantic network you can think of whole lot of things remember that things are not so crystal clear and things are not presented in isolated way we have discussed here in the example, but then we have to simplify it for our understanding as a living being we cannot live in a complex system where most of the things are you know, you are not capable of interpreting them and therefore, semantic networks plays extremely important role here.

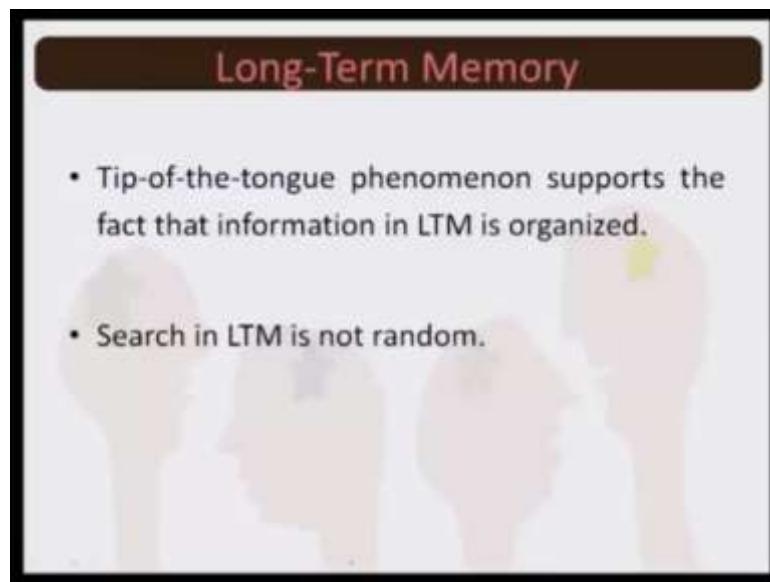
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Now, when we come to long term memory organization of information in long term memory is purely subjective how you would organize it is your choice, is your convenience images of information's can be concrete or it could be abstract. So, if you are told something like say old and if you seen elderly grandparents in your house you will have somewhere an image of what is meant by the word old, if you hear the word brick, if you hear the word pencil, so many of these things will have a very concrete image that it will generate. Many other concepts might not generate concrete images say for instance if you are told you know that there was a king he was very honest. Now, there could be examples of you know what honesty meant, but then honesty cannot create very clear cut concrete image in your mind similarly if you are told that he was a very hard working you can think of whatever type of activity this character was involving in the story and accordingly you can think of, you can intensify the engagement of that individual in that given activity to visualize what it would mean to be hard working in this very scenario.

Similarly if you are told many of those qualifications which are more qualitative in nature like honesty, you have difficulty in creating clear cut images therefore, when we combine these things in long term memory we might have images of the concrete words and we might have certain images which are more and more abstract in nature and of course, because it is like this. Therefore, the learning of, the storage of, the concrete words would be much more easily compared to abstract words..

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Another interesting thing absorbed in long term memory is what is called as tip of tongue phenomenon. Tip of tongue phenomenon basically means that when we store the information and try to recollect it we failed to do. So, although we feel as if things are readily available it is somewhere on tip of the tongue, but it is not making its way out of the mouth and therefore, you are not able to recollect it. So, imagine something like this, snake inside a barrow this is the barrow the snake comes out from the barrow and again it goes down it is something like that you feel as if the event is about to be recollected, you can very easily extract the information from the long term storage. But somehow you keep struggling and you are finally, not able to do, this is called tip of tongue phenomenon and why this does this happen? This basically is a phenomenon which supports the fact that the storage of information in the long term memory is very, very organized. So, if you want to make a random recollection attempt the information will not be viewed be readily available to you. So, if you move in a sequential order in an organized order because information is stored in an organized manner, retrieval

becomes easier because information is stored in the organized manner and you start making random recollection, then you fail to do so.

Key words - autobiographical memory, long term memory, semantic memory

Introduction to Psychology
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Lecture - 22
Memory Forgetting

Now that we are on the last topic, today our focus would be not in terms of how much we succeed recollecting from our memory storage rather we would focus upon the failure in the attempt to retrieve information from the memory that is our focus would primarily be today on Forgetting. We will try to make out why people forget, how much they forget, and issues like this.

But before we come to what and why and how much, let us understand one thing and accept one thing that forgetting is one of the most useful attributes that you can visualize for human memory system. One way of looking at it could of course be that basically the message that has been transferred to the long term memory for certain reasons you have not been able to recollect it which results into forgetting.

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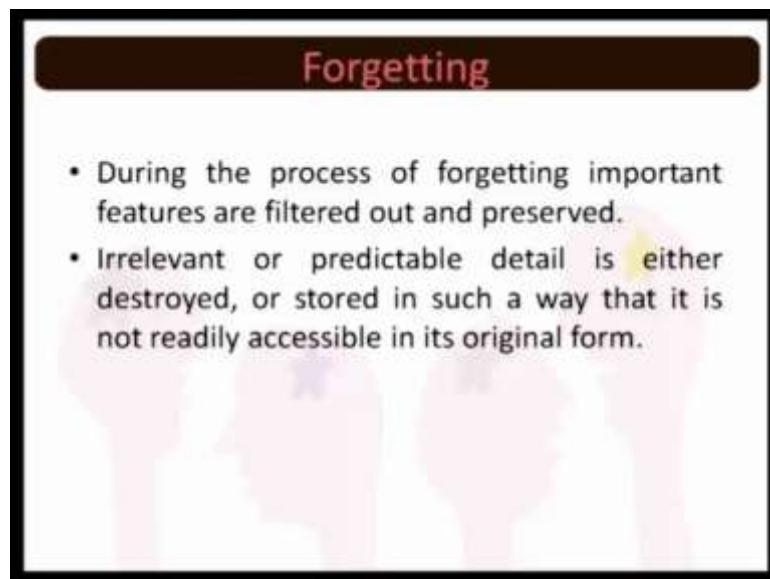
Forgetting

- Forgetting is a very useful attribute of the human memory system.
- Forgetting happens when messages have not been transferred to the long-term memory.
- “Time heals all wounds”
- Obvious benefit- Emotional pain and grief are softened.
- Forgetting also represents distortion of recollection of the past.

But there are obvious benefits attached to it. The most important thing that the emotional pain and grief, they get softened after a passage of time. You must have heard the proverb time that time heals all wounds. So what time does to the wounds? It basically helps you forget what you call the emotional balancing, the magnitude of the grief

gradually gets softened enough. Also forgetting might also represent the distortion of recollection of the past. The truth was something else and you narrate something else, which is completely devoid of the reality. But accepting all these things we must understand the value of forgetting.

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Now, during the process of forgetting, important features are either filtered out or there could be a possibility that they are preserved. Right now we will also refer to one fact that many a times you forget involuntarily and many a times, you forget because you want to forget that thing. Now things which are irrelevant to us or details which are predictable they are either destroyed or they are stored in such a way that it is not readily accessible in its original form. And therefore, when we try to retrieve the information we commit certain error. And this is what people consider that this is forgetting, you have not been successfully able to re-call what you are supposed to at this point in time. Therefore, it is called forgetting.

There are series of theories which explains why people forget. Let us talk about the dominant theory which tries to explain the process of forgetting. First and the most important theory is the Theory of Decay.

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Theories of Forgetting

Theory of Decay

- Forgetting is a function of time.
- Repetition leads to strengthening of memory traces.
- The associative bond weakens with the passage of time.
- We forget unused information.

Now, basically what theory of decay says is that you remember we talked about the fact that there are concepts which are remembered as nodes of information and then there are networks in these nodes. Now when similar type of events are repeated, similar information is given to you time and again, with repetition the memory traces they become very strong. Now think of a situation where you learnt something you memorized it, but then you did not get a chance to repeat it. So what would happen then, the associative bond that is formed that becomes weaker enough and the weaker the bond becomes higher are the chances that you will forget the information.

So, in all cases where associative bonds are weakened with the passage of time and because forgetting functions as a one of the functions of time therefore we will usually forget those information after lapse of certain period of time. This is what is called as Theory of Decay. Time has passed you did not get a chance to repeat the information and therefore the bond that was formed the memory trace that was formed that trace becomes weak enough to be recollected. This is Theory of Decay.

The other interesting theory which explains forgetting is the interference theory. Now interference you can very easily make out. Two things which interferes which overlaps. Now interference could be of two types. You remember when we were talking about transfer of learning at that time also we said that there is a possibility that things which are learnt previously might interfere with the learning of the new task. This was one

possibility. And the other possibilities were the newly learnt thing, it does not allow you to perform things appropriately.

