Selected Topics in Psychology
Neuropsychology
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Module - 5
Lecture - 31
Art and the Brain
Part – 1

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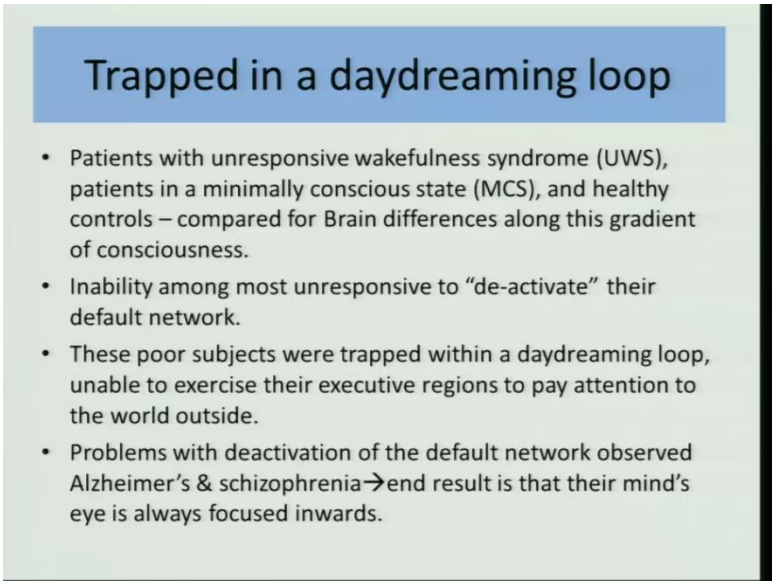

Now, why am I talking about this day dreaming thing, because sometimes day dreaming can become pathological; that, you stay in your default mode network. And it happens to some people who have some mental illness. For example, people who have schizophrenia, you heard of disorders like schizophrenia, they stay in that default mode network; and, they cannot come out and access what is happening in the real world.

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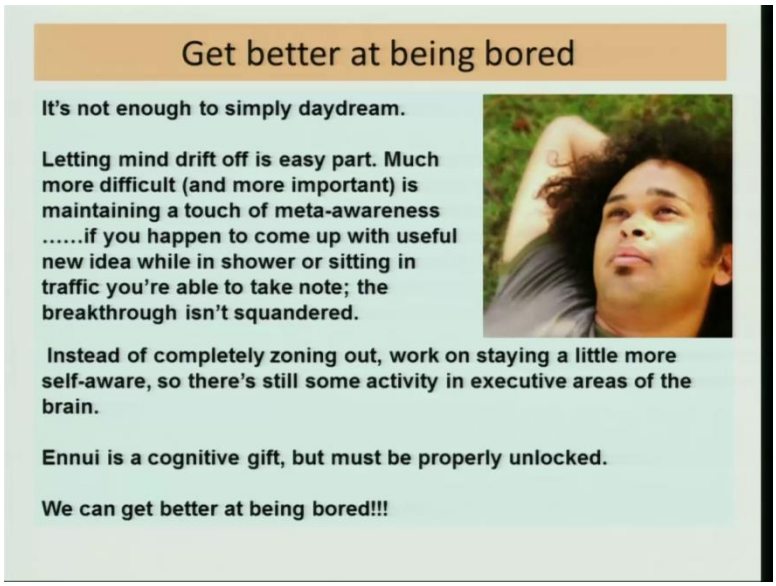

But, what might interest you is, how you can get better at being bored, how can you get bored more efficiently. Now, it is not simple enough, not enough to simply daydream, you know, letting the mind drift is the easy part, you know. Much more difficult is to maintain a touch of awareness that is called meta-awareness, see what has happening more or less.

And, if you happen to come up with something useful in your daydreams, come back to reality and say, you know what, that make sense, that is write it down or let us you know put a yellow posted note and that is very important. So, whole thing are annoying, which is why I am bored is a gift, but it is only a gift if you are able to do stop, start, and you are able to have some amount of control over it. So, as create a people, that is a gift that you must exercise and you need to learn how to turn it, off and on.

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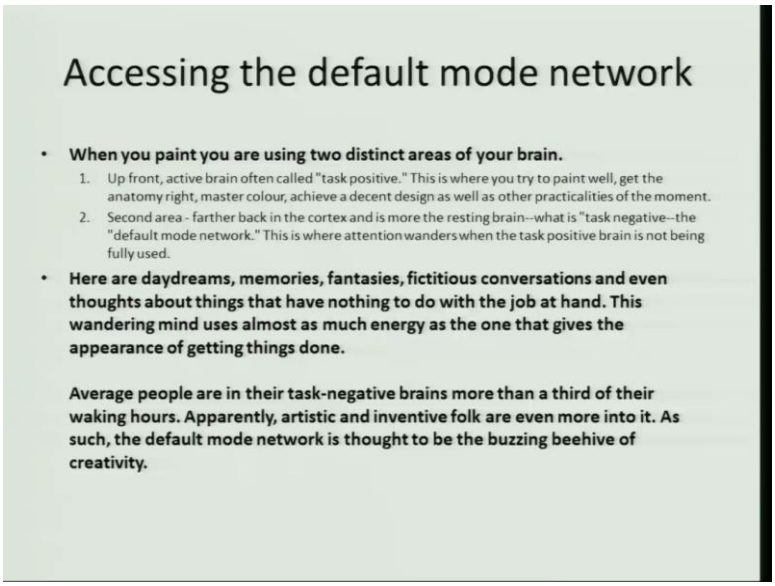

So, we can actually get better at being bored; how do we do that? That is something that painters have learnt to do. You know, when you are, when I am talking about these parts of the brain activity, when you paint, you are using 2 distinct areas of the brain – one, in front, is called the task positive. I know what I am doing. You know, when I am drawing a line, every part of my brain, especially the frontal part is telling me, that ok I am drawing it straight, am I drawing it straight, right; standing in front of you, this part is controlling here.

And yet, there is a part behind which is called the task negative whose job is to say, you know what this line is actually part of a tree. Because, the task negative is the part of the brain where the attention wanders, and here are the day dreams, memories and fantasies that we have. So, it is necessary to be aware of that, while one is drawing. I am sure, all you design students do that all the time, that you are using both parts of your brain; you are wandering from one to the other.

You are, when you are doing something, you are aware of, where it needs to be, how it needs to be, how precise it needs to be. But, you have a meta thinking that it needs to be part of a bigger story, right. I am standing here, part of my brain is saying, am I doing the right thing, am I saying the right words; did I say the last sentence, is it a continuation of what I am going to say next.

And yet, this one part of my brain saying, why am I talking to all these people, what is the larger picture that I want to give, does it relate to what I know; so as creative people,

when you get bored, you need to learn to do both of this. I will come back to how one does that.

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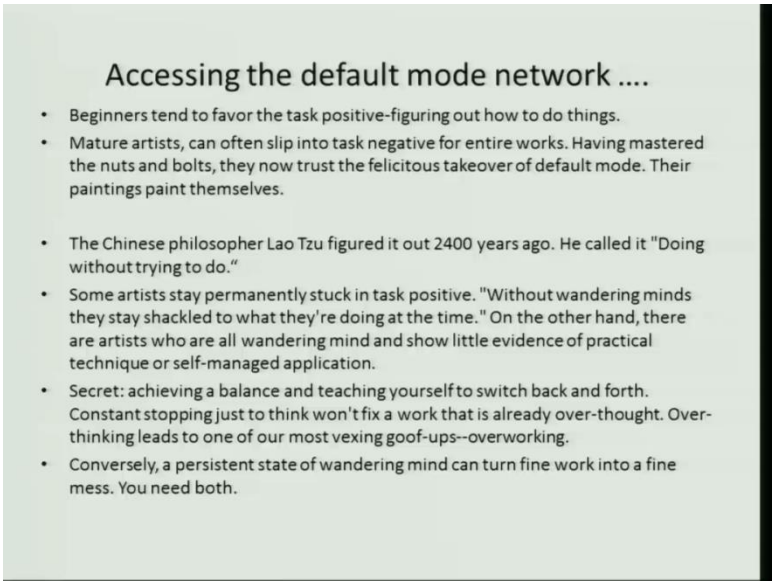

This line, the Chinese philosopher Lao Tzu called it, “Doing without trying to do”. Sometimes you try to do too much, and there are people who spend a lot of time in draftsmanship, in penmanship; they get 2 precise in that and then they cannot go back to the task positive, that the task negative.

There are some people who are trying to do abstract thought without doing the task positive; and, they cannot use the task positive. And so what happens is, you know, backward clouds they create, but it is not a painting. And then, there are some people who do precise things and it is not a painting, it is just a technical drawing. So, for creative people, one needs to know how to go back and forth.

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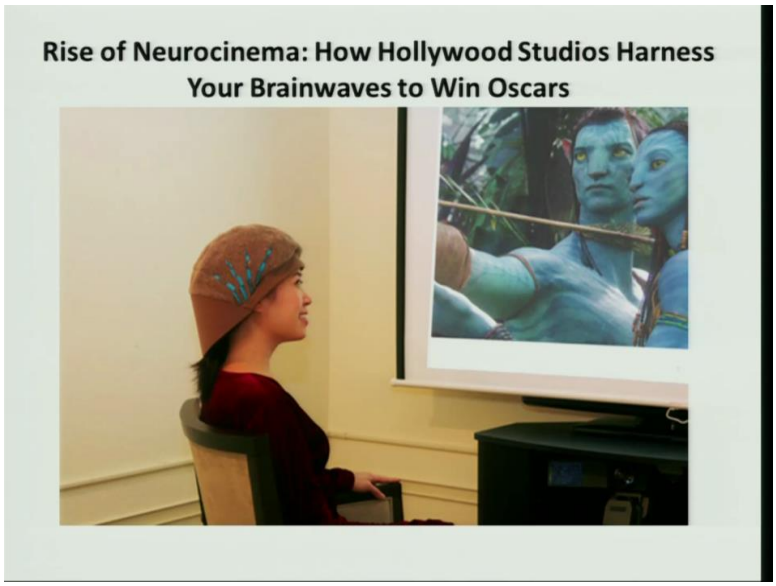

I will just end this portion with something that, you know, I found fascinating, some of you guys do cinema; are you aware of something called neurocinema? And that, bolly, hollywood is now using neurocinema to try and see whether their films will be successful or not. It started out very early, it is infancy, and I am just mentioning it as a joke to you guys.

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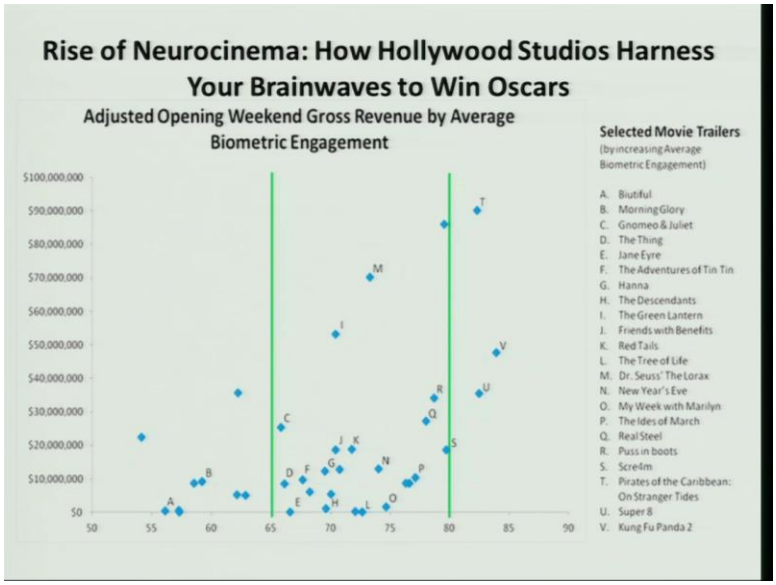

But, what they found is that, they could, using these principles, predict the gross revenue of the films, as to whether film [fl], this is something all the bollywood producers are worried about know; he put in so much, there is going to be run or not.

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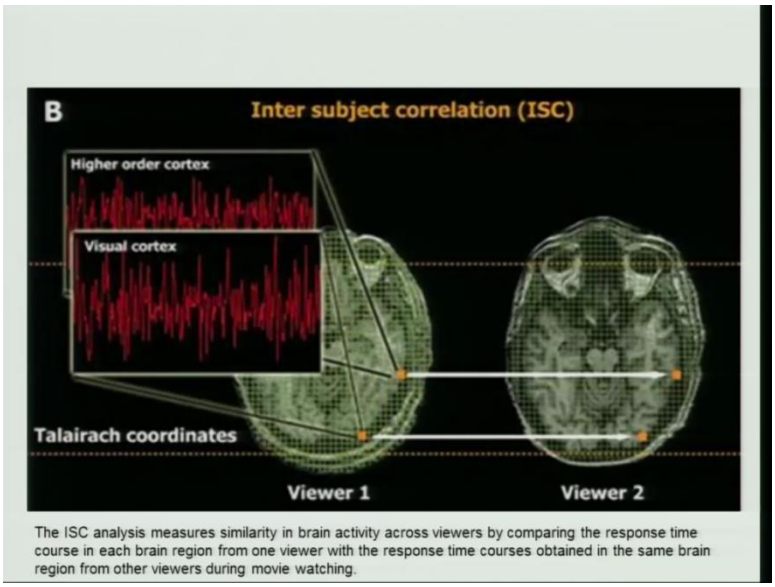

So, how they do it is, they show people a film. And then they basically look at, how people, the target audience reacts to the film. And they worked out certain co ordinates which is called inter subject correlation; that is, suppose they are 5 people, do all 5 respond to the film in the same way? Let me just show you examples.

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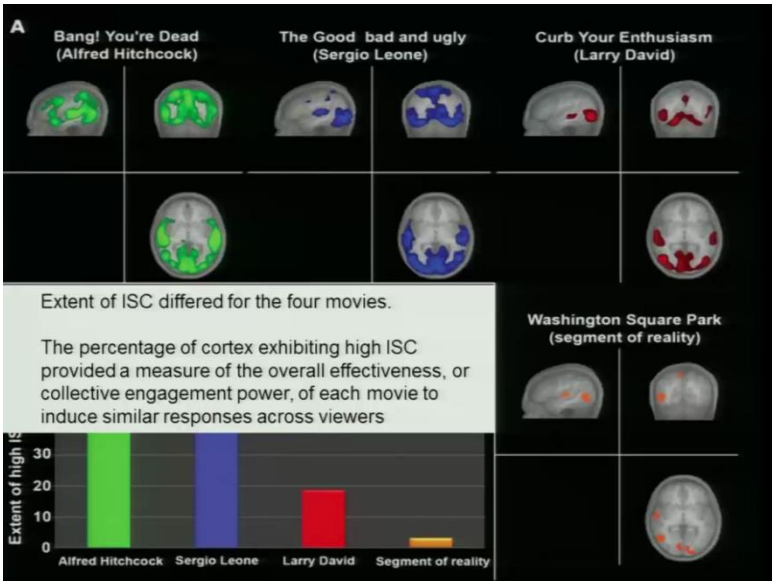

This is a response to an Alfred Hitchcock film. This is the extent of the involvement across, so if, I think, they use some 10 people. And they found that there was a commonality of activity. This was the commonality of activity to good, the bad and the ugly, you have seen that film. This was the commonality of activity to comedy TV serious called cubby or enthusiasm; some of you might have seen it. And this was the activity to an unstructured documentary, shot in Washington square; just they kept the camera there, and then they shot it.

As you have seen, people responded much more to this particular film, to the Alfred Hitchcock film, which the guys who did these experiments said, this is understandable; Alfred Hitchcock catches your thing, and it is very well constructed. So, the extent of the ISC differed for the 4 movies. The percentage of the brain, exhibiting high ISC, provided a measure of the overall effectiveness or collective engagement power, of each movie to induce similar responses to other viewers.