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Forgetting

Interference Theory

- Retroactive: Newly learnt information prevents retrieval of previously stored ones.
- Proactive: Previously learnt information interferes with the newly learnt information.

Similar type of situation comes up in case of interference theory also. There are two types of interferences; it could be retroactive or it could be proactive. Now proactive interference would be a situation, where newly learnt information it prevents retrieval of the previously stored information. So, I have learnt something in the past, I have learnt something very recently, and the newly learnt information does not allow me to recollect what I had already memorized in the past. So, earlier the stack that is with me in my long term storage that I am not able to extract out, because of the interference that is created by the newly learnt information. This is called Retroactive Interference.

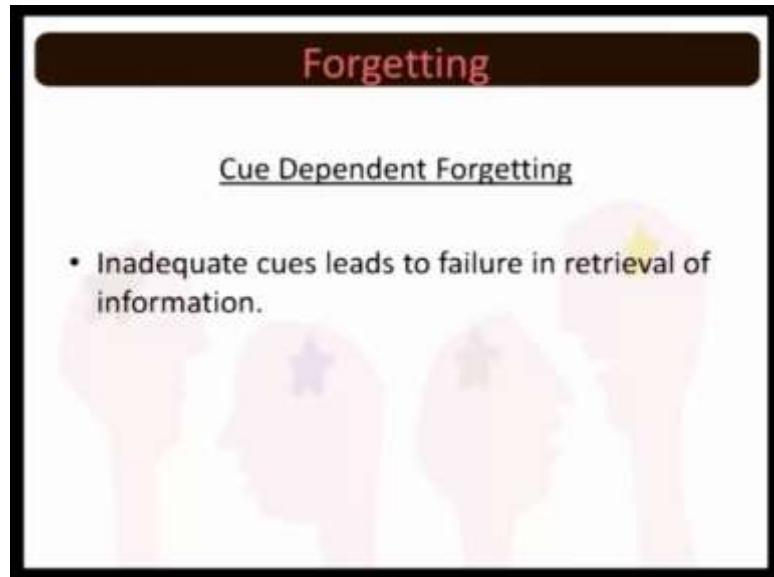
The reverse of it would be proactive interference. Proactive interference would mean that the previously learnt information that interferes with the newly learnt interference. I already have something in my stack; I have some already stored something in my long term memory, now I learn a new thing, I memorize it. When I try to recollect the newly learnt information I somehow extract the old information. So, what is happening actually, the previously memorized content that interferes with the process of recollection of the new information. This is called Proactive Interference.

Now interference theory says that either the interference is proactive or retroactive, but the fact remains whatever is that desired information that you want to extract out, that

information you are not able to because of this competition between the old and the new information. And therefore, you commit an error in terms of accuracy of recall of the content and therefore it is a kind of a sort of forgetting.

The third theory which also has to do with how we store information in long term, you remember we discussed that in long term one of the important strategies is to provide appropriate cue to the information, giving a good file name which will help you which will ease the process of search whenever you have do so in the future. Now if there is a problem with giving appropriate cue and therefore, if because of the inadequate cue you are not able to retrieve the information then this is called Cue Dependent Forgetting.

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You basically did not provide the sufficient cue the adequate cue and because of this inadequacy you are not able to recollect the information. This is cue dependent forgetting. So, this is the third theory which tries to explain why we forget.

And fourth theory is basically talking about the overall failure of the storage system. Now this theory basically looks at the information processing approach.

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Forgetting

Theory of Storage Failure

- Look at this viewpoint from the information processing approach (sensory → STM → LTM).
- When too much information pushed in, some of them are not retained.

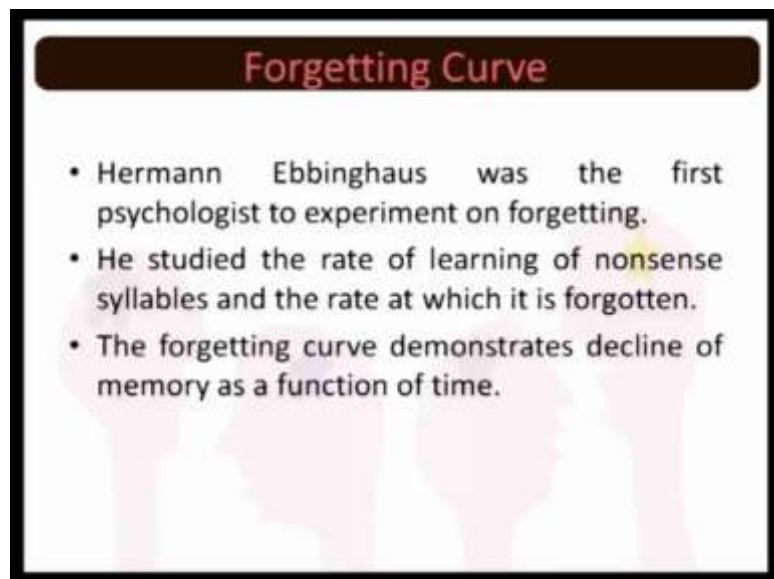
This is the view point, it says that from sensory to short term to long term this is how the memory moves. And it is long term where the information is stored. Now how much of information is pushed in, and how much of it can actually be retained, that is a matter. So, somewhere you can visualize this theory in little symbolic order. Say for instance you have attached a pen-drive or an external drive or SD card in a system and then you realize that it says that your external device, your pen drive or your SD drive has this capacity, say for instance it has one tb that is a size. Now that the external drive can store information only up to one tb. The moment you are about to reach that level it starts giving you a signal that, fine only these many bytes of information can be stored more because you have gone for an optimal usage of this external storage device. So, theory of a storage failure actually banks on this very hypothesis that the information that is supposed to be retained is dependent somehow on the overall capacity. Now remember one thing we discussed in long term storage, that the ultimate capacity of long term memory system is not known. All we know is that based on personal significance and based on the other relevant information most of the things are retained with us.

So, certain things that we know that it is extremely useful to us, we will always recollect it, we will always store it, and will never commit error in terms of recollecting it back, whereas certain types of information might not be significant after passage of certain period of time. Say for instance you memorized the poem because it was one of the expected questions in your examination. You know that this was just a poem which was

basically memorized only to serve you the purpose of successfully scoring in your examination and therefore the chances of further forgetting it is very high.

If you recollect now when you memorize questions from your notebook, you even remember where the teacher had put a red mark, where did you turn the page, the commas, the full stop, most of these feature you remember. And within a certain period of time, just within few days you start forgetting these traces and little later you do not even remember any of those things. Now all these theories can be used to explain it. Decay explains the process from one point of view, cue dependent forgetting explains it from a different point of view, storage system explains it from a different point of view, and the interference theory explains it is from a different point of view. But all these four theories basically explain why people forget.

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Let us now come across one of the examples. Let us first understand that Hermann Ebbinghaus was the first psychologist who conducted experiments on forgetting. And he basically what he did was he again use the nonsense syllables tried to see how much people forget over a period of time. So, forgetting was actually experimentally verified in terms of decline of memory as a function of time.

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Now, this is the curve what is called as forgetting curve and Ebbinghaus came forward with this very curve. Basically what he did was that on y axis he had retention and on x axis was the number of days. How much of information is stored or how much of information is lost? Remember he was using nonsense syllabus for his studies.

So, meaningfulness was already taken care of. All the items that were supposed to be memorized did not carry any meaning. Now of all these now meaning devoid information, how much of loss takes place actually and this is what Ebbinghaus was trying to study.

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Forgetting Curve	
% of forgetting	After lapse of (time)
47%	20 minutes
53%	60 minutes
56%	9 hours
66%	1 day
72%	2 days
75%	7 days
79%	1 month

What he found was that after lapse of around 20 minutes there have loss of 47 percent of information. After 1 hour 53 percent loss of information, after 9 hours we have 56 percent of loss. After 1 day we have 66 percent, 2 days 72 percent, 7 days 75 percent and after 1 month we have loss of 79 percent of information. Now if you look at this curve you will realize very interesting phenomena; the loss in the first few minutes is very high and gradually it starts stabilizing.

So, from 1 hour, that is 60 minutes to 9 hours you just have an addition of 3 percent of loss, whereas in the first 20 minutes you have a massive down fall, 47 percent of information is lost. 20 to 60 minutes you have a 40 minutes gap, but then the information lost is very little, just 6 percent more, 3 percent in 9 hours and 10 percent when you cover one full day 24 hours. So, that way you realize that there is not much of a loss. And again the loss of information at the end of the second day is 72 percent, whereas loss of information on the 7th days 75 percent only.

So, in 5 days you lose only 3 percent of information. This basically gives us a feel that actually what happens in the case of human being is that in the initial phase we have a drastic loss of information and this loss gradually starts getting stabilized. And by that time we complete 7 days, 1 week period, we realize that the information is by and large stable now. Little bit of loss is there, but it is still stable in nature.

So with this we come to an end to whatever we had to talk with respect to forgetting. But because we are talking about Ebbinghaus, so let us understand one thing, Ebbinghaus also gave a formula to understand how much we save in the process of retention. Therefore, it is called a method of Relearning or Saving Method.

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Saving/ Relearning Method

- Ebbinghaus used saving method as a measure of retention.

$$\frac{\text{Time taken in original learning} - \text{Time taken in new learning}}{\text{Time taken in original learning}} \times 100$$

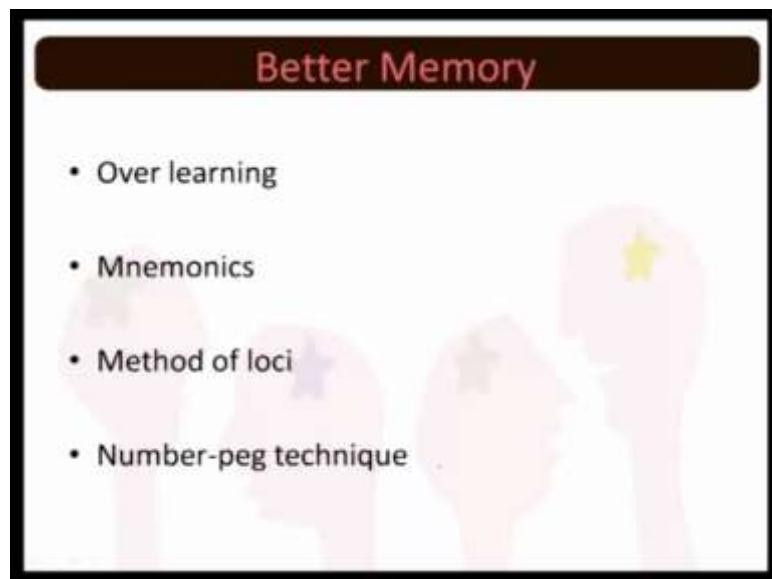
So, what he said was that the time that you take in original learning minus the time taken in the new learning. You have learnt the information, memorized it, now it is lost you are again trying to memorize it. So, time taken originally and time taken in the next attempt divided by the time taken in the original learning and you multiply it by 100 and he said this is what is called as Ebbinghaus Saving Method. Because it is realized that you save lot of time; you remember even in leaning when we were talking about extension and when we referred to spontaneous recovery, there also we had discussed that once the extension takes place the process of spontaneous recovery is very fast even if the animal took say a series of trials to learn the information originally.

Subsequent learning takes very few attempts so is the case with the memory. And therefore the time taken in the next phase is different from the time taken originally to memorize the information, and this is what is Ebbinghaus contribution to the process of forgetting.

So, what have we discussed till now, we have tried to understand the process of memory, we have try to succinctly now understand the process of forgetting. Now realizing the

importance of memory and also of course accepting the beauty of forgetting, all of us would always visualize of situation where the overall capacity of the individual to memorize things should multiply should increase. So, what are the tips for better memory? Let us discuss it very succinctly.

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Four options can be thought of, either you over learn or you use three other techniques; the method of mnemonics, the method of locus, and the number-peg technique. So, very succinctly in next couple of minutes, we will discuss methods which can enhance your memory and you can try it out.

Now, the process of over learning, basically means that you keep on keep on repeating it to an extent that the whole process becomes automated. So, it is nothing but doing it several times, several times. So you over learned the thing, because you repeat it several times therefore automatically the information becomes much more automated, the whole process of recollection is automated. This is the method of over learning. But remember over learning is too tedious and approach, let us think of the other intelligent options.

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Better Memory: Mnemonics

- **Mnemonics:** Mnemonic devises aids memory by associating easy-to-remember constructs and the task at hand.
- Rhymes & jingles are good examples of mnemonics.
- Although they are mostly verbal, they can be visual or auditory in nature.

Mnemonics is another interesting method. Mnemonics devices they basically aid our memory by associating easy to remember constructs and the task at hand. The best examples of mnemonics are rhymes and jingles. I cannot give you very good example other than repetition of a rhyme, but I can share one interesting experience with you. During my student days I had a friend in philosophy and he would memorize the entire book just by attaching it, and what you call putting and fitting the theories hardcore philosophical view points and theories into nursery rhymes.

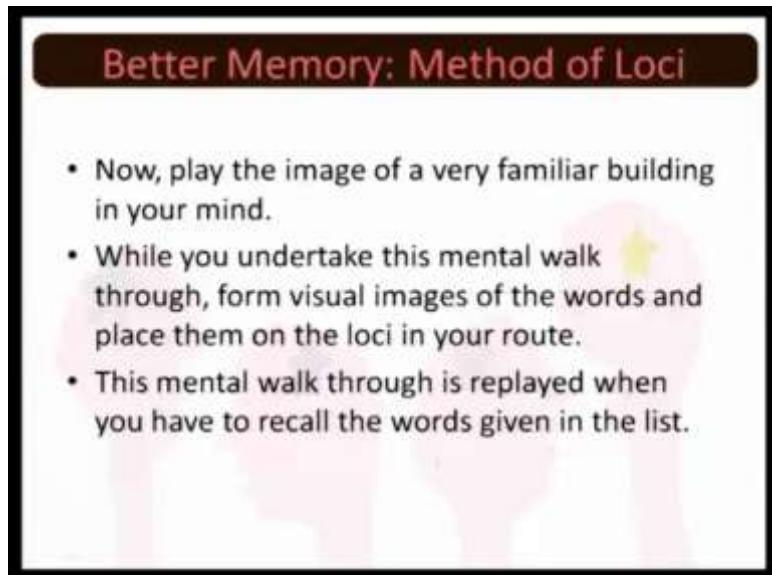
So, if you remember jingle bear jingle bear jingle all the well, all you do is that big big theories would be now put into such rhymes and he would just recollect the rhyme because he already had memorized it. And now big theories can be retrieved using those cues. Although, rhymes and jingles are mostly verbal, you can think of visual and auditory formats of rhymes and jingles. We saw this very example. Now at that time we were looking at this very example with respect to how the mother recollects the episode of how her child used to sing this very song. But now let us replay the same video and see how the child learns the rhymes.

Look at the clip to see an actual attempt by a child to memorize a poem. Now two methods we have discussed, now either you over learn or you have already memorized some rhymes and jingles. So, you convert the new information into rhymes and jingles you embed it over the existing rhymes and jingles and you will have a better memory.

The third format that can again enhance your capacity to store information is method of locus. Now what happens here is that you have already a memorized space, say for instance, your college building, your school building, your office, so you have a walk through you know where to enter, how to move, how does the corridor move ahead, what leads to where and so for. And now once you have the memory of the space, all you have to do is that you associate it to the new information that you are supposed to memorize.

Say for example, if you have a list of words with you, that you have to memorize all you have to do is that you associate it with the space that you have already memorized. Now the prominent places in the building; the gate, the corridor, the first door, the brown door, the green door likewise.