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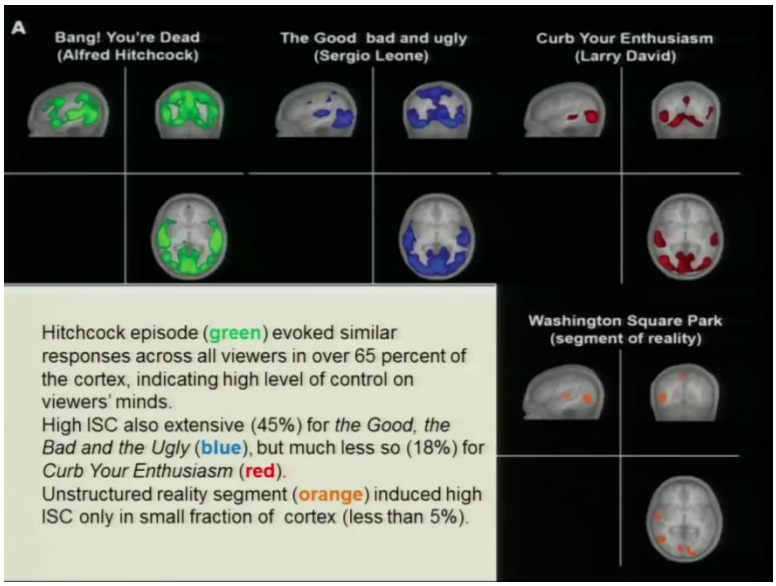

So, like I said, you know, I have already explained that the Hitchcock got the greatest number of, I mean, the greatest amount of response indicating a high level of control on the viewers mind. And this had the lowest level of control on the viewers mind.

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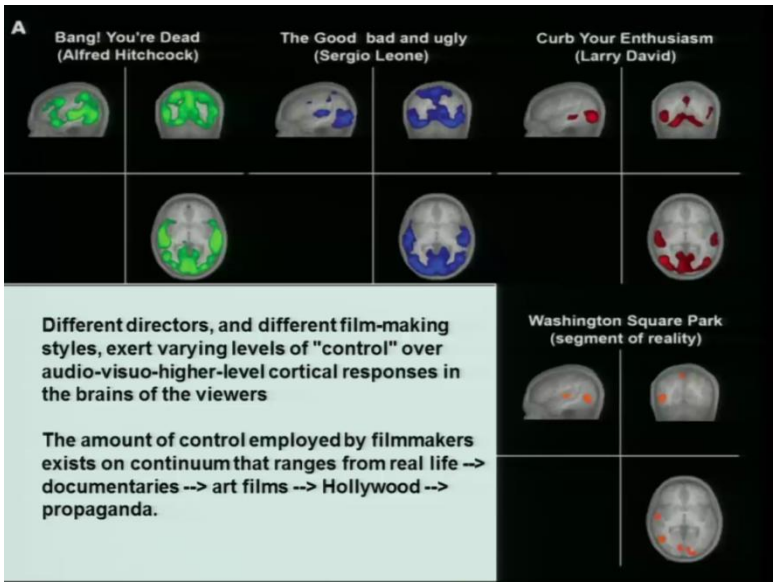

So, different directors, and different film making styles, apparently exert varying levels of control over the cortical response of the brain responds of viewers. Now, the amount of control what these guys are saying, this is very early earn. I cannot really say that this is established.

What these guys are saying, this is the amount of control employed by filmmakers exists on continuum that ranges from real life, least amount of control, to a well scripted Hollywood film where every line, every comma, every breath, is scripted. And if it is, then it is more likely to catch hold people's imaginations.

What I am going to talk about today is, basically about how the human brain perceives art; why does it, why does the human brain create art, how it looks at art, how does it process art. And you know, I am at the end of the day a clinician, so the question that I ask myself is, can one use art as a window to the troubled mind; and, most important is, can we use art to heel.

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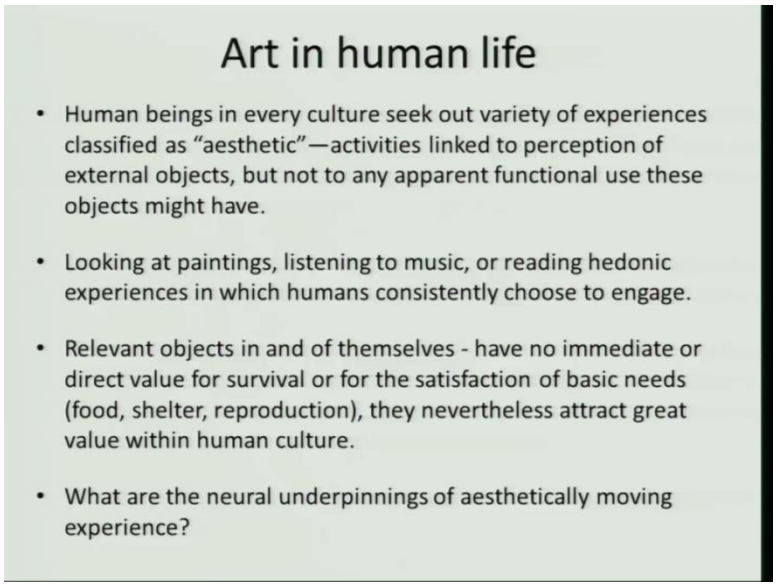

So, I will try, and answer some of these questions from recent research that has been done. But, when you look at art, you are aware that the human beings in every culture have sort out a variety of experiences which have been described as aesthetic, which have been linked to perception of external objects. People have looked at paintings, listen to music, there is even art in cooking and tasting; but, what are the neural underpinnings? What are the brain underpinnings of say, listening to music or looking at a work of art?

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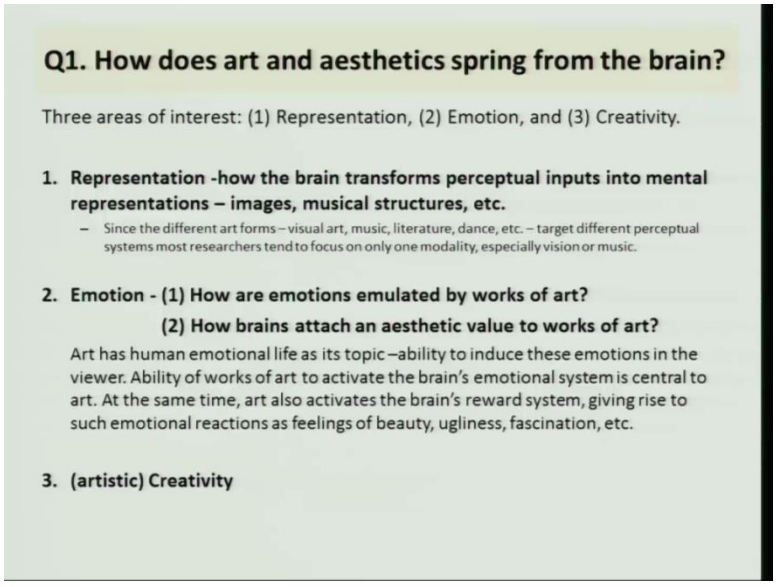

So, the question number 1 is, how does art and aesthetics spring from the human brain? You know, why am I talking mostly about humans, because we are not really sure, whether dogs and cats appreciate art. To the best of my knowledge, they do not create art. Although, sometimes, you would read of some elephant which is been taught to use a brush and splash paint and then you sell the painting at huge price, but still the juries doubt as to whether that really is art.

So, the 3 areas have interest are representation, emotion and creativity. How does one represent something, that one sees or experience, through the form of a painting, through music, etcetera? The second is, how does a work of art evoke certain emotion in you? And the third one is, of course, about creativity; you know, I might draw and paint, but if I am not creative it is not really going to evoke emotion. And if am I try very hard to do something, and I am cannot able to do it; and, somebody else you just wake up and do something and will have this ah ah reaction and will do it; so how does that happen?

So, representation is about how the brain transforms perceptual inputs into mental representations, whether there is images, musical structures, etcetera. Emotion is, how our emotions emulated by works of art, because the greatest works of art are actually emulating some emotion. You know, when you hear a piece of music, it supposed to invoke a particular emotion in you.

And, how brains attach in esthetic value to works of art? I might draw painting, but you see Picaso's painting and you will say, wow; you certainly pay much more for Picaso's painting than you will for mine, is it not? So, how do brains attach importance to that? And third is, of course, about creativity, artistic creativity.

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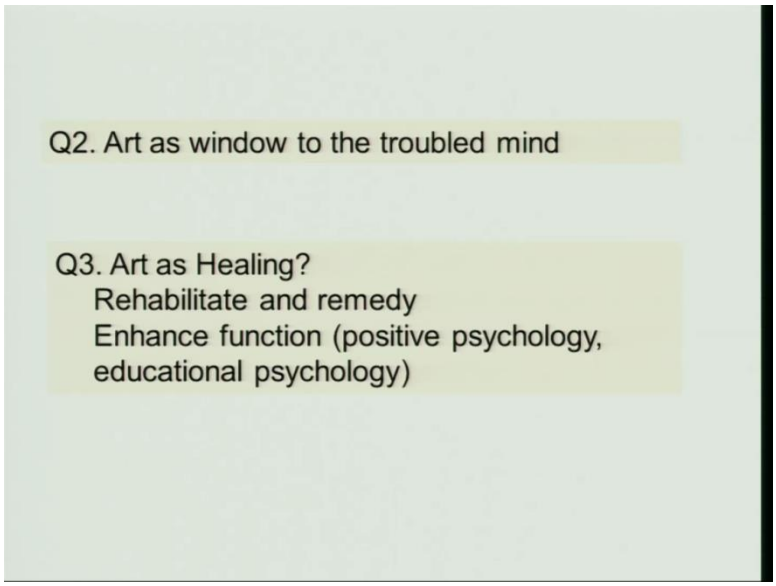

The second area of question is, as I told you, I will talk about is, art as a window to the troubled mind. And the question number 3 is, whether art can used to heal, to rehabilitate remedy, to enhance function; not just necessarily people who are not well, but for people who are well, can they be made better.

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So, how does art and aesthetics spring from the human brain?

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Let us start off with different kinds of things, one needs to, when one talks of art, one is not really talking of great paintings, one is also talking about pretend, make believe that we do when we use a dolls and we pretend, that is really drama in the most primitive sense. When you go and see a painting and try to copy it, that is also art.

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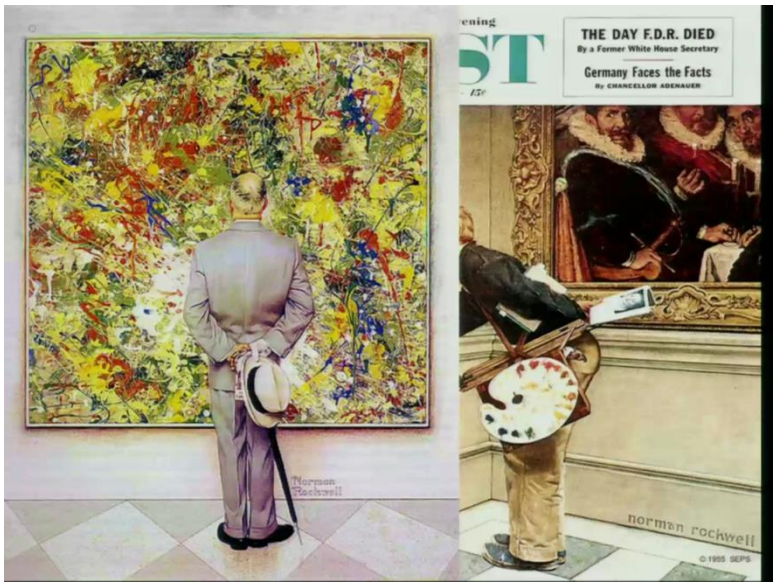

When you try to make sense out of a jumble which is a Jackson Polack painting, you are also trying to fathom what is there; you using your brain to do that.

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And of course, when you try and represent something, for example, this is somebody, a man, trying to imagine himself as a woman, and so therefore, wearing. You know, that there these therapy courses that are done to teach people about sensitivity, to gender sensitivity, etcetera. Sometimes you give dolls to young people and they carry these

crying dolls to their class, etcetera, to teach them how difficult it is to bring up children. So, that itself is also an art form in that sense.

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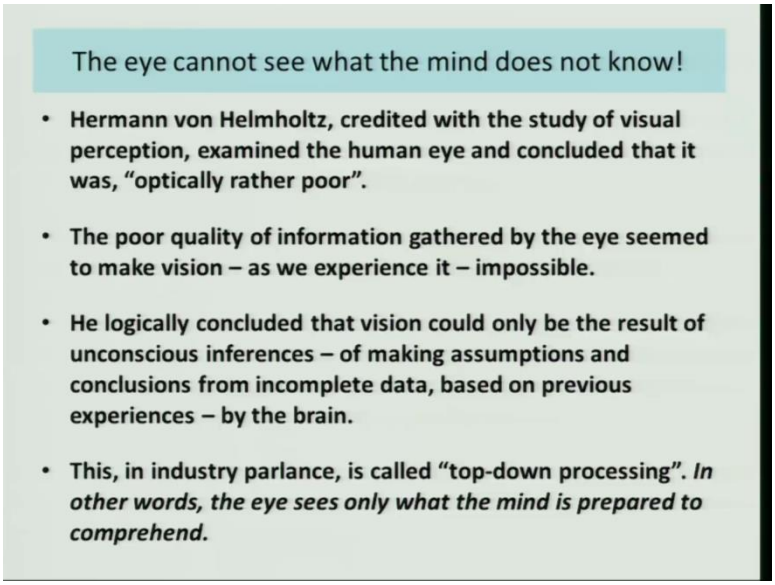

But, the eye cannot see what the mind does not know, right. And basically, this is a very busy slide, but what I wanted to talk about is that, that if I do not know something exists, is it really there? Because, what you see and what I see, are different. It is the same object, this one, you know, what you see and I see are different; what you and I make out of it are different; but, we have learnt over the years to call it a pen, because, our sensory systems are different.

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The eye sees only what the mind is prepared to comprehend. And we spent many years trying to understand that. But, having said that, the visual system and human beings allows us to assimilate information from the environment, but it is a mechanical thing. Somewhere in the brain, these have to be put together to make a representation of what is out there, and each ones brains make a different representation.

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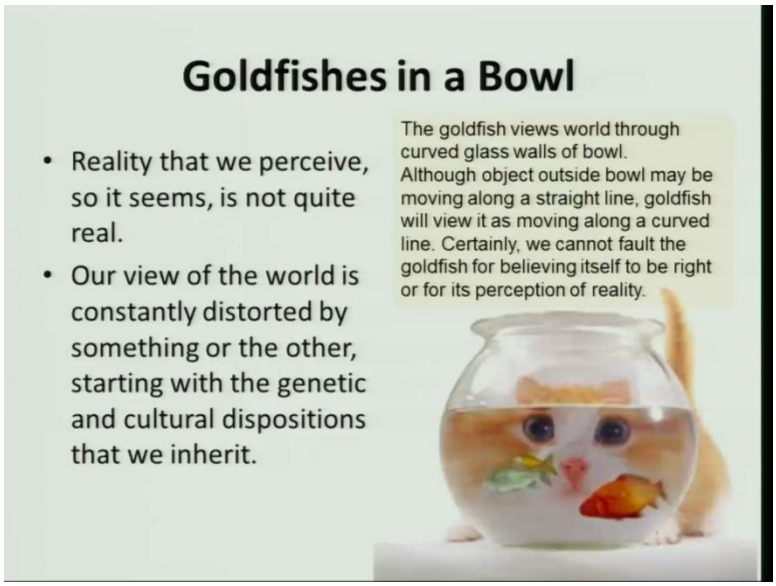

So, it is like, we have like, goldfishes in a bowl. Reality that we perceive is not quite real. You know, this is, we have gone into the field of philosophy, but our view of the world is

constantly distorted by something or the other, starting with our genetic makeup, without cultural predispositions, etcetera. For example, in some primitive societies, they cannot count upto 10; they count in units of 5. So, there perception, the world is based on their cultural, a cultural knowledge.