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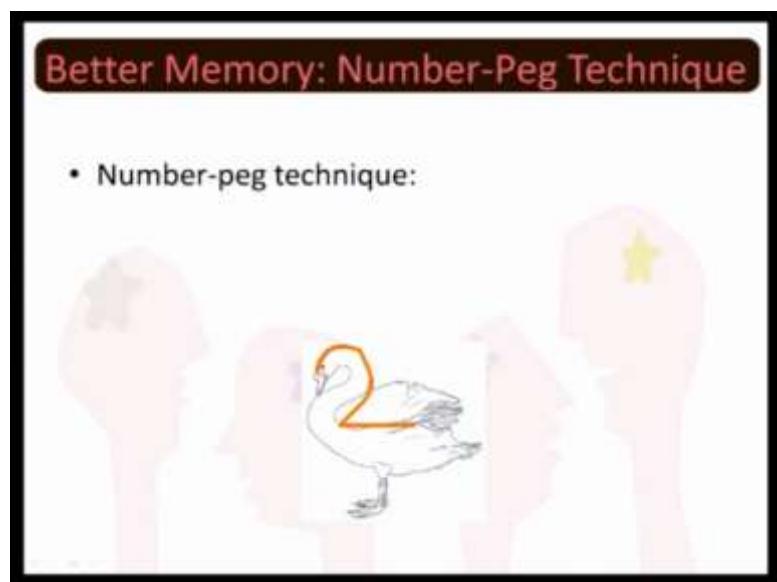


So all you do is that you now undertake a mental walk through and when you take the mental walk through you form the visual image of the world and all you have to do is that in that very mental walk through you keep on locating these words, their visual images, so that next time when you have to recollect all you have to do is it we have to just walk through that very space. And in this process of mental walk through the second time, the moment you see the main gate, you remember what was the word; green gate, brown gate, the left turn, the right turn whatever significant land marks that you have identified, all those significant land marks on a mental walk through is now associated with the visual image of the walk and that would help you a lot. In fact, the person who

holds the Guinness book of records for the best memory ability. If you see him performing in the experiment all he does is that he uses this very technique.

And the last method that can be used to increase memory is what is called as Number-Peg Technique. Now number-peg technique is a very interesting technique. You have information given to you and this whole piece of information all you have to do is that you have to convert it into number. Those numbers are then further linked in the form of a story and then you memorize the story you remember the whole information.

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Look at your screen you see a swan and then you can now make out that there is an actual mental image that you already carry and that mental image now you have convert into two. So likewise, all forms that you have already with you in your memory system, you can convert them into numbers. And more rhyming you make it the better you would succeed. Now let us take an example I will ask you to memorize a number.

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Better Memory: Number-Peg Technique

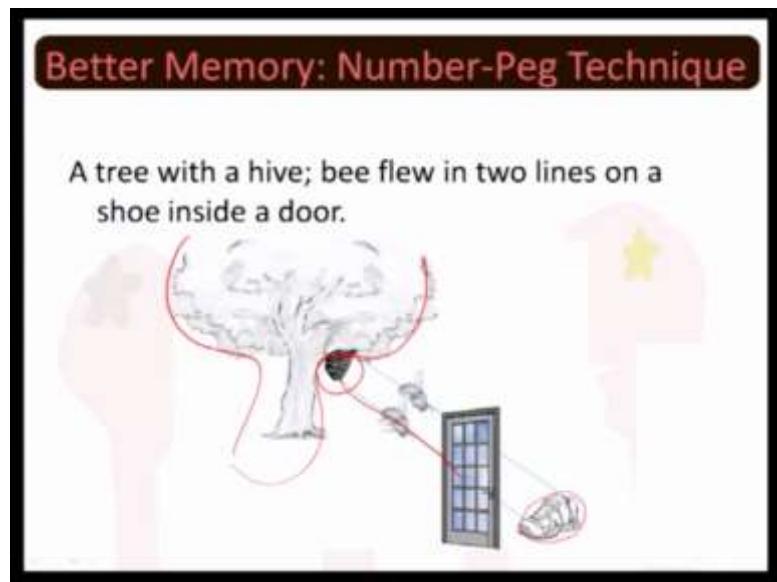
- Suppose you have to memorize the number
- 359924.....
- You convert these numbers into pegs and make a story

3= tree
5= hive
9= line
2= shoe
4= door

And the number is 359924; This is a number that you have to memorize. And this might now continue you remember we had done this exercise when we were going through chunking, where we said that you break the information in the chunks of 3 or in the chunks of 4 and this is how you enhance the capability of your short term storage. Right now we are talking about number-peg technique and imagine that this is the number that is given to you and you are told that you have to memorize it; 359924 and this might continue.

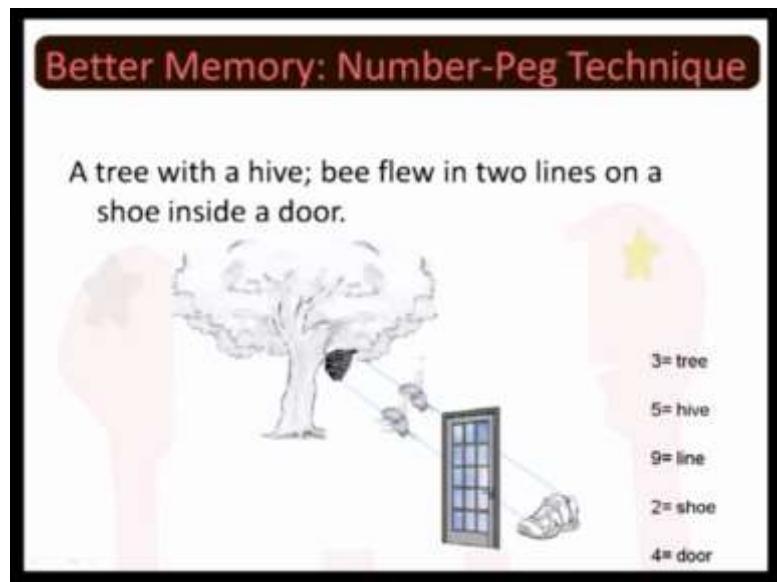
Now, convert these numbers into pegs and then construct a story. So, 3, the rhyming word would be tree, 5 the rhyming word would be hive, 9 line, 2 shoe, 4 door. So, these are basically the rhyming words and what you do now is that you simply now convert this numbers into pegs and then you make a story.

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Now, you look at this image 3 tree. So, all you do is that you have now made a tree here. So, this is 3, 5 is a hive, 9 is line, 2 is shoe and then 4 is door.

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So, let us again now look at this story. The number that was given to us was this 359924. So, 3 was tree, so you have made a tree, 5 was, hive you have added a hive to the tree, because there was double 9 therefore you have drawn two lines. And all you are now visualizing it that from a tree, two bees from the hives they are entering through the door

and then going to the shoe. So, a tree with the hive bee flew in two lines on a shoe inside a door.

So, all you have to memorize, it is very easy to visualize a tree with a hive 2 bees following a straight line entering through a door and there entering into a shoe. This is called number-peg technique. A bigger chunk of information, what you do is these numbers are converted into pegs and these pegs are further attached together to convert into a story. This creates a mental image which in turn will help you recollect the number very fast. So, this is called Number-Peg Technique.

And with this we have come to an end to our discussion on the topic memory. Just to summarize, we talked about the three structures of memory; the sensory, short term, and long term memory. And in long term of course we devoted too much of time to understand different formats of long term storage. Semantic memory, we talked about episodic memory, there also we classified, that I witness and flashbulb could be to such important different distinct type of memories. And then we came to the procedural aspect of the life that we memorize saying that memory can be divided into procedural and declarative memory what is also called as explicit and implicit aspects of memory. And then we talked about forgetting.

And now we are finally concluding our discussion on memory trying to understand that there are possible techniques of enhancing the overall ability of an individual to store more and more information using intelligent techniques, such as method of locus or number-peg technique. When we meet next we will be talking about a new concept. And that new concept would be emotion.

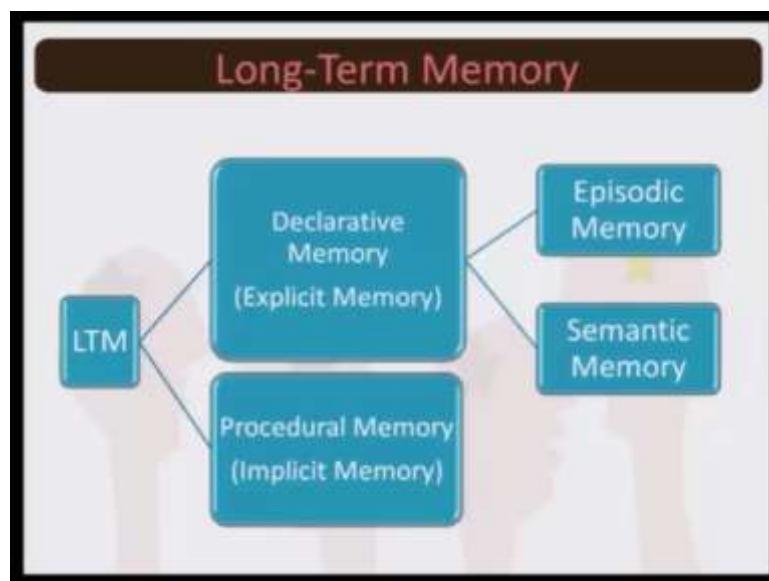
So, we started with sensation, perception, learning, and memory. And now we would be coming to the one of the most significant attributes of human beings, that is human emotion. That will be our next series of lectures.