And, the classic thing which I will talk about later is, if we go and play a sitar to a finish audience who having ever heard of a sitar or Indian music, they will probably describe it as screeching sound; they will not be able to perceive the beauty of it. You will be able to perceive the beauty of it because your culture has programmed you to understand the nuances of this cluster of sounds.

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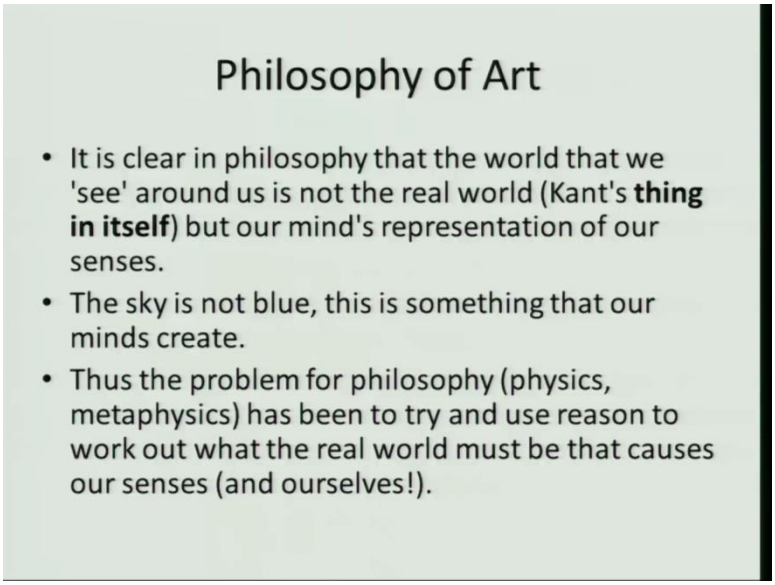

So, it is clear that the sky is not really blue, it is just that; that is what our minds create out of our perceptions. For some people whose minds cannot create it, they often see the sky is red or whatever color, you know, people who are were color blind, which is where we come to the ancient Sanskrit word of, rasa.

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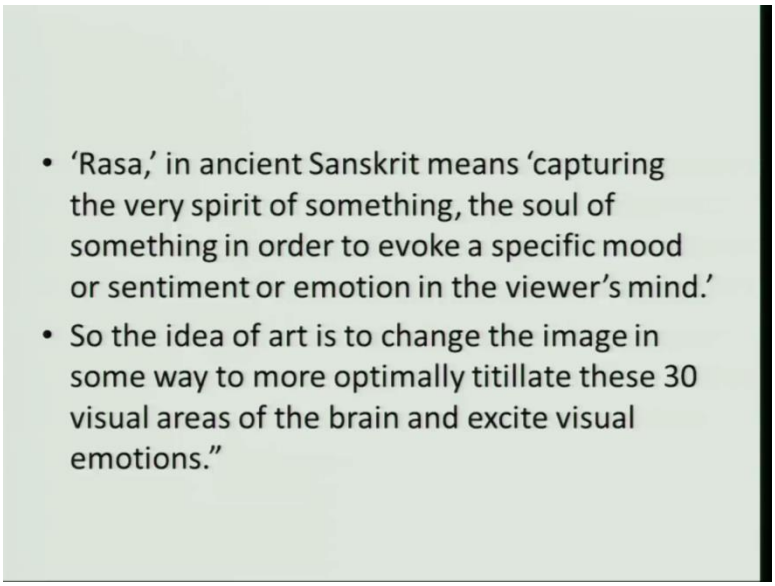

Rasa is to take, to inspisate, to squeeze out the meaning, and that is what the human brain does best; it gathers information, it gathers perceptions, and squeezes out a meaning.

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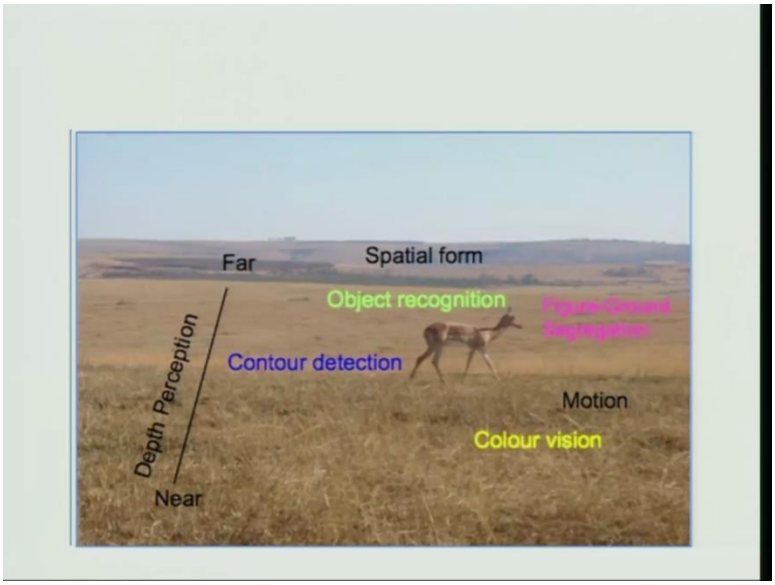

Let me go past. This is the picture of an antelope. You know why we see it? Because, as a part of evolution, parts of our brain have developed specialized forms, specialized functions to look at this special form, to recognize that this is a deer object, recognition, to detect the contour, to see the color, to see depth, but these are all done separately.

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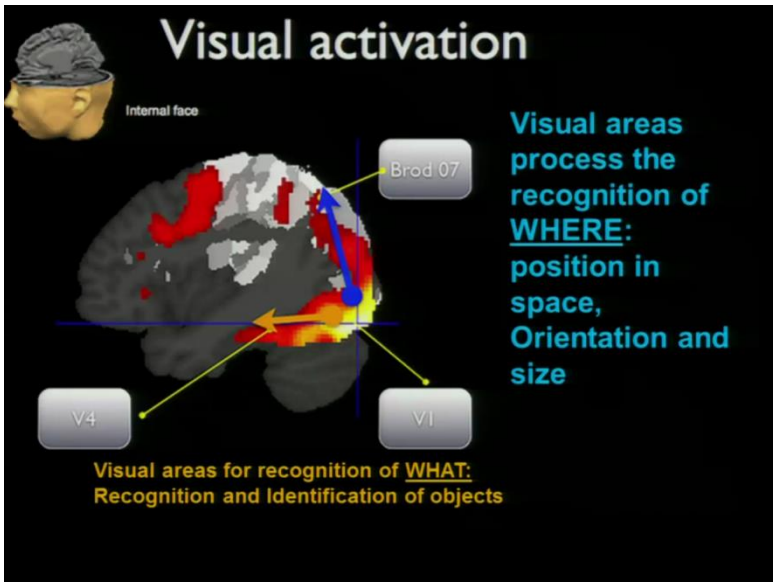

So, there are different parts in the brain; say, for visual activation. The part here, for example, in the visual area processes where, something else. These are the areas in the brain which process, what? What is this? What is this is different from where it is. You know, for people who have this area knocked out, they can say this is a moda, but they do not know how far it is.

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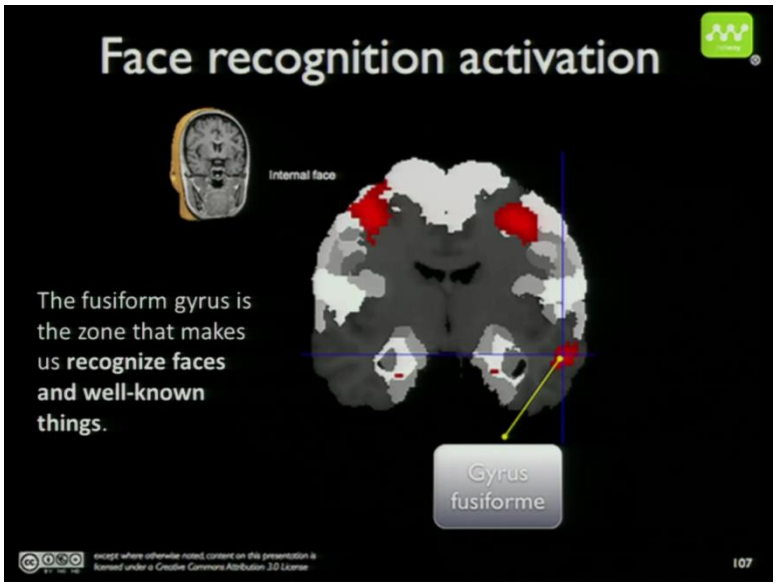

Similarly, there are areas in the brain which are specialized for face recognition. Now, if I see, you sitting there, and have seen you earlier, all these 3 areas have to send me

information, and I have to work it out, that it is you who I seen earlier in the morning, right, sitting 6 feet away from me, and I recognize your face, but all 3 have to work together.

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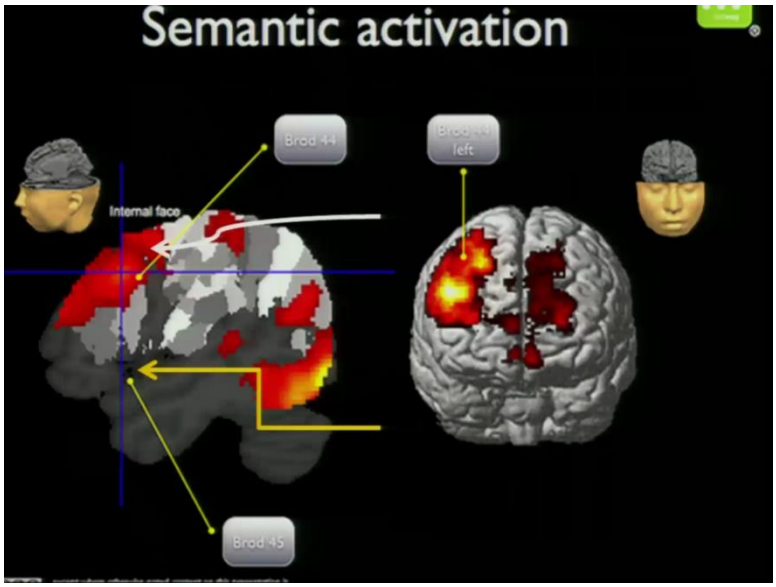

Then there is another area for semantic activation; that is, putting a name to it. You know, it is a great skill, putting a name to a face; it is unfortunately a skill which I am loosing very fast apart.

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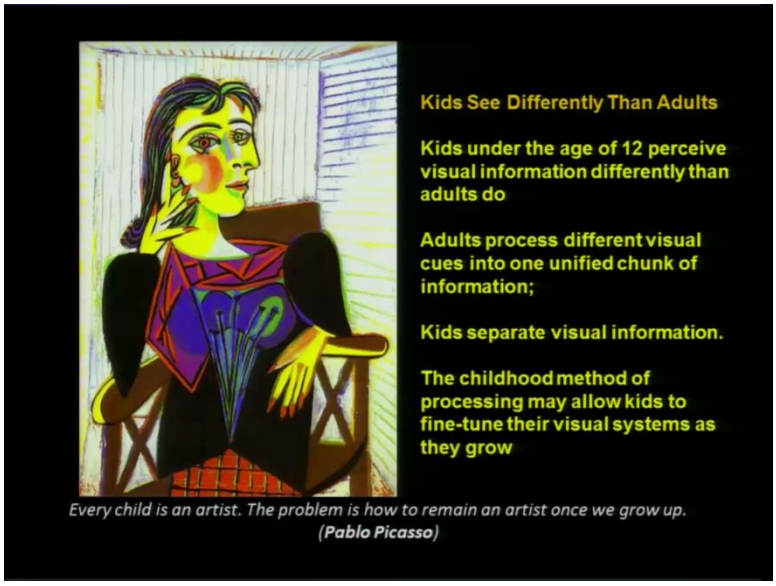

So, Picasso was one person who deconstructed this, the whole cubism movement. You know, by deconstructing this, space and form and contour, he used the brains ability of putting these together and by reconstructing it, to create mystery in your minds. And he very famously once said, every child is an artist. The problem is how to remain an artist once we grow up.

From the neuroscientist point of view, this is very significant because children see things differently from adults. You know how children see? Children see these different parts as different parts, and then they have to put it laboriously in their brain, they have to put it together. So, if you see how children draw, do you remember, or you do any work with children, they draw in ways which adult too try to learn how to draw. But, as they grow up this process of putting things together becomes an automatic thing.

So, the way adults see the world is very different from how the children see the world. So, for an adult to draw like a child you have to relearn the entire process. And Picasso says that, you had to relearn the entire process of looking at the world as a child and redrawing, I mean, drawings like a child. Kids see differently than adults. Kids under the age of 12 perceive visual information differently. Kids separate visual information.

The childhood methods of processing may allow kids to fine-tune their visual methods thus they grow, but once you fine-tuned it, then you have to unrefine it, to be able to see you know, when you create a work of art you have to then unrefine it again.

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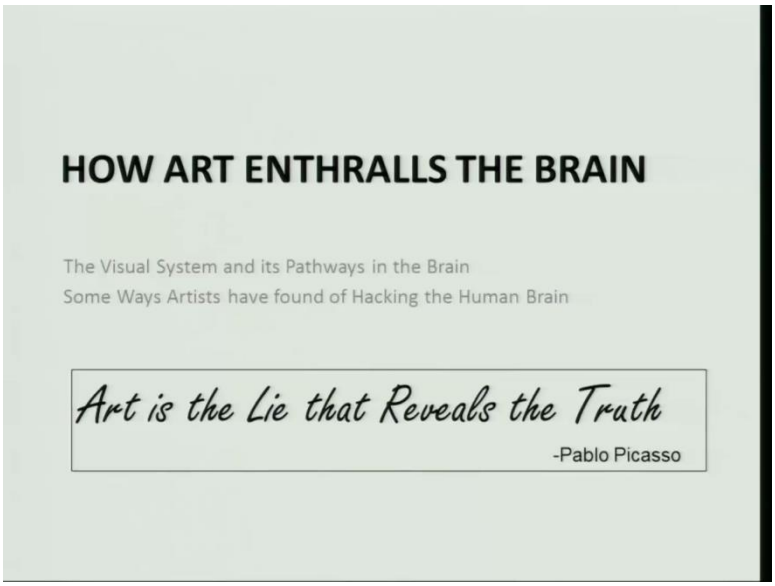

So, we come to how art enthralls the brain. Again, to quote Picasso, "Art is the lie that reveals the truth". You know, just nearly representing what is, what you are seeing, is not interesting; a plain photograph is not interesting. And eversince the discovery of photography, artists has stopped representing reality, as they see it. They are trying to reconstruct, deconstruct, bend, catch the attention, you know.

There was a, you heard of E.M. Foster, the writer. He said, as far as art is concerned, whether it is literature, etcetera, there is only one thing that you need to do; he said, only connect; that is you have to, whatever you do, has to connect to a human brain. And however you do it, is actually the process of art.