Key words - forgetting, theories of forgetting, forgetting curve, mnemonics, number-peg technique, method of loci

Lecture - 21
Memory Long Term memory-Procedural Memory

Till now, we have talked about episodic and semantic memory which are basically part of the declarative memory it is also called as explicit memory.

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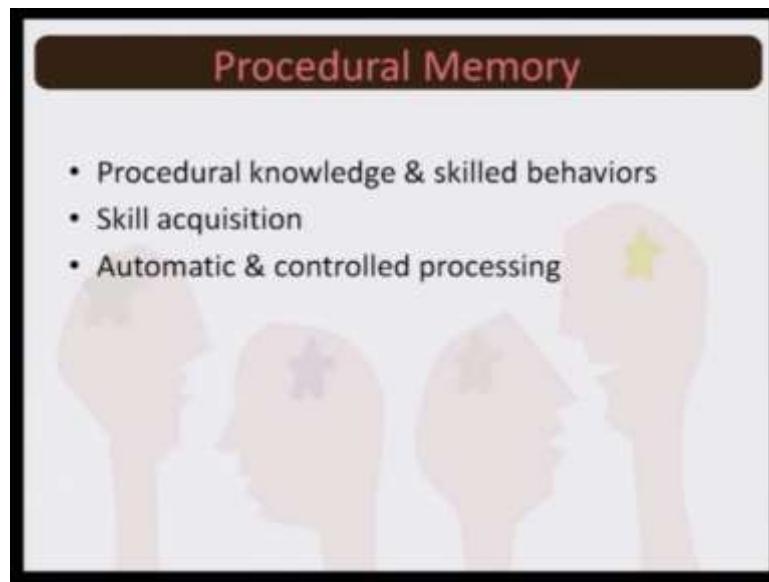


Let us now, come to the implicit sight of memory what is called as procedural memory procedural memory basically constitutes the knowledge of the procedure and the skilled behavior.

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Procedural Memory

- Procedural knowledge & skilled behaviors
- Skill acquisition
- Automatic & controlled processing



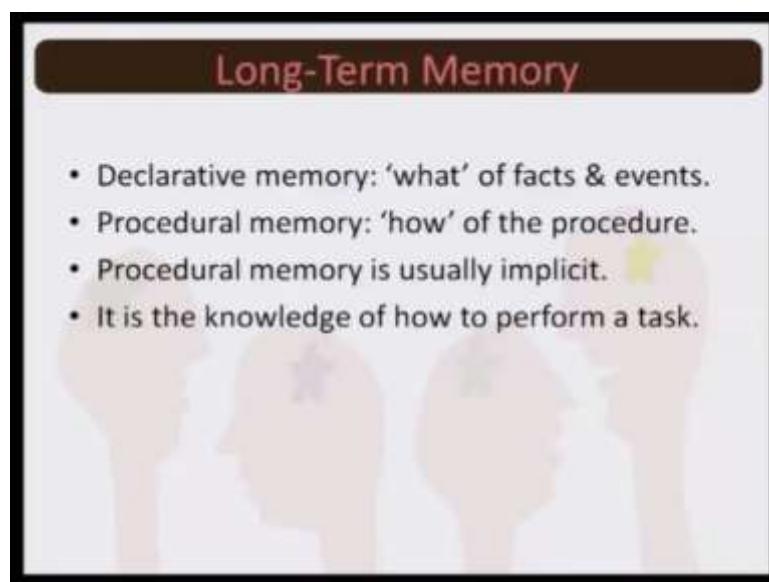
So, when we acquire a skill and gradually we realize that the whole process that we have learnt for a particular type of an operation becomes too automated and we have developed the control we have developed mastery over the process that is called procedural memory.

Now, declarative memory from that point of view, if you see they are basically what of the facts.

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Long-Term Memory

- Declarative memory: 'what' of facts & events.
- Procedural memory: 'how' of the procedure.
- Procedural memory is usually implicit.
- It is the knowledge of how to perform a task.



And The events where as procedural memory basically denotes how of the procedure and therefore, procedural memory is usually implicit in nature you must have seen many, many events in our life. Where you perform that task and you remember the full mechanism how as to how to operate it say for example, cycling riding a bike running a computer whole of this mechanism you would realize that there are steps series of steps you know and all this steps have has to be religiously followed in sequence. If you want the mechanism to work appropriately, but then it is now, so nicely know acquired by you that this intermediate this steps transition between the steps none of this things you remember you realize as if things are getting done automatically this is called procedural memory.

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Let us look at this very video to see how a medical technician actually performs a task meticulously although he knows what the apparatus is he knows what the concerned doctor has asked this technician to perform rest all involves whole degree of moment of knobs fixing the machine taking the output of the machine have a look at this [FL].

Now, let we have understood explicit and the implicit side of the memory, let us look at another aspect of long term memory what is called as prospective memory prospective something which is about to come. So, if a person fails to remember what he or she was going to do.

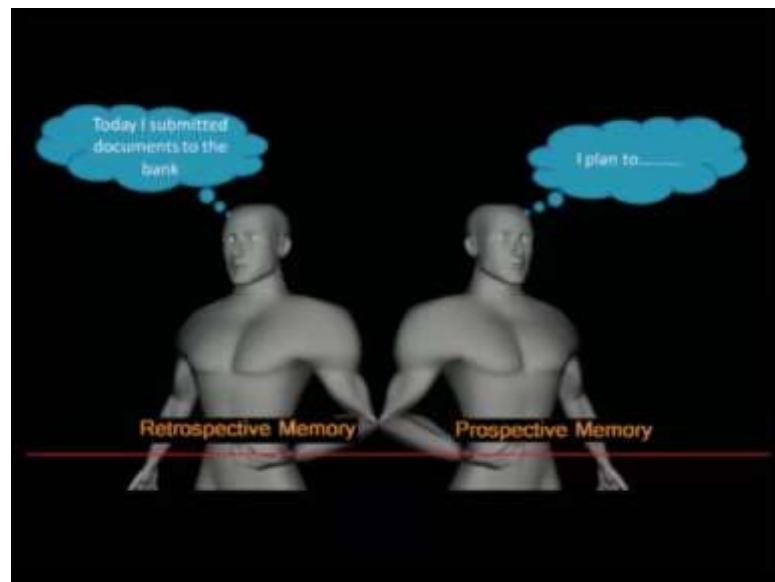
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The slide has a dark red header bar with the title "Long-Term Memory: Prospective" in white. Below the header is a light blue background area containing three bullet points in black text. The background features a faint, stylized illustration of a person's head with a brain-like texture.

- It is the failure to remember what the person concerned was going to do.
- Inability to remember the intended action.
- Older people show problems of Prospective Memory.

So, say for instance I intend to go and switch on the light, leave my table go towards the switch board and half way if I forget what thought that is loss of prospective memory. So, the inability to remember the intended action is what is called as prospective memory older people usually they show this problem of prospective memory in our young days adulthood. Usually we do not have this type of problem unless we are too busy and we are into multi tasking then, it might happen because of competition between two thoughts which are going parallelly else even in the case of at least older people even if they have one single thought one single prospective is steeped at the head plan to execute there might be a problem in terms of inability to recollect what he or she was intending to go and do.

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So, this very image represents what actually retrospective and prospective side of memory would be now retrospective memory. If you think today I submitted documents to the bank you have already performed that task and you remember prospective memory would be I plan to and you have planned something what exactly you have planned half way while trying to execute it, you forget that is loss of prospective memory it is mostly seen in elderly people having. Now understood sensory short term and long term memory let us once try to compare between this three systems of memory we will try to you know compare this three structures of memory on certain criteria's.

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Comparing Memory Systems		
Approximate duration		
Sensory	STM	LTM
Iconic: 1-2 sec.	20-30 seconds	Days, months, years or life time
Echoic: 4-5 sec.		

So, on this screen when you see on the white font the word written there is the criteria on which to three memory systems are being compared.

So, first let us compare the memory system in terms of their approximate duration sensory memory. We discussed the duration for 1 to 2 seconds for iconic memory and 4 to 5 seconds for echoic memory this expands substantially. It goes from 20 to 30 seconds in the case of short term memory and in terms of long term memory it could be days months it could be even life time something starts from 1 second upto life time this is the whole expansion up to the first 5 seconds part of sensory memory upto 30 seconds that is short term and thereafter it is long term.

In terms of capacity we realize that sensory memory also has a relatively large capacity in terms of storing information and at least 16 items can be stored at the level of sensory memory.

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Capacity		
Sensory	STM	LTM
Relatively large. At least 16 items much more	Relatively small. About 7 items	Very large. Limit unknown

And probably little more can also be done short term memory from that point of view given the time it has we realized that the capacity is relatively small, but this capacity increases many fold, if the items are divided into chunks depending on whether you form a chunk of three or chunk form of chunk of four items approximately up to 40 items can be stored in the short term memory.

Long term memory it is very large and the limit is just not known any and every thing can be stored then we come to transferring memory.

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Transference		
Sensory	STM	LTM
Attention & recognition.	Rehearsal: Items appropriately rehearsed move to LTM.	NA
Items attended to & recognized move to STM.		

In terms of transfer we have the long term memory where transfer is not at all needed because information is already stored there it has nothing to do beyond that, but in case of sensory memory attention and recognition. They play an important role items that are attended to and items that are recognized they have the likelihood of moving towards the short term storage items that we do not pay attention to items that you fail to recognize they will not be forwarded to short term storage.

In case of short term we did discuss this factor also that there are two types of rehearsal the maintenance rehearsal and elaborative rehearsal now depending on the rehearsal the items are appropriately forwarded to long term memory.

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Comparing Memory Systems		
Type of information stored		
Sensory	STM	LTM
Copy of input.	Sounds, visual images, words & sentences.	Primarily meaningful sentences, life events & concepts, some images, semantic & episodic memory.

Now, we come to the type of information that is stored in case of sensory memory, it is exact copy of input that we stored in the case of short term it can have sounds visual images words and sentences long term memory has the fantastic thing, long term memory primarily has the meaningful sentences life events concepts images .right Now we discussed semantic and episodic memory. So, whole of this becomes the part of long term memory in terms of inability to recall information from long term if you consider reason for information loss in sensory memory decay of trace as considered as the important reason why information is lost.

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Comparing Memory Systems		
Reason for information loss		
Sensory	STM	LTM
Decay of trace.	Displacement of old information by incoming information.	Faulty organization, inappropriate retrieval strategy, interference.

In short term memory, it is the displacement of the old information by the incoming information, but in the case of long term memory it could be faulty organization it could be inappropriate retrieval strategy or it could be interference. So, two information, if they compete against each other to be recollected ,this could lead to interference you have given the file name memory and you search by file name emotion you will not get the information. So, inappropriate retrieval strategy is used or if because you know that the information is stored in an organized order you go for a random search, you are not able to retrieval the information this would be the possible reasons of loss of information from long term storage.

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Reconstructive Memory

Bartlett's Study

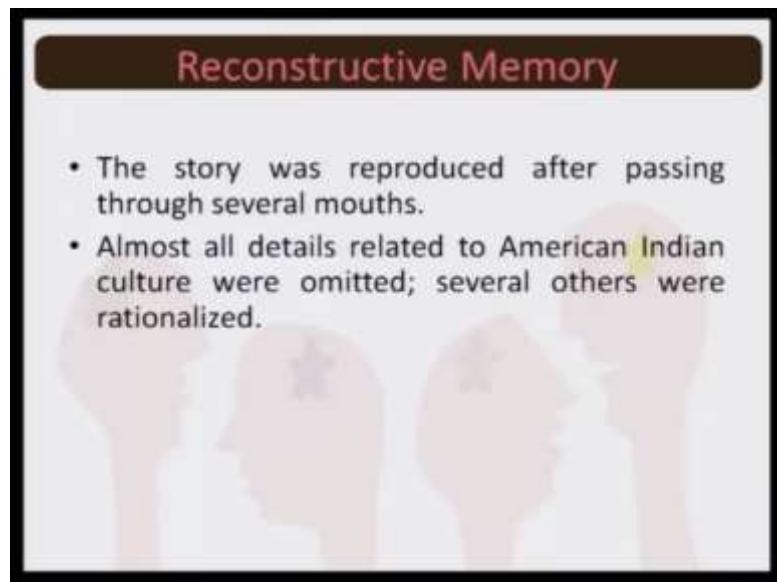
- Sir Frederic Charles Bartlett came forward with several short fables. 'The War of the Ghosts' is the most popular example talked about in psychology.
- A group of students were asked to read this story about North American Indians.

There are two more interesting things about memory we will talk about one right now the reconstructive aspect of the memory, Sir Frederic Charles Bartlett performed a very interesting experiment. What he did was that story was narrated to a group of students titled the war of ghosts and then the story was supposed to be reproduced by this students who had actually heard it what Bartlett able to prove was that the story. When it was reproduced to passing through several mouths underwent series of reconstruction.

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Reconstructive Memory

- The story was reproduced after passing through several mouths.
- Almost all details related to American Indian culture were omitted; several others were rationalized.

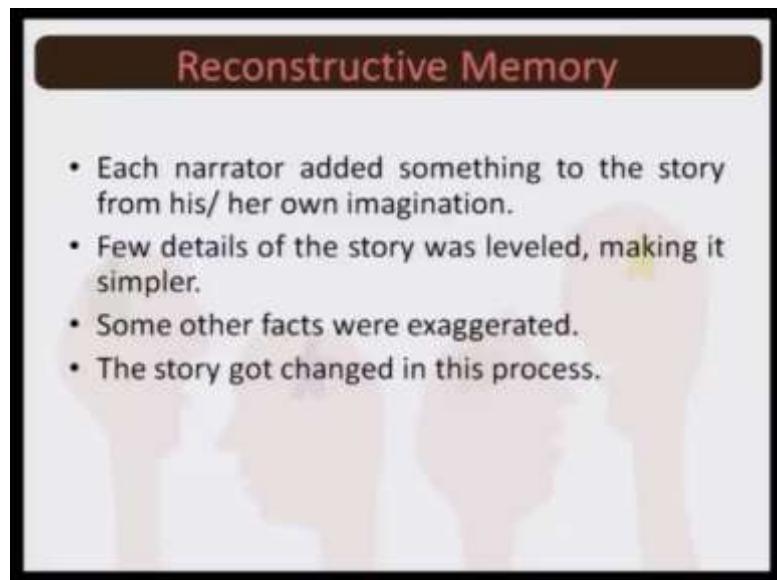


Almost all details related to the American Indian culture were omitted; and several others were rationalized. When students try to recollect the story reconstruct the story, what was very also interesting was that each narrator added something to the story based on his or her own imagination.

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Reconstructive Memory

- Each narrator added something to the story from his/ her own imagination.
- Few details of the story was leveled, making it simpler.
- Some other facts were exaggerated.
- The story got changed in this process.



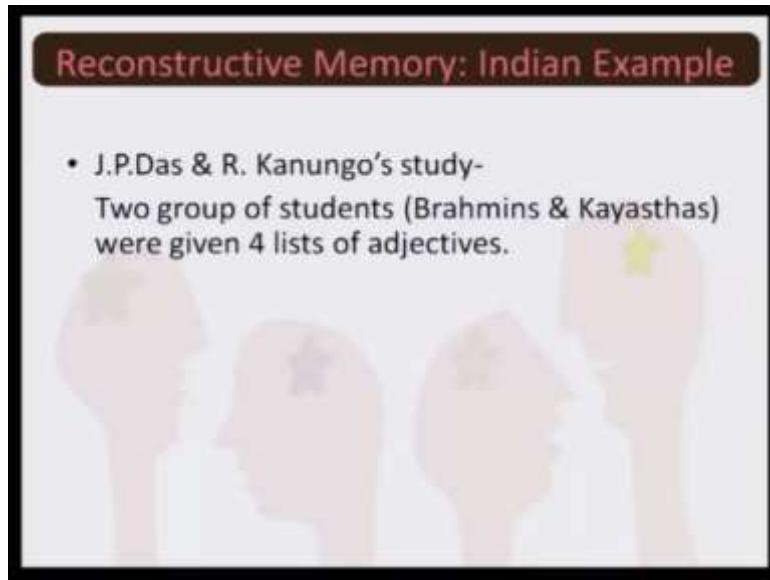
Few details of the story was leveled making it very, very simpler some other facts were exaggerated and therefore, what happen finally, the story got changed in the entire process Bartlett said that this is reconstructive memory. Why because something you

have heard of when it is transmitted from mouth to mouth the whole episode gets reconstructed several things are leveled several things are exaggerated several things are downplayed and therefore, the original content and the later content undergoes a big difference.