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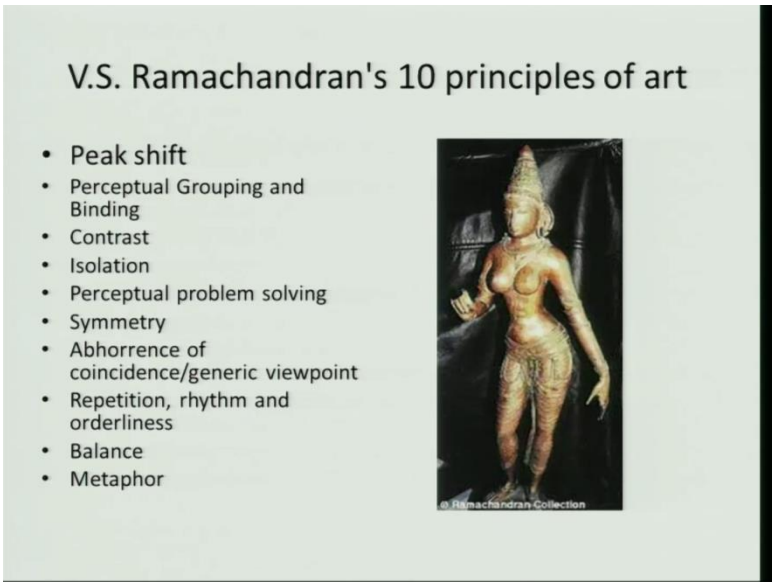

So, you heard of Doctor Ramachandran, Vilainoor Ramachandran, the fantomlim person. He and others have worked on this whole thing of neuroaesthetics, as to what is the neurology of esthetics. You know, what is esthetic, and why something is esthetic? And they worked out certain principles of why something is esthetic and why something is not, why does it catch the eye, why does it catch the human brain, why does it connect, and, some of these things that I will go through.

He says that any great work of art which is what is called a peak shift; that is, if you look at a Chola bronze, you will immediately know that this is not how real women look. Real women do not have such thin waists; they do not have such long hands; they do not have such protuberant dress, but that is what the artist does; he shifts the peak; here, she shifts the peak. The peak has been shifted; this has been shifted and immediately grabs your attention. So, that is one of the principles that artist use knowingly or unknowingly to grab the attention of the brain.

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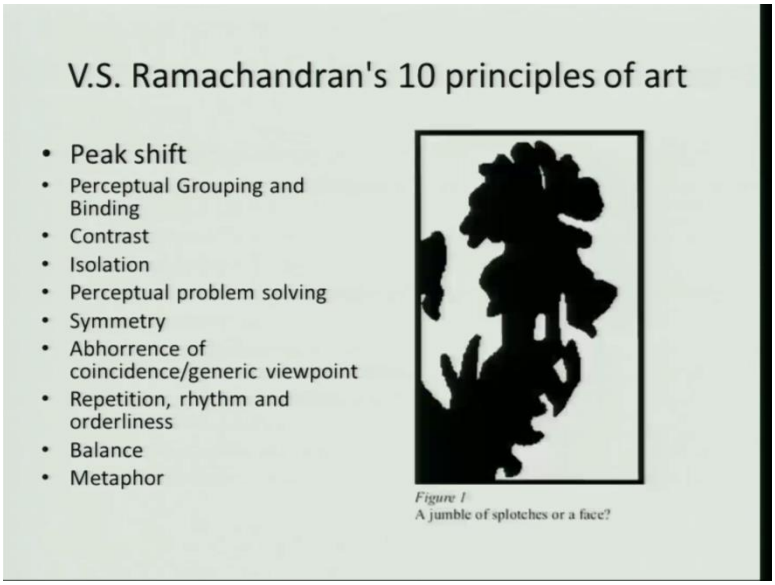

The other one is called perceptual grouping. What you see in this? Is this a jumble or splotches, or do you see a face here? Why that a face? Because, in your mind all these clutches have got grouped together and you see the face, is it not? So, this is something which the brain does, and the artist has overtime realized that if you exploit this, the brain say, wow.

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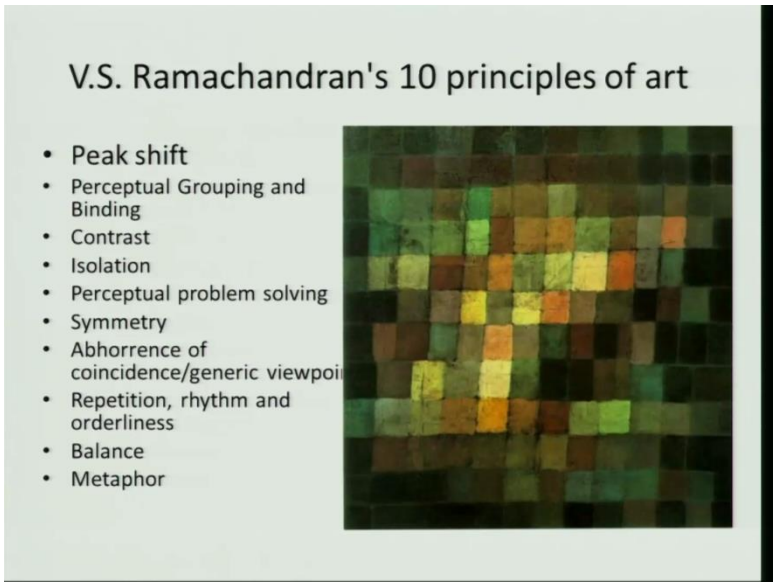

Then, the other one is contrast. This is, you know, this is pal clay. What is this? You use this and you contrast this with a different color, different temperature; and, immediately this hits you; it strikes out.

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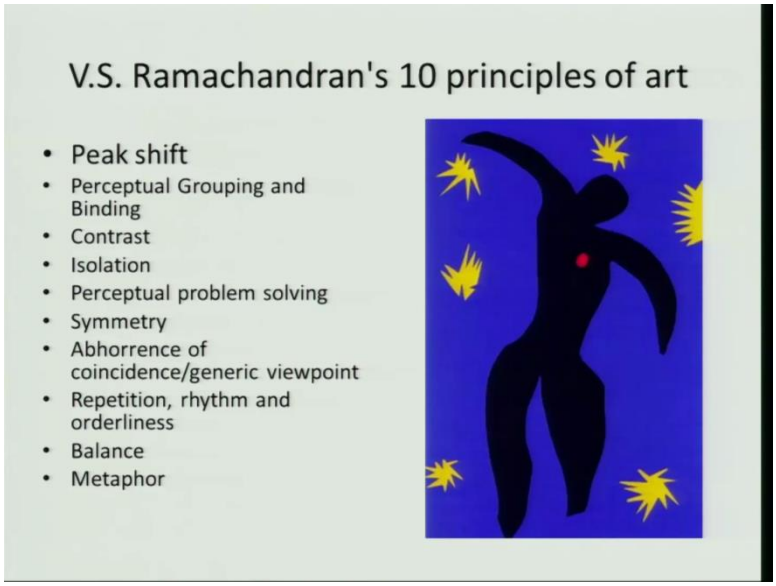

Isolation; what you see in this picture? The red dot; it is isolated. You have the splotching yellows, and you have the red dot, that isolated by the black, right.

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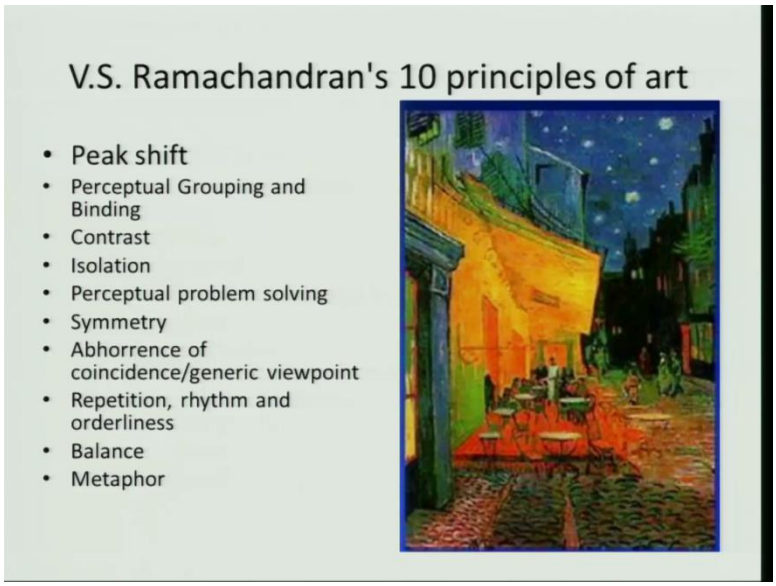

This is called perceptual problem solving. There are lots of things here, but he as shows it, is given to you, your brain would say, what it cannot make sense, what is this? But, then it becomes very interested and you see the yellows, you see the reds, and you see that this is a café seen. So, so on and so far, I am not going to go into all of these.

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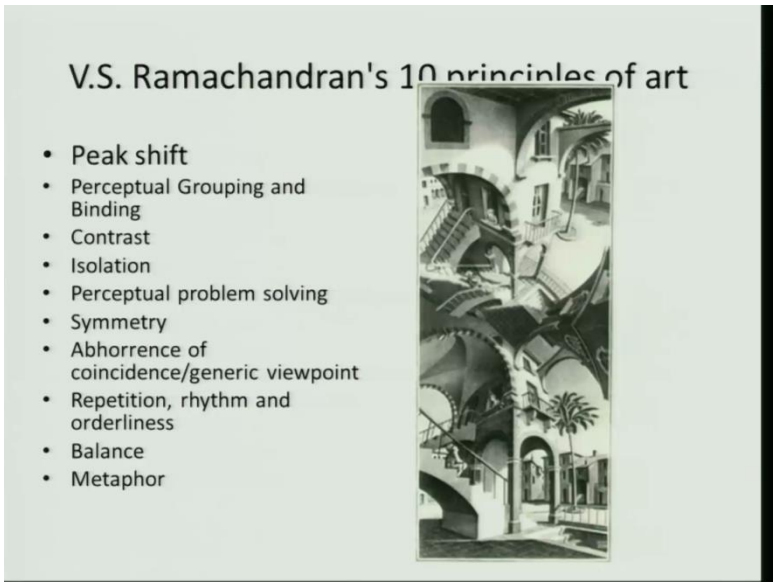

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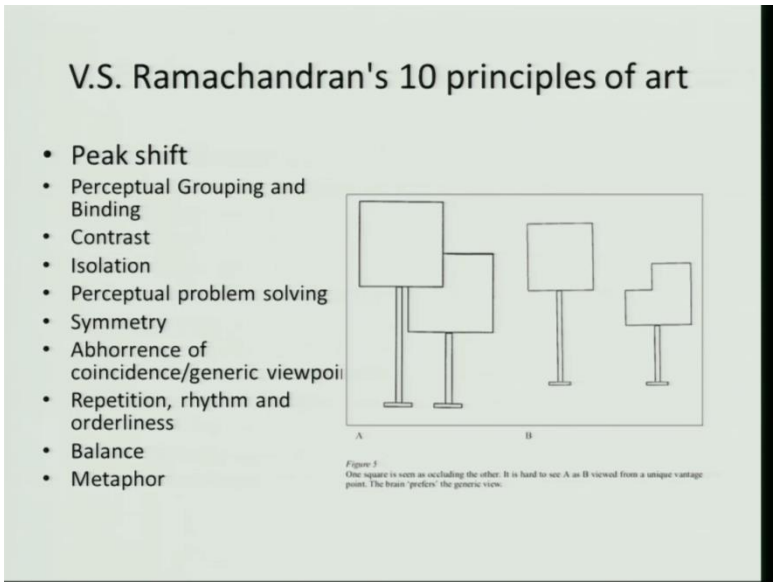

There is another thing. For example, this is abhorrence of coincidence; the brain does not like coincidence. So, what is this? Is these 2 things, one behind the other, is this perspective, or is it actually 2 shapes like this. If I did not show you this, what would you think with this? One behind the other. Because, the brain does not want this; and so it automatically criticizes the letters one behind the other. This is something that artists and designers used.

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So, anyway, I do not want to bore you by going through all these things, what. Again, let me give you an example in ways in which artists have learnt to hack the brain. This is Monet's field of puppies, Coquelicots. What you see? Just look very closely at the painting. No, look at the painting what is happening there. They are moving; what is moving? Not the people; if you see, the movement comes from somewhere else. No, it is the puppies which are moving, but you saw the movement, is it not? But, this will movement, Monet drew this a more 100 years ago.

Why do you see movement there? Let me do one thing. Let me take the color out. Where are the poppies? No puppies, right. Monet discovered one great artistic principle; then we bring the color back again. He actually painted these at the same color temperature. They just contrast, but the color temperature is the same. So, what happens is, the parts in our brain which seen black and white, which is the part in our brain which actually supposed to look for distance, for shape, etcetera, keeps firing and looks at it in black and white. Hence is no difference.

The poppy and the green fields are the same. The parts of our brain which code for color vision, fire at another time, and this is the red green, red green, red green, difference. So, your brain is moving from black and white, no difference; to color, difference. And so there is, you shifting from one to the other and you see movement. So, artists have learnt to hack it. I am sure, Monet did not know neuroscience; it is just that.

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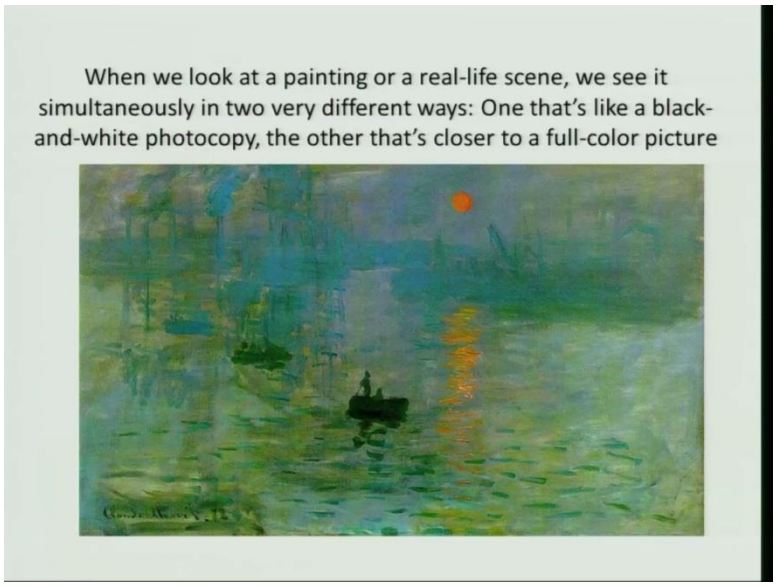

Again, this is the sunset; let me take off the color, is know, that comes back again; then you can see once you do that which seem as this moves. So, like I said, one that is like a, you actually see simultaneously one that is like a white photocopy, and other that is like a full color picture and keeps moving from one to the other.

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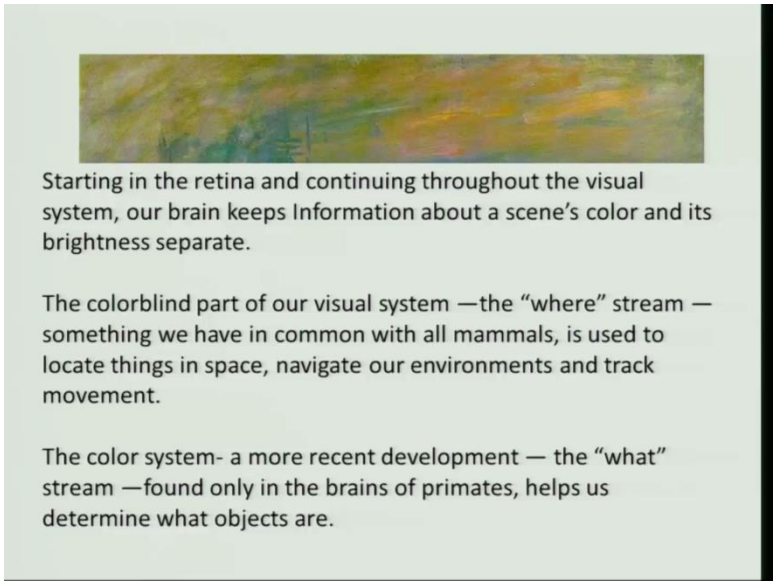

So, starting in the retina and continuing through the visual system, our brain keeps information about the scene's color and its brightness separately. So, the colorblind part of our visual system - the "where" stream - something that we have in common with all

mammals; you know that dogs do not see color; you know, is used to locate things in space, navigate environment, etcetera.