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Reconstructive Memory: Indian Example

- J.P.Das & R. Kanungo's study-
Two group of students (Brahmins & Kayasthas) were given 4 lists of adjectives.



One very interesting example, I would like to quote from one of the Indian studies by J.P. Das and Rabindra Kanungo they conducted a very interesting study where two groups of students who belongs to two dominant casts in the country. Brahmins and Kayasthas they were given 4 lists of adjectives the first list had adjectives describing Brahmins in favorable terms like nice good looking clean and so on.

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Reconstructive Memory: Indian Example

- List 1- Adjectives describing Brahmins in favourable terms.
(nice, good looking, clean, etc.)
- List 2- Adjectives describing Brahmins in unfavourable terms.
(rude, greedy, fat, etc.)
- List 3- Adjectives describing Kayasthas in favourable terms.
- List 4- Adjectives describing Kayasthas in unfavourable terms.

The second list had adjectives describing Brahmins in unfavorable terms. Like rude greedy fat and so on. And the same thing was done for Kayasthas list three had adjectives describing Kayasthas in the favorable terms list four describing in unfavorable terms. Now when this Brahmins and Kayasthas students are supposed to recollect the content every one remember more unfavorable adjectives than, the favorable ones and based on this J.P. Das and Rabindra Kanungo they inferred that people preferred to remember the bad attributes rather than, good ones one interesting thing which is also talked about in introductory psychology is an effect called Zeigarnik effect.

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Zeigarnik Effect

- Bluma Zeigarnik, a Russian psychologist, compared memory for tasks that were successfully completed & those which were not.
- In fact she interrupted the work & did not allow them to finish it.
- Interrupted tasks were remembered more frequently than those which were completed.

Bluma Zeigarnik, was a Russian psychologist, who actually compared memory of tasks which you are able to complete and compared it with the task which you are not able to what she did was she basically interrupted the work and did not allow the participants to finish the task.

What she finally, found out and what is now called Zeigarnik effect is that interrupted task where remembered more frequently than, those which you are able to complete things that you are not able to complete, you would remember it more.

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Zeigarnik Effect: Indian Example

- Dutta & Kanungo gave a new interpretation to Zeigarnik effect.
- The intensity of emotion aroused by the completed or the interrupted task is the critical factor.
- Any activity that gives rise to strong emotion, be it pleasant or unpleasant, is remembered better than ordinary everyday action.

Now, this might mismatch with her daily life experiences another interesting study again by Rabindra Kanungo along with Dutta they give a interpretation to the Zeigarnic effect they said that the intensity of the emotion that is induced by the complete or the interrupted task that becomes a critical factor. So, it is not the task per say, but the emotion that it leads to. So, any activity that gives rise to a strong emotion whether it is pleasant or unpleasant that does not matter the fact that the activity gives raise to strong emotion such events will have better memory.

you remember right now we said in are previous lecture the things which as an element of surprise things which as personal significance and things which induces great degree of emotional arousal in you, those things have better chances of getting recollected. So, this was the explanation given by Dutta and Kanungo. Why Zeigarnic effect works another interesting thing that is also talked about in memory is memory construction.

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Memory Construction

- Recall of events that did not take place
- Memory implantation
- These are not necessarily deliberate
- Suggestibility

Bartlett he proved that there is a reconstruction in memory construction of a memory has basically to do with the experiences that was gathered in the clinical set up where memory is implanted and therefore, the participants recall events of their life which had actually not happened.

Now, this depends on the suggestibility of the participant certain type of content is implanted into your memory and you are supposed to recollect it. So, when you recollect know your life experiences you try to recollect when those events which are actually you did not experienced, but you are told that this is how things are happened with you this is called memory construction this type of memory modification.

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The slide has a dark red header bar with the title "Memory Implantation" in white. The main content area is white with a faint background watermark of a person's face. A black border surrounds the entire slide.

- This is a type of memory modification because of misinformation.
- After experiencing an event, when individuals are exposed to new misleading information the recollection of the actual even gets distorted.
- Suggestive interrogation

Basically takes place because of the misinformation and after experiencing an event when individuals are exposed to new misleading information the recollection of the actual event it gets distorted and this is something that sometimes is also witnessed in interrogation what is called suggestive interrogation. So, if an officer interrogates the suspect and you deliberately you know ask questions which have lead answers.

For example if I ask you were you present there in that very building at that time that is a question which asks you to declare whether you were present or not and you have a option of saying that was not present in that building think of the other situation when I say. So, you are in building what actually happened at that time you are not given the opportunity to declare I was not available in the building the question is based on the premise that you are actually present in the building and then, it goes beyond asking you what actually did you see inside the building this an example of suggestive interrogation therefore, this is a misinformation the fact that you are not present in the building is not taken to account, but then a misrepresentation allows the whole construction of new sequence of events therefore, it is called as constructive memory.

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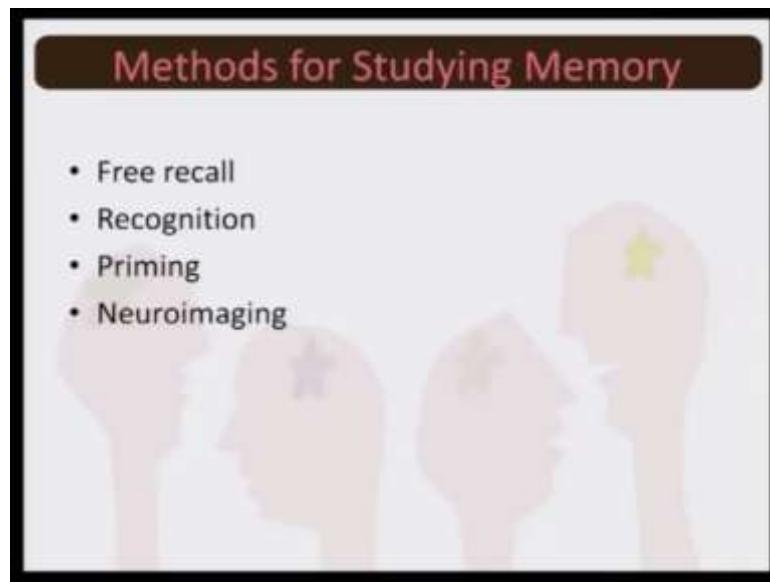
The slide has a dark red header bar with the title "Memory Distortion" in white. Below the title is a list of bullet points in black text. The background of the slide features a faint, stylized illustration of a person's head and brain.

- The change in the content of recall (memory) as a result of internal or external factors.
- Cognitive biases
- Suggestive questioning
- Schemas
- Motivation

Now, we come to what is called as memory distortion remember we are still not talking about forget forgetting will be our last lecture with respect to this very topic on memory now memory distortion basically in a change in content of the recall as a result of internal or external factors. So, there could be cognitive bias you have bias which does not allow you to remember good things about somebody about whom you have negative feeling. So, for example, if you do not appreciate someone all good things told about that very individual because of your bias you are not able to remember.

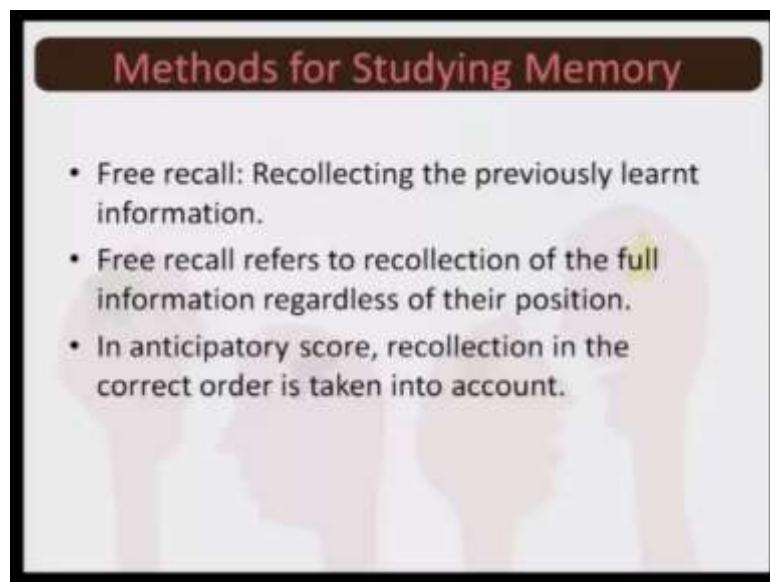
Say for example, right now we took the example of suggestive interrogation if you go for suggestive questioning the question that I ask suggests gives a cue to you as if what is expected out of you, what type of response should you give this is suggestive questioning this is bound to distort the memory plus this schema, you know how the representation of the world it you have made in your mind the mental representation that might be important in terms of better recollection accurate recollection or distortion and how motivated you are to recollect information that would also play an important role.