The color system is more recent - the "what" stream - what is it. So, it is found only in the brains of primates, apes upwards; it helps us determine what this is; is this an apple or is this a poisonous berry; you know, color is very important there; that is different; so it keeps going from one to the other.

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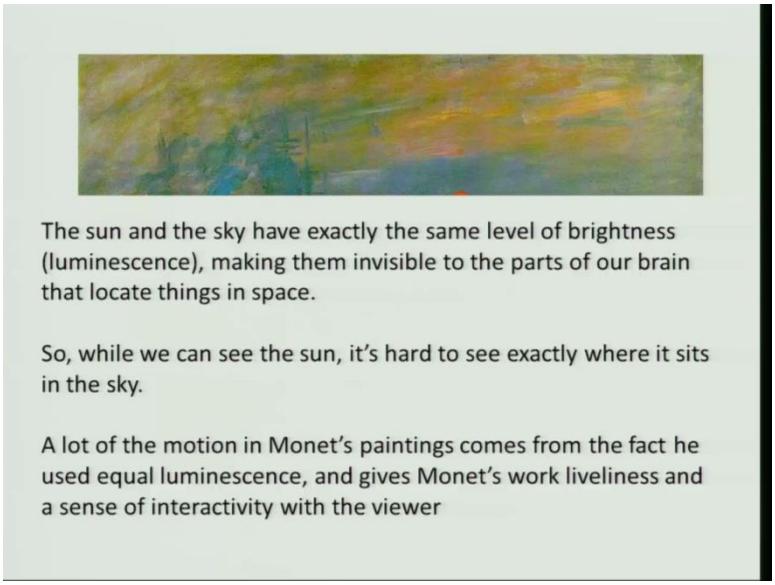

So, like I was saying, the sun and the sky have exactly the same level of brightness, luminescence, making them invisible to the parts of the brain which locate it in space. So, while we can see the sun, it is hard to see exactly where it sits in the sky. A lot of motion in Monet's paintings actually comes from this principle.

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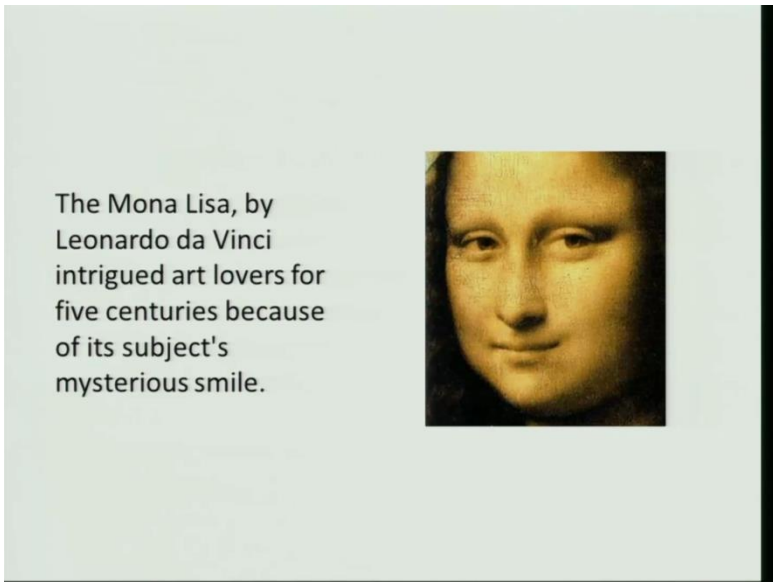

Let me go to another picture; you all know this picture, right. This is Mona Lisa, most famous painting on earth. The biggest mystery with this painting is, whether the Mona Lisa a smiling or is she frowning, right. Look at the picture, what happens? Again this movement here; you think sometimes she is smiling, sometimes she is frowning; why does that happen?

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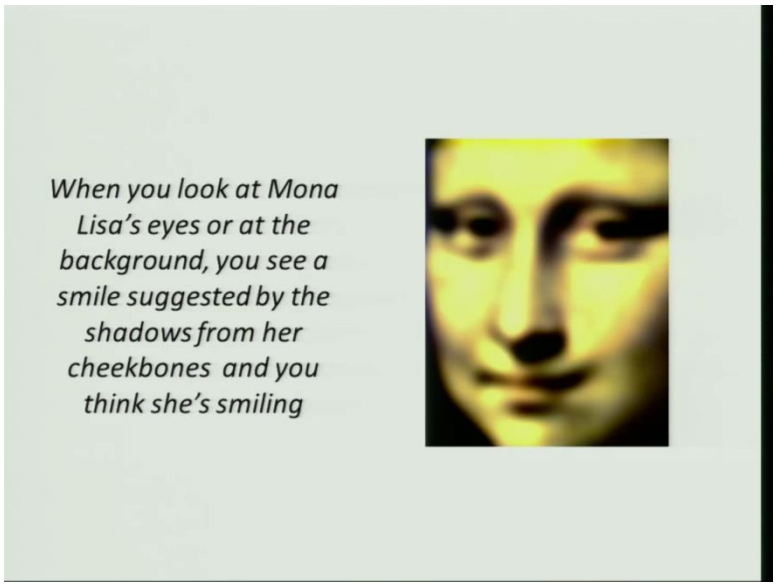

Let me again do a little bit of manipulation. I have manipulated the picture, a little bit. So, I have taken out the shading here, what do you see? When you look at the Mona

Lisa's eyes or at the back ground, you see a smile, because there is shadow under her cheekbones, right. Leonardo used a very new technique which the renaissance painters have just discovered; it was called a sfumato technique, which was the use of, using dots to make the shadow, instead of making a solid layer.

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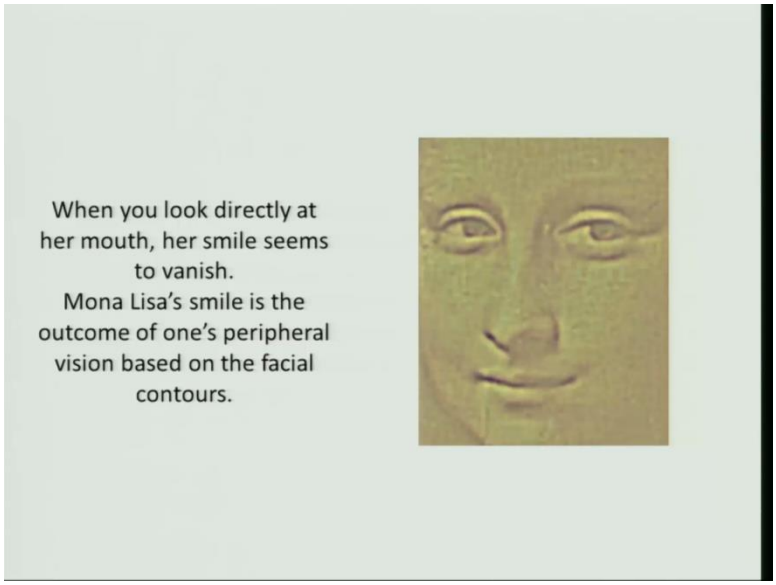

So, when you do that, when you look directly at her mouth, her smile seems to vanish because you are basing it not on this, but only on this.

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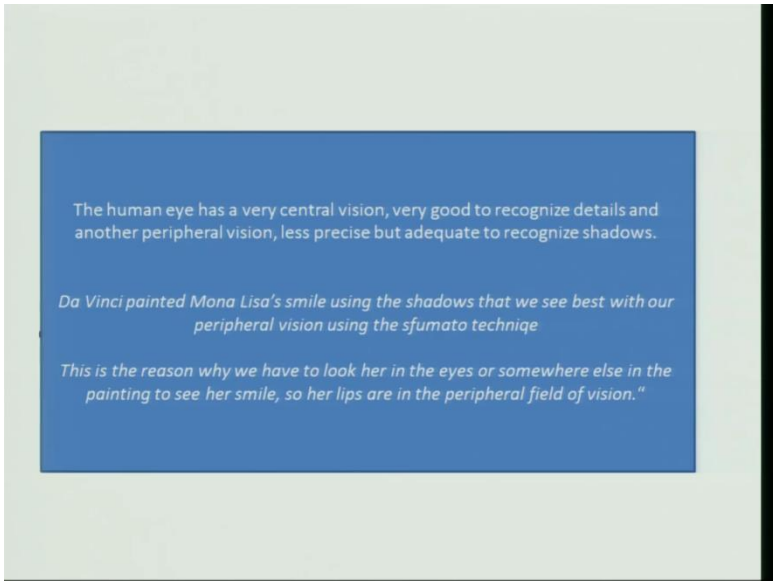

The human eye has a central vision which is very good, and it is used to recognize details and another peripheral vision which is used to see shadows. Because, again, we want to see this, but I also want to see movement here because, you know, danger might be coming from there. Remember, we are not all sitting in class rooms, 40000, 50000 years back. So, we needed to see shadows moving, but you also needed to see what is right there. So, these are 2 different systems, and they work independently.

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So, artists have used these 2 different systems like, you saw in that painting; you know that Impressionist painting is most popular in the world, why? Not really; what is the thing about Impressionist painting? Some of you are art students here; gives an impression, does not give you the full details; why is it so fascinating to the human brain?

Student: It gives an opportunity to know more.

It gives you an opportunity to guess. This has actually linked to the brain early warning system. I will show you why?

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Let us go to the, let me just go to the picture, and then I will come back. Let me just show you this picture first. What do you see here? This is Dallie's painting on the slave market. What do you see? That is the bust of a voltaire. So, the painting is actually called the bust of voltaire or the slave market. And your eyes go to this.

Once you discovered this, it is no longer the slave market; your face keeps, your mind keeps going back to this thing, why? Because, your, this is the mystery there. And once your brain has discovered the mystery, it keeps going back. Have you ever had a some cut in your mouth, your tongue keeps going, human brain is a very curious organ. So, once it discovers some mystery, keep going there; and coming back, going there.

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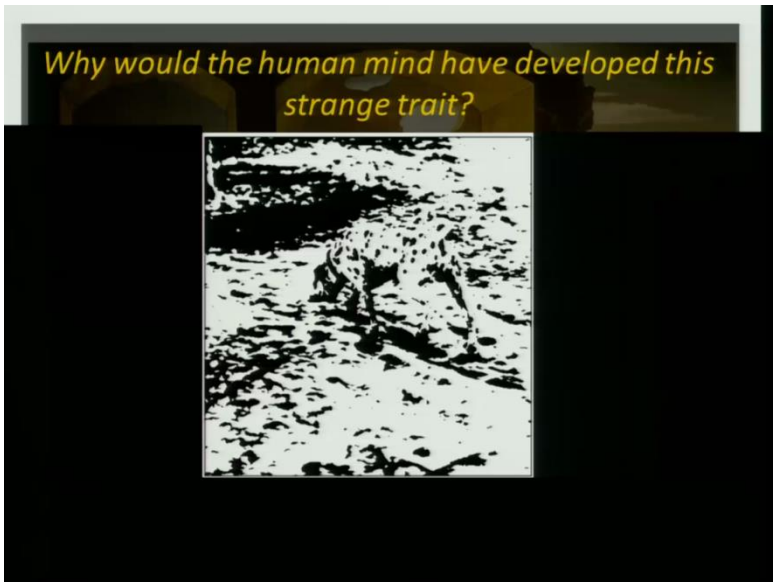

Let me try and see whether, let us no, let us go to, what is this?

Student: It is a dog.

Are you sure?

Student: Yeah.

Not just leopard, but your brain has to make sense of this. Remember, you know, where this comes from; our brains are used. Human brains have had to for a long time make sense of whether that movement, is just lives moving, or it is a leopard. So, we have to develop this thing. So, the human brain is very good at sorting out mysteries, actually looks for mysteries, in our visual cues, in our music, etcetera.

So, even in music, you have something which is repetitive, your mind gets bored; you miss a beat, so your mind just says, wow, you know. And that is something that you do in art also. When you, I am, in painting, you represent something which is, we just represent the forms, you miss out the content, and becomes that much more pleasing; because, you allow the mind to recreate to, to add in the missing portions.

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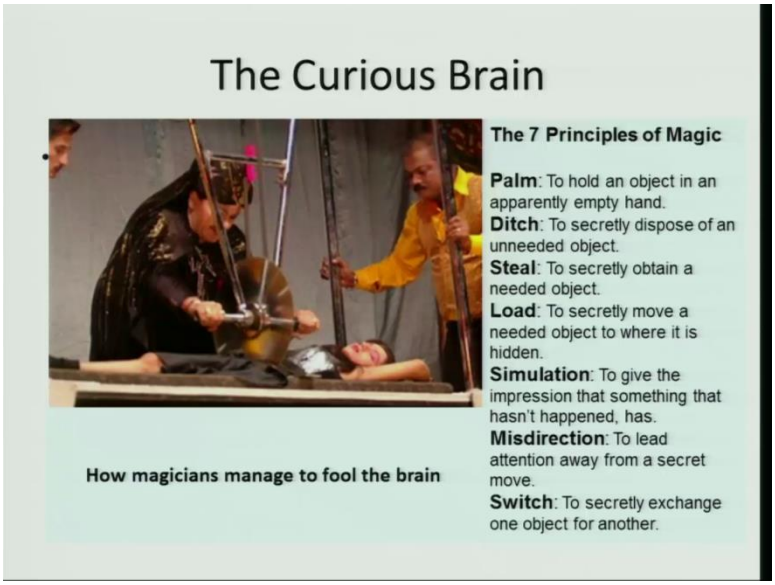

And, this is something that the magicians rely on. The magicians will do something, and they will let your minds make 2 plus 2. Now, this lady is getting cut, and he will do something and you think that actually the saw is going through, when is really not happing. The slight of end that you do for cut tricks; your mind just adds up 2 plus 2 is equal to 4, because you expect that to happen.

When it does not happen, your eye is, your mind does not register, although your eye sees that. So, if you look at some of the TV magic, you will find that is, if you slow it down, you can see what is happening, but at the real place your mind is just preparing over the, ok.

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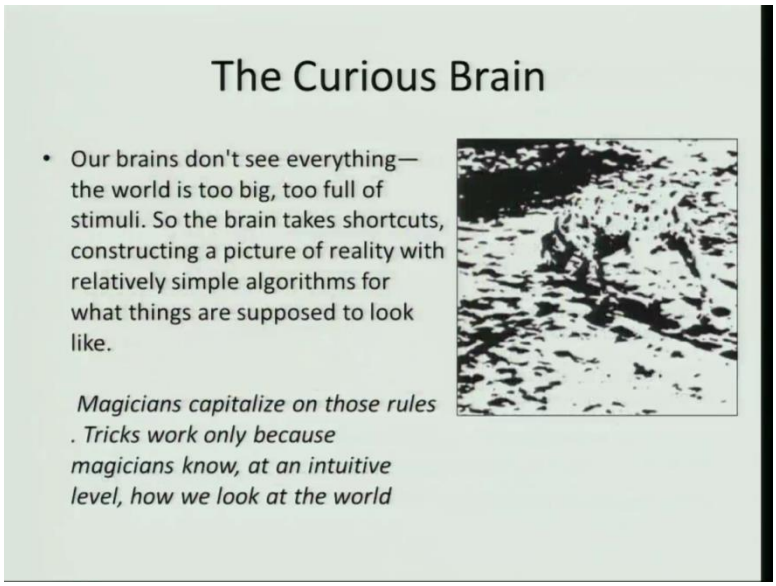

So, basically, what I am saying is, our brains do not see everything. The world is too big, too full of stimuli. So, the brain takes shortcuts, constructing a picture of reality with relatively simple algorithms for what things are supposed to look like. Magicians capitalize on these rules. Tricks work only because magicians know, at an intuitive level, how we all look at the world.