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So, let us know talk about the methods that are predominately used for studying the process of memory four important methods. We talk about today free recall recognition Priming and Neuro imaging the recent phenomenon you find is the dominant uses of Neuro imaging technique, wherein the brain scans are used to identify which regions of the brains are involved in the memory of what kind of information.

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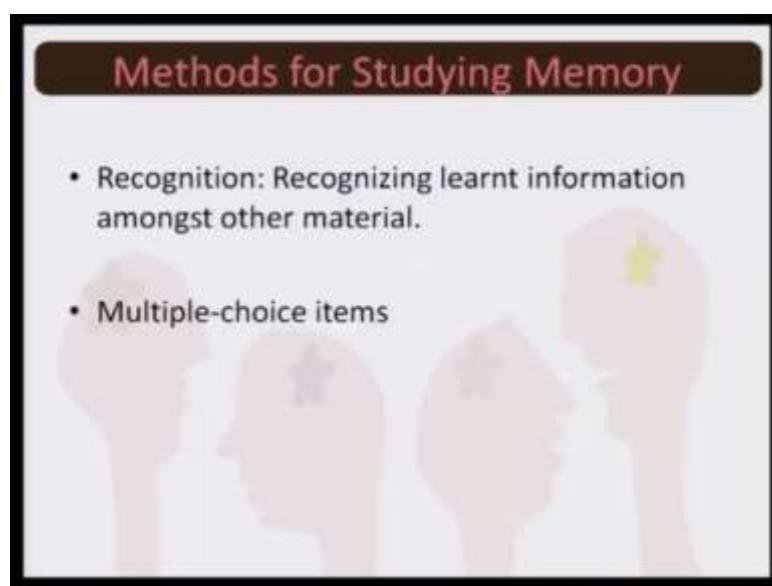
Let us first begin with free recall free recall as you can make out from the word itself, it is recall that is recollection of the learnt information in a free order this means that you

are free to recall the information regardless of the position of the event .you remember We talked about serial position effect you know primacy in the effect. So, free recall basically means that you are supposed to recall the information regardless of it is position we have talked about know serial position effect the primacy and recency effect.

Now if I give you a list of items and then tell you that you have to recollect information in the order in which it was presented to you. So, say for example, if I give you a list of items that you have to procure from the market and said this 15 items have to be recollected in it's serial order. So, first item should be recalled first second item for at the second order third at the third-order you would realize that usually people commit much of an error in terms of recollection and that is what is called as you know recall where we have serial position effect where we have the primacy and the recency effect.

But free recall usually is considered as one of the good methods because you do not want to worry of about the relative positioning of the information rather you have to simply recollect the information. Now in anticipatory score recollection in the correct order is taken to account, but free recall would basically mean that you regardless of the position you just recollect the information and accordingly you know you get a score for that. So, that is one of the dominant methods in studying memory the second important method for studying memory is recognition and that is one of the most generously used techniques.

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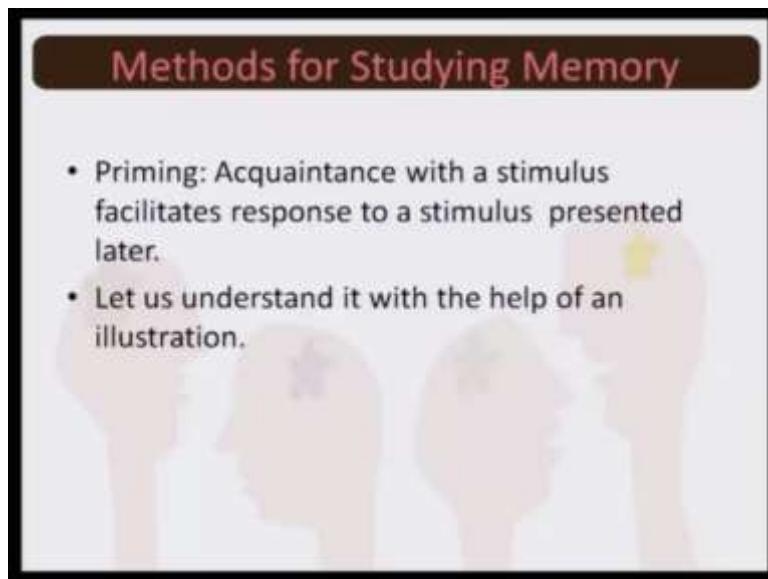


Now a day, even for this course we will come to evaluation we will come across multiple choice items. So, when you are supposed to recognize the learnt information which is hidden among other items. So, you have the question written in the top and you have four options only one answer is correct and the rest of the three are false information. So, when the actual information is hidden amongst the other information and you have to recognize this is the correct answer this is what had learnt this is called as the method of recognition multiple choice items is a best example of it.

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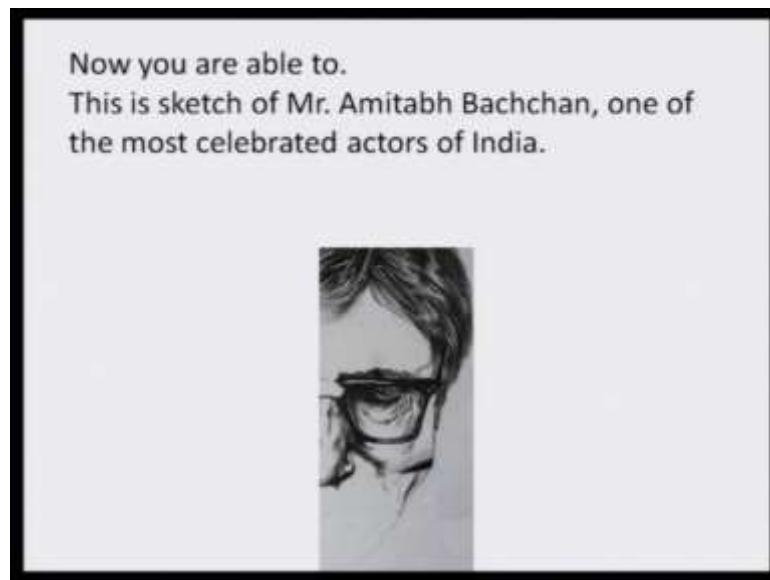
Methods for Studying Memory

- Priming: Acquaintance with a stimulus facilitates response to a stimulus presented later.
- Let us understand it with the help of an illustration.

An illustration showing two people from behind, looking towards a computer monitor. The monitor displays a presentation slide with the title 'Methods for Studying Memory' and a bulleted list about priming. The background is a light blue gradient.

The third and interesting method of studying memory is priming. Now in case of Priming how acquaint you are with stimulus that is important. So, what happens? Acquaintance with a stimulus basically facilities your response to this stimulus which is presented later now let us understand with the help this illustration.

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Now, I ask you that look at your screen and the based on the sketch you see at the bottom of the screen identify the person and am sure none of you would able to identify the person. add a little bit to it and say can you now identify the person given that you have little more clues perhaps some of you might make a guess,I add little more and, say now that very recently you saw one of his recent movies in which he had this very character con you know identify who you are looking at now when you see half of the face. So, you know him, he is most celebrated actors of Indian cinema Amitabh Bachchan this is Priming technique.

So, what actually happens here you are acquainted with the character you were presented with part of the information and depending on how well acquainted you are with facial features you would have identified first case you certainly not succeeded many of would succeeded just after the second slide. When this know little more clues were given some of you would by this time many of you would probably identified and after this much approximately all of you identified who is person is this is called the Priming technique.

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The slide has a dark red header bar with the title "Methods for Studying Memory" in white. Below the header is a large, semi-transparent image of a human brain in profile, facing right. A small yellow star-like icon is positioned near the top of the brain's cerebral cortex. To the left of the brain, there is a bulleted list of points:

- Priming is most effective when used in the same modality.
 - visual priming with visual cues
 - verbal priming with verbal cues

Now, Priming is considered to be most effective when it is used in the same modality. So, if you are using visual Priming then, it is good to visual clues and when you are using verbal Priming then it is good to use verbal clues in that case Priming will be very, very effective because you are using same modality.

Key words - procedural memory, memory systems, reconstructive, zeigarnik effect, construction, distortion, priming