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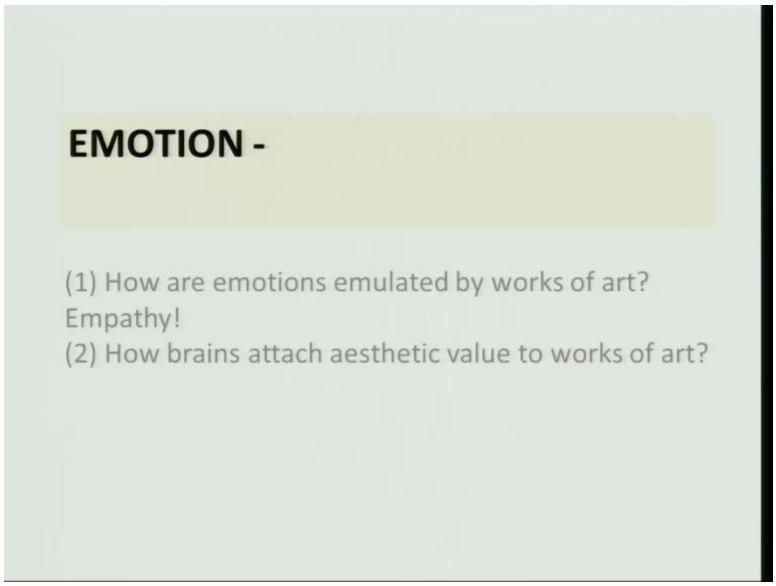

Emotion; how are emotions emulated by works of art? How brains attach aesthetic value to works of art?

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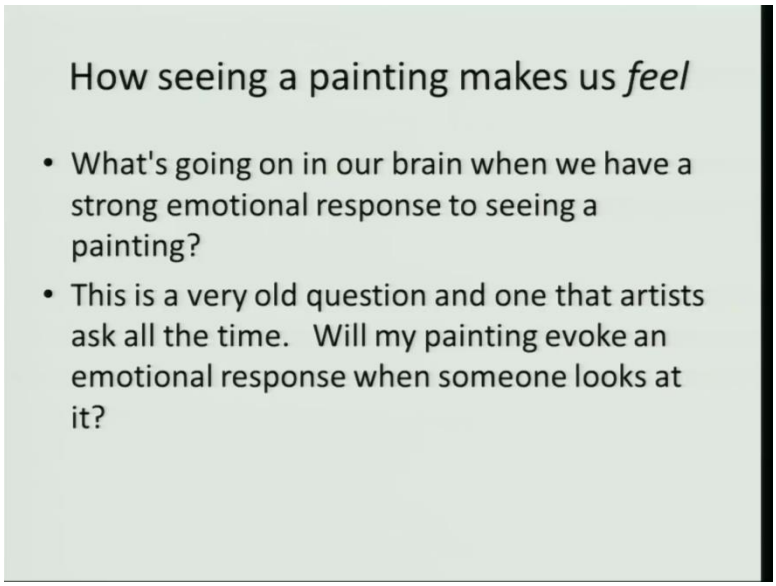

What is going on in our brain when we have a strong emotional response to seeing a painting? You know, artists are always asked you, guys always ask, that if I do this, a dream make somebody feel, wow.

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This is the study that people did: subjects were told to rate a painting, in 1 if they did not like it and 4 if they like it a lot. They looked at different paintings and give ratings while sitting in an a line, or in an MRI machine. When they saw a painting they liked, it evoked

a different response in their brains; we all know that, is it not? This is, for example, is a expressionist painting by Max Ernst called Chinese Restaurant; and. do you like it? [FL].

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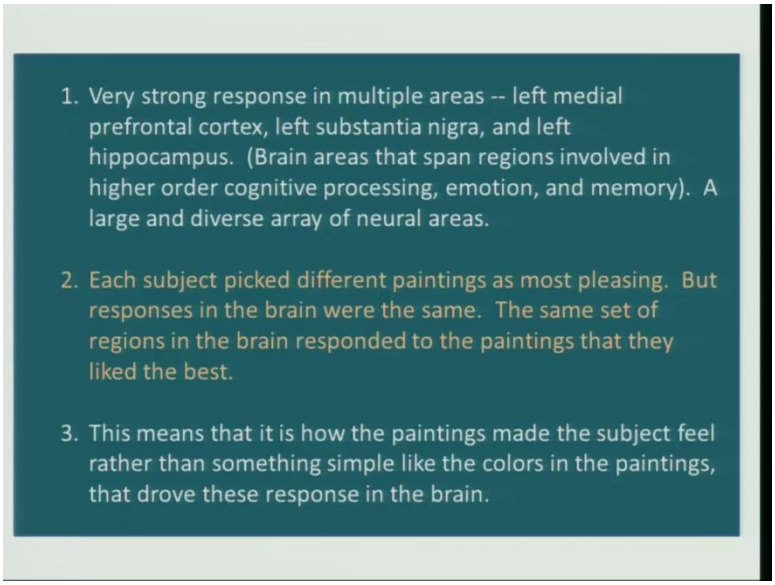

But, there was a very strong response in multiple areas in the brain when people like the painting. Each subject, there in this experiment, picked a different painting, that something as they liked. But, what is fascinating is, that some paintings made the subject feel, know, that they liked it more.

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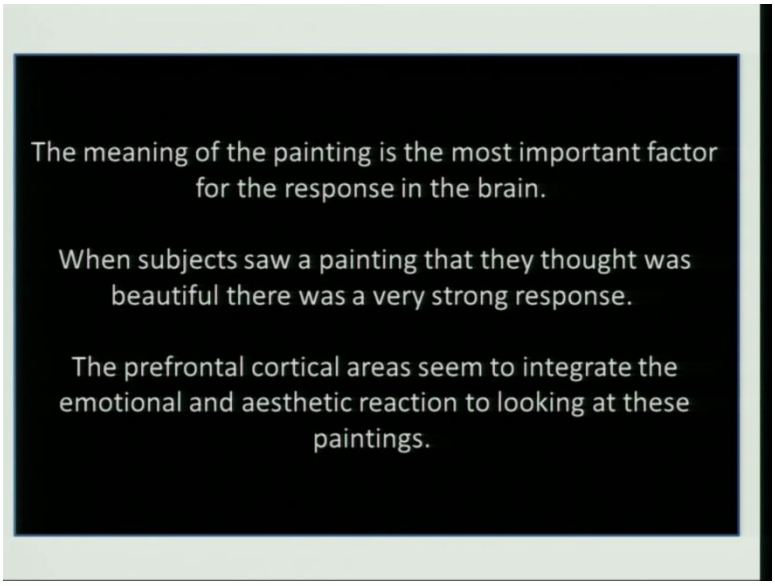

So, what happen was, the meaning of the painting appeared to be most important for emotional response in the brain, for people who saw. And so there was certain areas of the brain which are responsible for searching for meaning which seem to light up when they really liked a painting.

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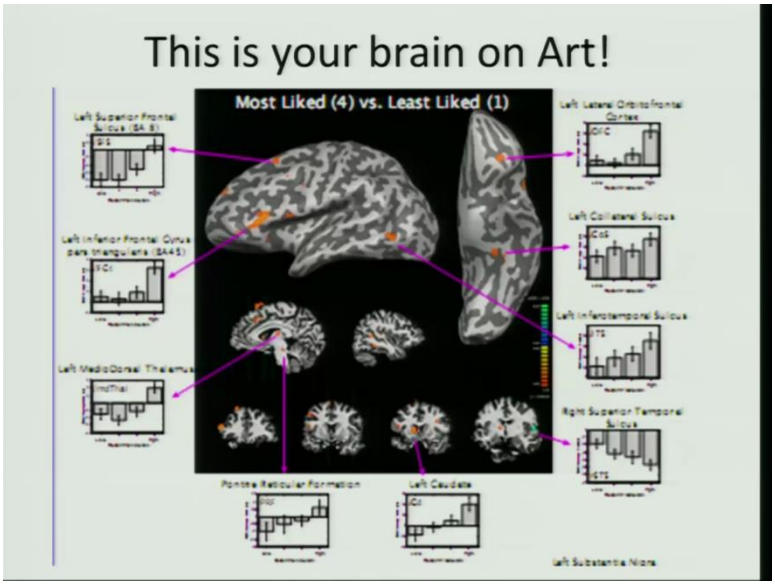

Let me show you the pictures. This is your brain on art. So, these are some of the areas where most liked, you know, increased activity rather than least like. And these are areas which are responsible for distinguishing between right and wrong. These are areas which look at error detection. These are areas which say, wow, when I have chocolate. And these are the same areas which are simulated when you look at a painting.

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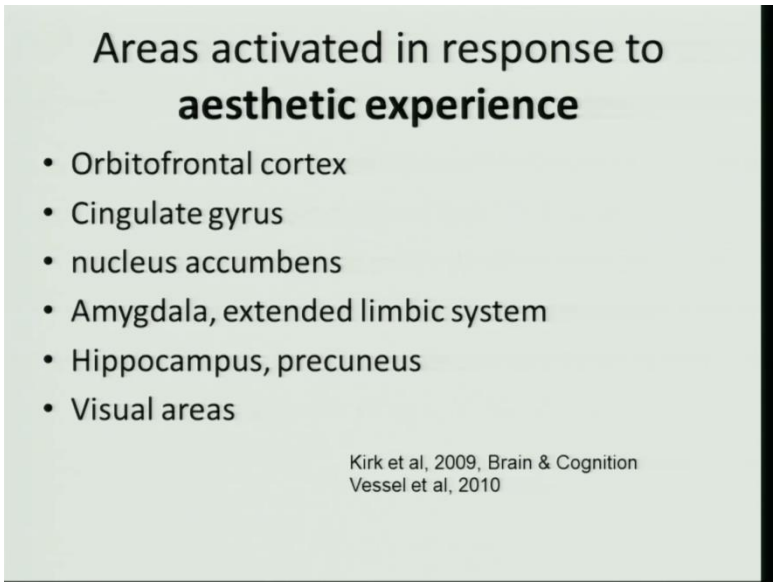

This is more of the same. These are some of the areas which are activated in response to aesthetic experience. We would not go into that; this was made for a slightly more neuroscience audience.

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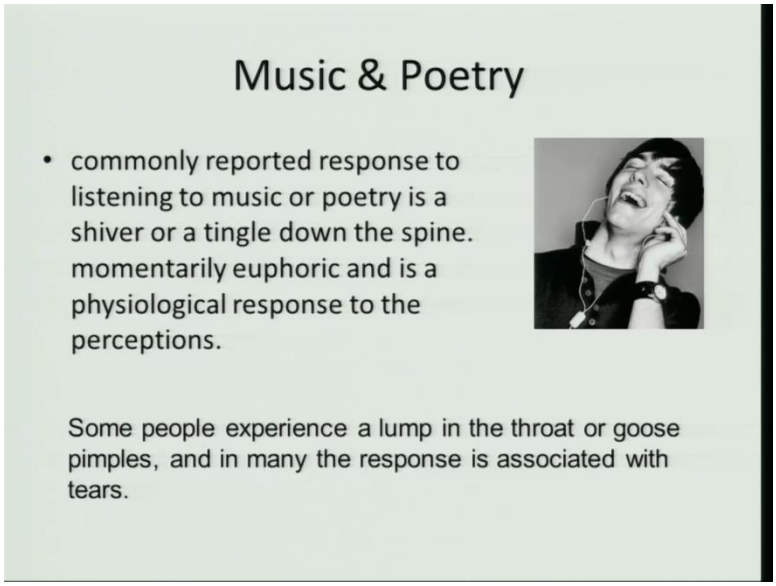

Let me go, pass it an, music and poetry. Commonly reported response to listening to music or poetry is shiver, or a tingle down the spine. Some people experience a lump in the throat or goose pimples, or they get tears.

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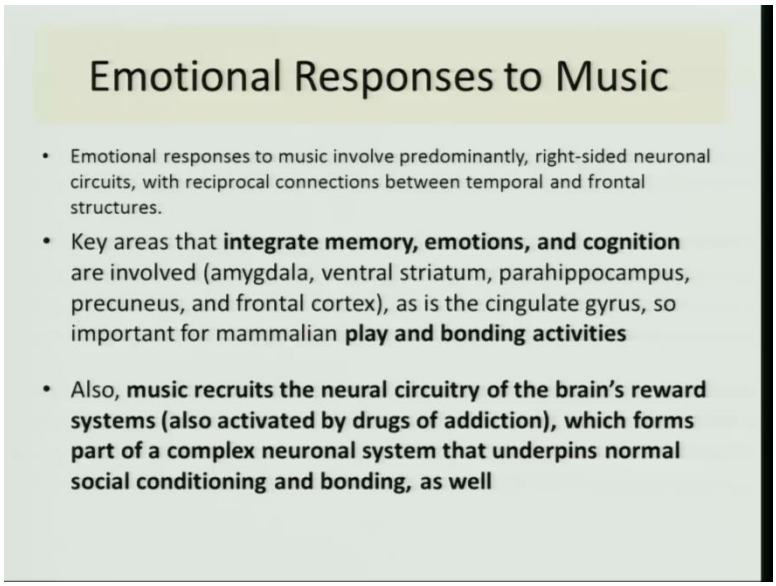

Now, the emotional responses to music appear to occur in areas that integrate memory, emotions, and cognitions. And these are also the areas which are involved in play, in bonding, in material bonding, etcetera. So, it is not surprising that when you listen to music you get the same kind of, I am safe or I am happy, ok.

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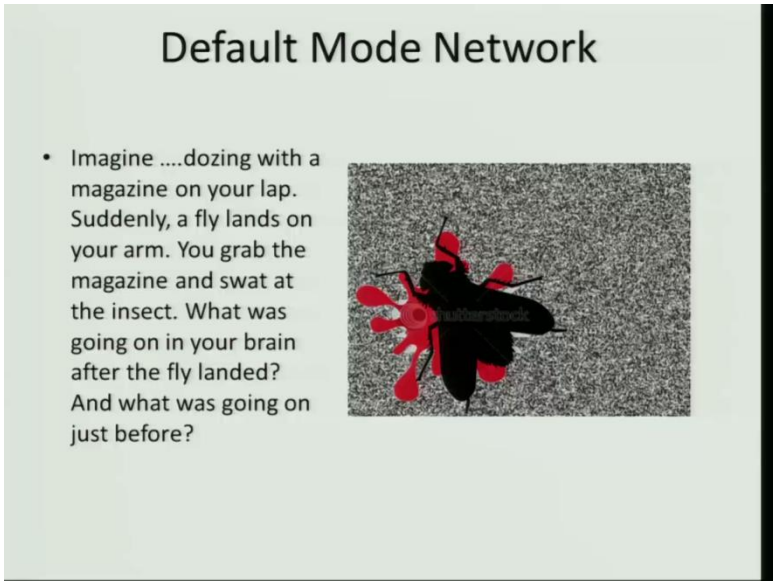

Let we go pass this too much neurobiology here. But, imagine you are dozing with a magazine on your lap. Suddenly, a fly lands. So, what you do? You grab one magazine and swat it. But, what was going on in your mind before you did that, and what happens

just after you do that? Now, why am I talking about this? Because, most of the time our creation is done; when do we do our creation? When our minds are active, or when our minds are passive? Actually both, what do you mean?

But, most of the time when you are doing creation, you are just flying down, what is called brown study, is it not? And then, suddenly you get an, ah hah, reaction. So, let us examine what happens there? When the mind is not working, when people are day dreaming, we are always state that the day dreaming is bad know, and people would day dream a later procrastinating, the lazy, they not doing their work, etcetera. So, what people did?

You know, there have been some people who have been working on the neurobiology of day dreaming. So, they said, ok, when the brain is not doing anything, you just lie in a scanner, do not do anything. And what they expected was, the activity in the brain would be the least; what they found, was fascinatingly wrong; that, when your brain is not doing anything, is the most active.

And, if then your brain is asked to do something, you woken up from your, then the brain has to take activity from this and devoted to something else. It is almost as if when you are doing nothing, parts of your brain are gossiping with each other and sharing information.

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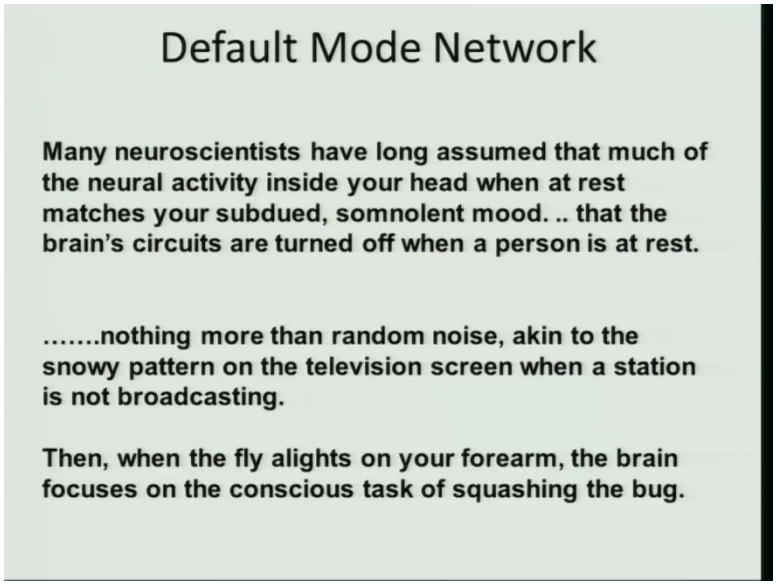

And, this is called the default mode network.

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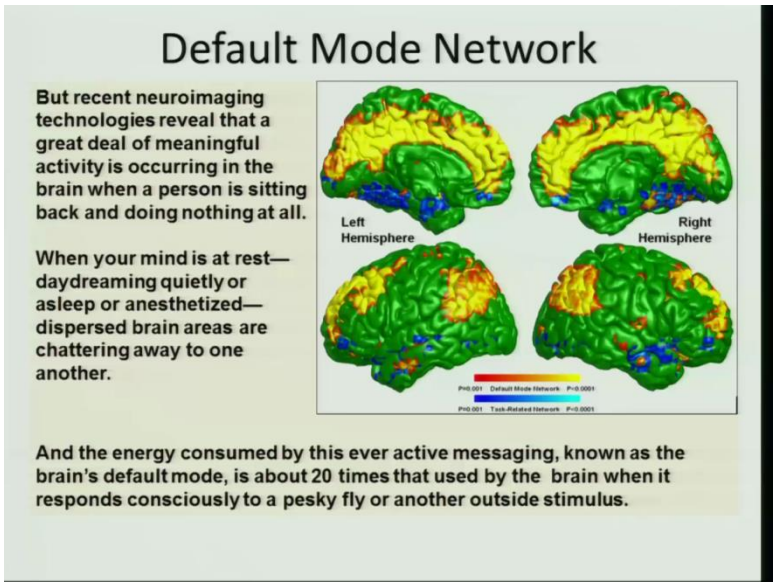

Let me go to, these are some of the areas which are very active when you are doing nothing. And I will come back, and now, I will tell you why I brought this up.

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It is like people gossiping. This is a normal Rochwell painting of people, a rumor gossip going, coming back to the same person.

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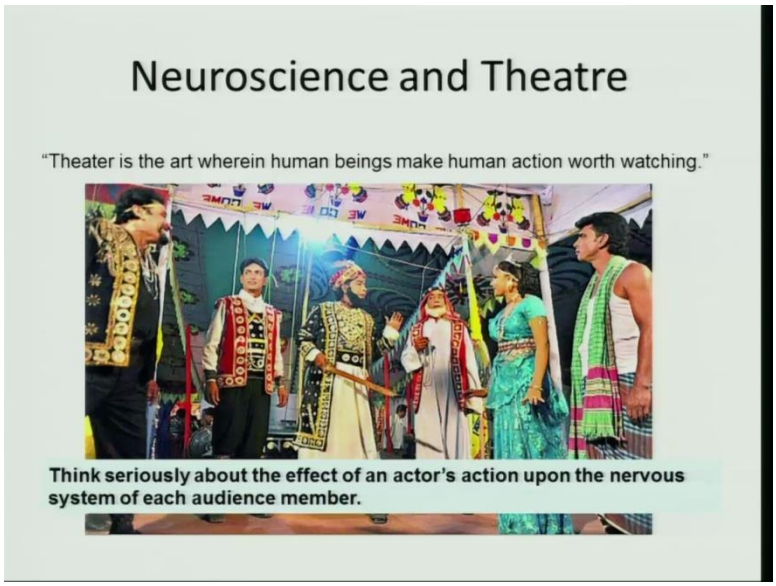

This slide is out of place; neuroscience and theatre, I will come back to it.

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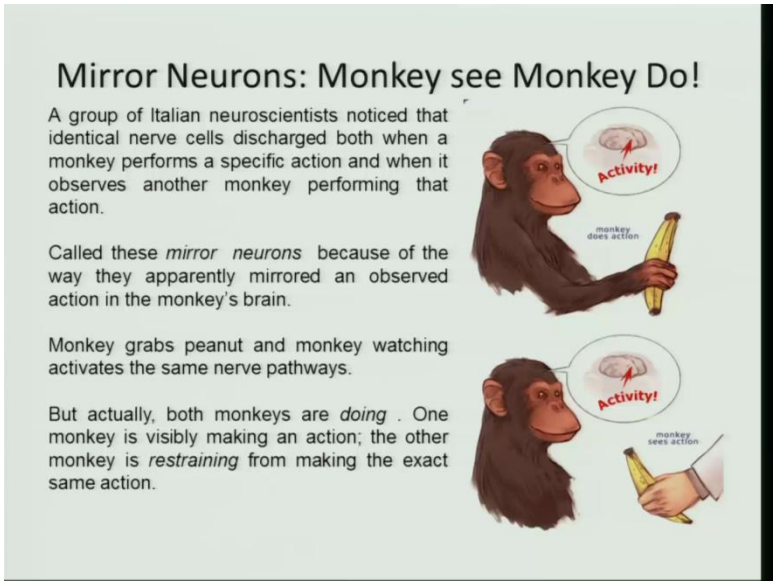

The other part that I wanted to talk about neurobiology was about mirror neurons. That are something that, you know, if you get a monkey to do a particular activity say, take a banana, and you put a electrode in the brain, you can find out which area of the brain is firing. Take banana, you know, has one part of the brain working.

Now, if you give the monkey, or more pedestal, you give another monkey of banana; this monkey is take banana, part of the brain starts firing, you know; it is almost as if when I am seeing you do something, same area in my brain starts mirroring your activity.

And, this is very important in us, human beings understanding each other; how do I understand you, how do I understand that you are feeling bored right now, or that you are smiling that, you know, you are have amusement, and I can understand your amusement, I can, you know, because as soon as you are smiling, my smiling areas in the brain also get turned on. So, it is like a mirror, ok.

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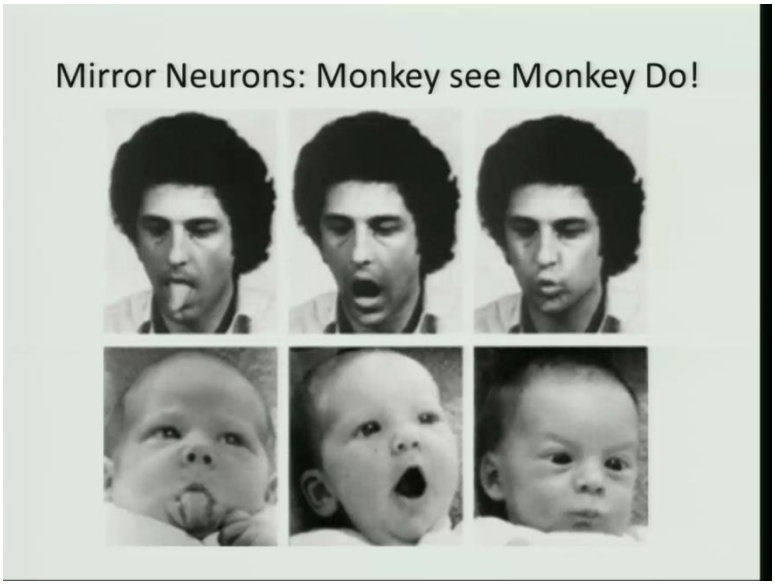

And, this is something that we learn to do as children. This is a famous experimental somebody did. You do this to a child, very small child, you know not children like us, very small, and the child will do it back to you. Do this, child do that at back to you. And this is Monkey see Monkey do. And we have areas in this, in the brain which are Monkey see Monkey do areas which allow us to understand other human beings, to understand.

These are called mirror neurons. And this is also very important when you create art. Because, when you see something somebody has done, you are also able to understand that. You see a picture of goya, is somebody is, you know, tearing of somebody's limb, visibly feel the pain yourself; you know, he, get in your mind and that is because artist have learned to utilize this; it is a neuroscientist are only now learning why the artist have done it, ok.

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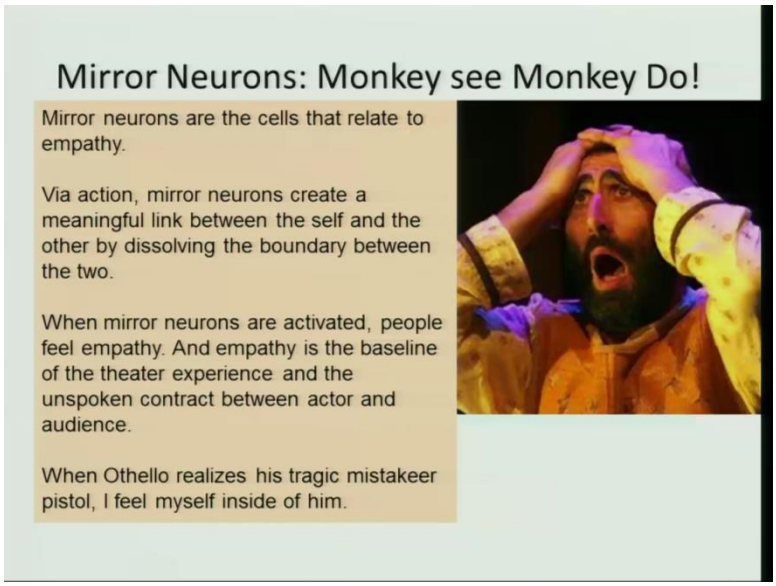

This is something that we do in theatre. You know, when you see Othello killing his wife, and then say, oh my god what have I done; you know, you feel the, oh my god.

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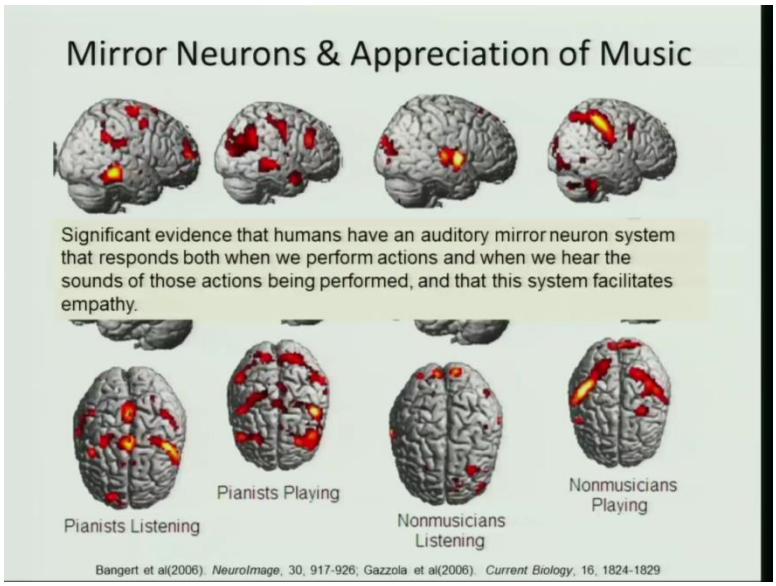

These are some of the mirror neurons which light up when you appreciate music. So, that is how art evokes emotion in, because somebody has put it emotionality into something, and you are able to appreciate somebody else's emotion through this something. So, it is significant evidence that humans have an auditory mirror neuron system. For example,

that responds both when perform actions and when we hear the sounds of these actions being performed.

So, if there is a musician and he sees the other musician playing, you immediately are able to do that in your mind. As a non musician, when I hear the sounds being played, I, my emotional areas raise on it at that level. And to give you an example, anybody who drives cars, is used to driving a car, you setting in the non driver seat and the other person is driving, you will see immediately the other guy brakes, your foot also goes on to the brake, you know, something like that, ok.

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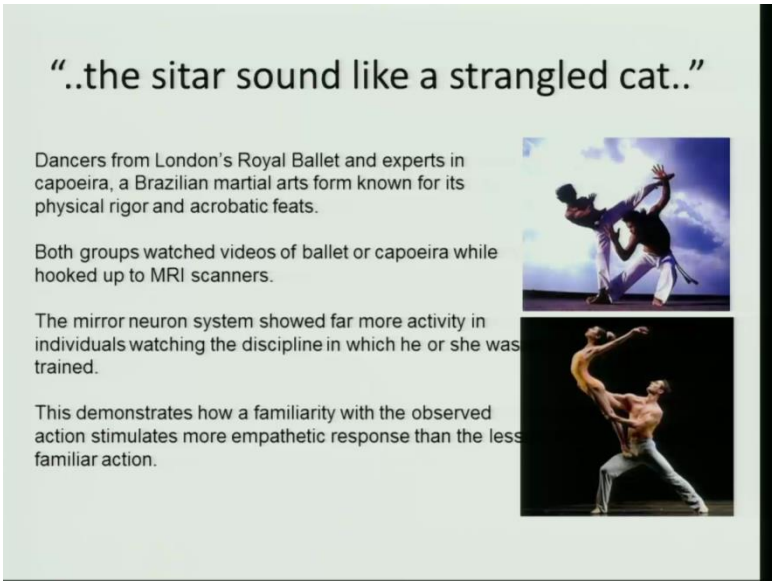

This is where culture comes. When the brittles were originally asked about Ravi Shankar's sitar, they said, one of them I forget whom say, sounds like a strangled cat. But, then they came to India sat with Ravi Shankar, (Ref: 48:17) sat with Ravi Shankar, and they become great devotees.

Similarly, dances from the London Royal Ballet were shown, you seen capoeira, the martial art, dance from, you shown each other's forms; and, the mirror neurons work better when they were shown each other's forms, and worked less when they were shown somebody else's form. So, culture also has a lot to do with it, ok.

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Now, what next? So, basically, do not show cow your paintings; the cow does not share your mirror neurons.

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Some of the difficulties that we have in emotional significance and aesthetic value; so aesthetic value is also influenced by context. So, if I see a Husain, a lot of it, is also related to the fact that I know it is Husain.

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Emotional significance and aesthetic value: a tin was sold for 124,000 Euros at Sotheby's on May 2007 containing this. So, aesthetic values strongly influenced by contact. So, behavioral studies show that the presenting artworks accompanied with titles, text, and other forms of cognitive information can significantly influence an observer's reported evaluation of the artwork.

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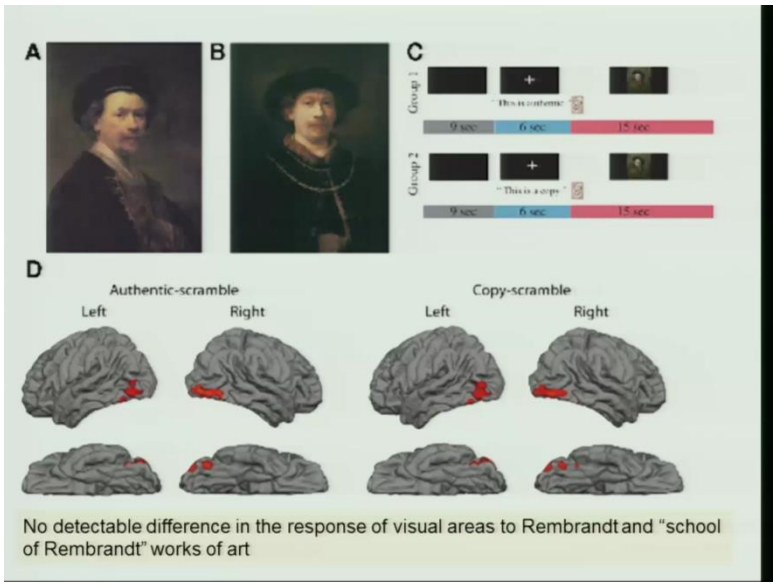

In fact, this is the study that they did. They showed Rembrandts and fake Rembrandts. And people were told this is a real Rembrandt, this is a fake Rembrandt. Sometimes, they

were told the opposite - for a real Rembrandt they were told fake, and for fake they were told real. And basically, to cut a long story short, the human brain reacts much better when you are told this is a real Rembrandt. Imran you seeing a real Rembrandt and you told a fake, not good.

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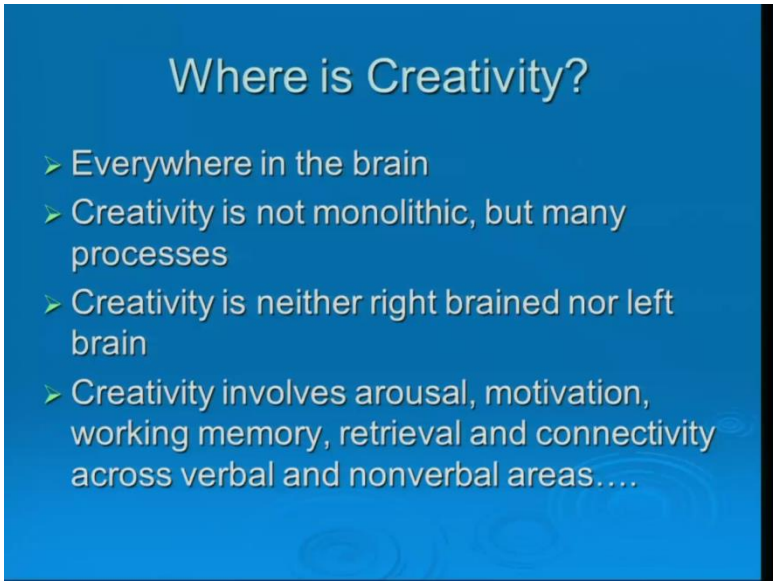

Let we go, pass this, because this is a very long lecture. So, I will, let us comes to creativity. Where is creativity? Creativity is everywhere in the brain. You know, it would be nice to say, creativity occurs here. But, it is probably not; it is not monolithic; it is a culmination of many processes.

There used to be a myth that the right brain does something, left brain does something; and, there are right brainers who think differently and left brainers who think differently. What we now understand is, there is no such thing. And the right and the left have to work together to solve mathematical algorithms; and, the right and the left have to work together to create amorphous works of art.

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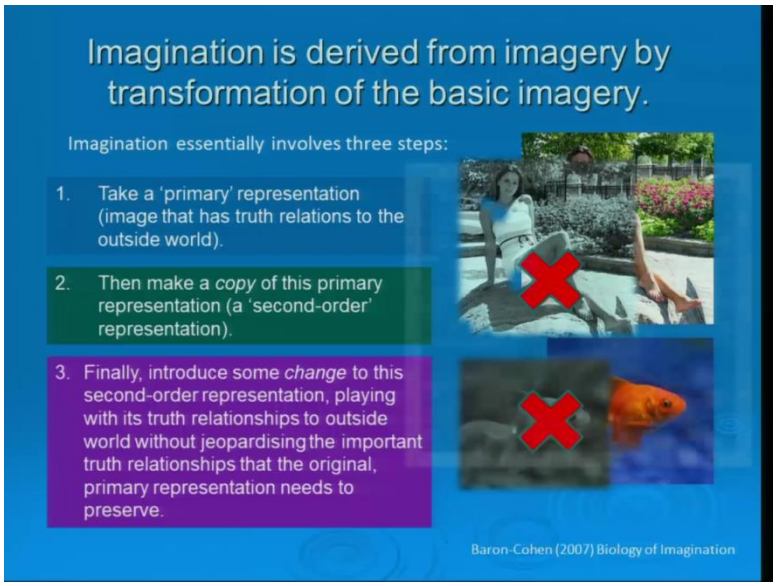

Imagination is derived from imagery by transformation of basic imagery. You know imagination; what is imagination? You know, you have a unique on, you have a horse with twisted horn; that is imagination. How do you put these things together? So, you have to use imagery which exists and modify it.

So, imagination involves 3 steps - one is, take a primary representation and imagine that has truth relations to the outside world. This is the girl, no doubt about it. So, my mind takes a girl. And then, this is the gold fish, right; this exists. Then what my mind does is, it makes copies of these. You know, it, for you guys it will be easy, just cut and paste. So, you take that and you paste it, in another part of your mind. So, then make a copy of this primary representation which is a second order representation.

Then, what it does, is that you nock of parts, introduce some change to the second representation, playing with its truth relationships to the outside world. But, not so much that it becomes totally un understandable, and then put them together. So, what you get? You get this, ok.

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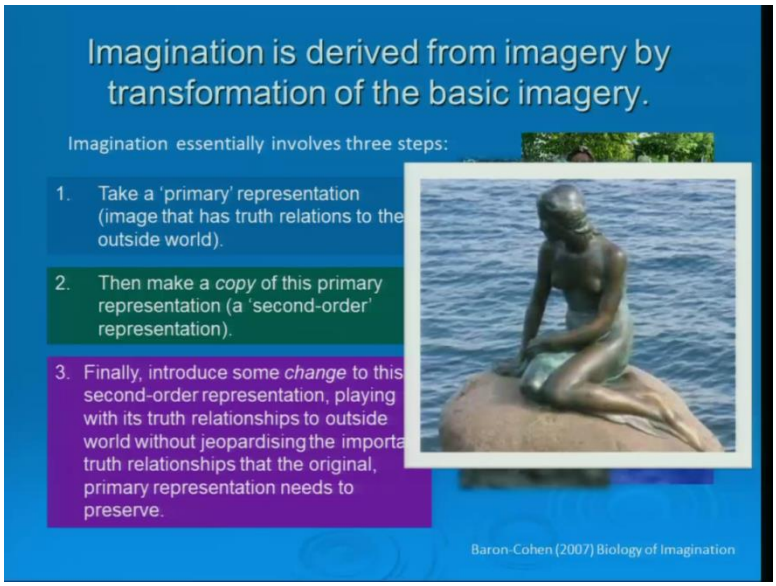

So, this is something that, when you are creating, you do unthinkingly, but what neuroscientist now doing is, able to track this process of how creativity occurs.

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For example, development of imagination is something that does not exist in very young children, and you have to go through pretend play, to learn how to imagine, ok.

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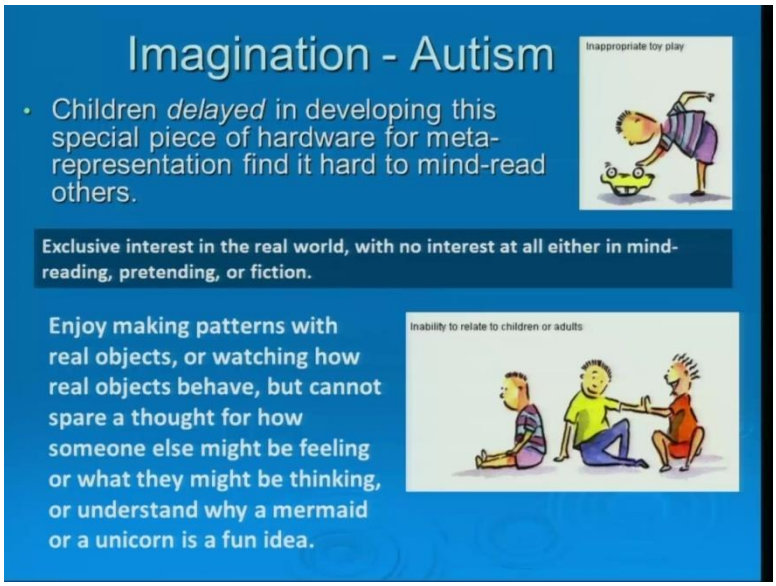

And, some people are not able to imagine. And these are disorders of that we face. For example, children who are artistic, are not able to intimately relate to children or adults because you have to do pretend. They are able to play with inanimate objects because they lack the ability to do this pretend, they lack the ability to actually mirror neuron, to imagine what the other person is thinking; you do not have to imagine what a car is thinking.

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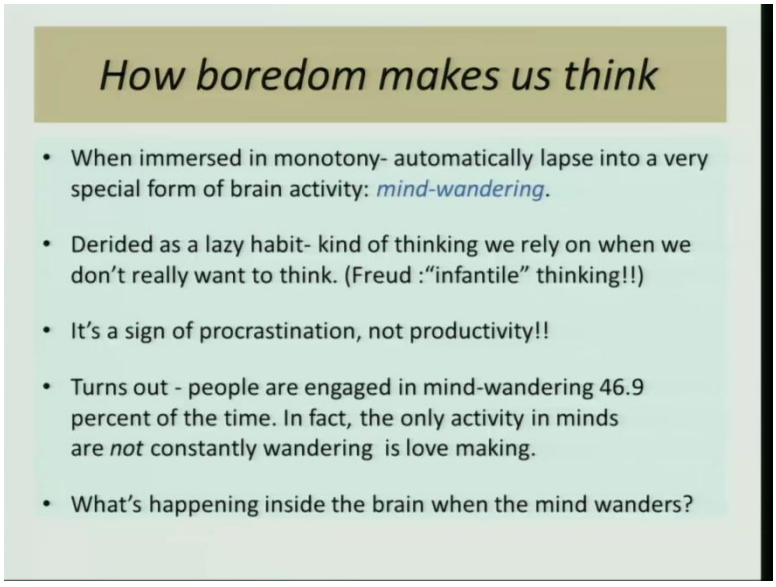

Let us go, pass this because, ok. Let me deal with this. Sometimes, most creators will tell you that the best flash of genius actually came; they were lying there doing nothing. Something flashes, you know, there is poem called the Daffodils written by Wordsworth. And Wordsworth said, it flashed upon his inward eye, while he was lying there doing nothing; watching the clouds go by, suddenly it arose in his mind.

And, boredom has always been blamed, but boredom actually makes us think. When immersed in monotony, we automatically lapse into what is called mind wandering. Now, it is always been thought as something bad. You know, Sigmund Freud say, it was infantile thinking, baby like thinking, and therefore, bad. You know, parents, throughout history has said, we should not be sitting and letting our mind wander.

It turns out, when people are engaged in mind wandering, it is a large proportion of your time that you spend mine wandering, you know; almost 50 percent of the time your mind is wandering, right. What is happening inside the brain when the mind wanders?

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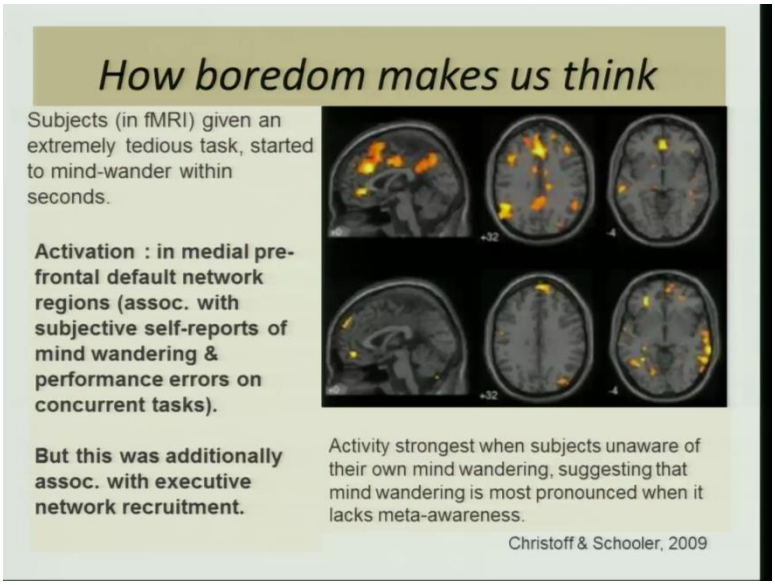

So, what happens is, huge proportion of the brain is active when the mind is wandering. Remember, I showed you this, the picture of the default mode network; that is when the brain is actually talking to; you know, the parts of the brain have happily gossiping with each other; you know, picking up as to what did I know, what do I know, what have you learnt, what are you saying, and this is not in conscious, in consciousness.

As people have said, genius occurs only from a prepared mind. If you have not done a lot of perspiration before, you are not going to get that certain idea. You know, it does not come from the sky; you have to have done a lot of work and then go to sleep. So, the best way to actually create is think a lot about what you are going to do, and then go after sleep.

Because, if you have a, if you are trying to find a solution very hard, you will find that you cannot find the solution; 99.9 percent of the time, you cannot. Especially, when you have a thing that you have to deliver, you have to give your assignment in, you will find you just cannot do it; you are getting more anxious and anxious and anxious, but you cannot do it, right; and that is because of this.

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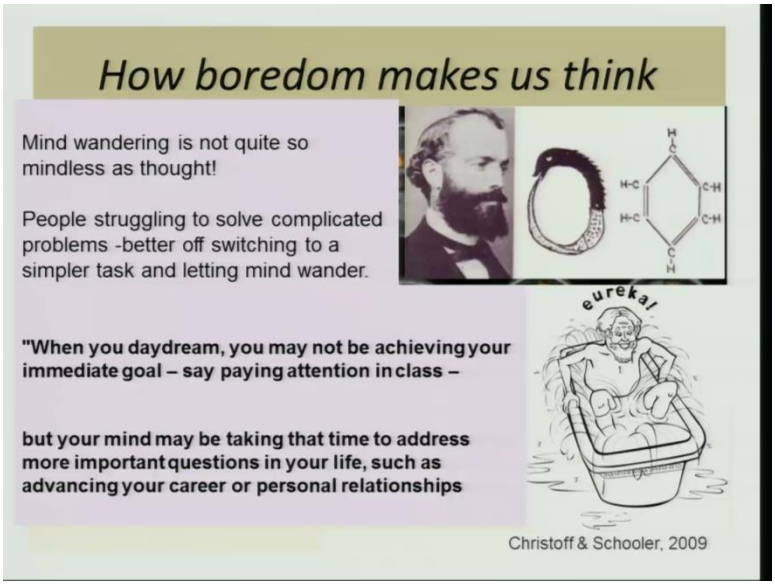

Let me just take you to, how boredom makes you think. You have 2 examples - one is, of course, the, eureka, example of, was it, yes; then, this other example of guy called Federick was a Chemist who is working on this whole thing of carbon atoms, carbon. He, through all these things, he decided that there have to be 6 atoms; but how do 6 atoms fit together? And. he worked, worked in it, worked in it, worked in it, tried different kinds of things, just could put them together.

And, when he went of sleep, and in his dream he saw one snake swallowing another snake; and he woke up and said, wow, that is it; it is a ring, you know; and, that is how creativity, that is how things happen.