How The Brain Creates Mind
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Lecture – 09
Dynamics-3

Welcome again, and we ended at TMS. And TMS actually stands for Transcranial Magnetic Stimulation, Transcranial we put magnetic field and stimulate a certain area give a certain task and look at it. So, these are correlation studies. Now (Refer Time: 00:33) requires a lot of machinery and all, slightly costly investigation. EEG helps boiled down to almost portable machines. This is what you are looking at the activity, functionality; the two most popular investigations are positron emission tomography and functional MRI, which provide the indirect measure of metabolic activity.

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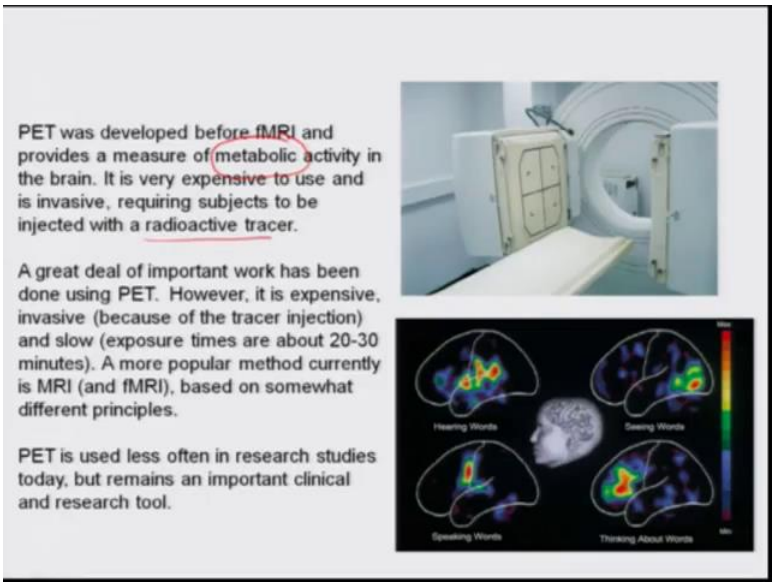

Metabolism as you have understand, you must be aware. It is the process of formation and repair and consumption of energy are all though run your bodily system, very expensive and, but this is the physics principle, that you inject the person of the radioactive tracer and has the radioactive tracer decays as it is normally, it is a glucose based radioactive tracer and as the glucose is utilized, there is a the electrons release and then these two gamma waves are created which are caught by the scanner and that depending on the area where, this whole thing is used gives you these type of images.

Now, but remember we do not know what is happening in the resting brain you can do a PET of the resting and PET is also used for tumors because tumors tend to pick up more glucose and release all this emitting waves and so you have to give a task. All ready you give a task, you have all ready injected. So, the task is being done in certain areas of brain and those areas of brain become active and this is what you see. You see a PET image of when you speak words that is a Brocas area. So, if you remember at I talked about gall, who was talking about bumps here and bumps here and brain. So, it is re confirming, all that (Refer Time: 02:54) certain areas of brain.

So, when you are hearing the words, this is the area of brain temporal lobe gets active. When you are seeing words, this is what that becomes active whole vision. When you are thinking about words it is again the frontal lobe. You can see actually if you look at it. These are the PET images, but then PET is very very slow to act. You have to give a task record all this. It is a matter of minutes and, remember, when I showed the skill the activities happening in milli seconds. So, this discrepancy, so what took over?

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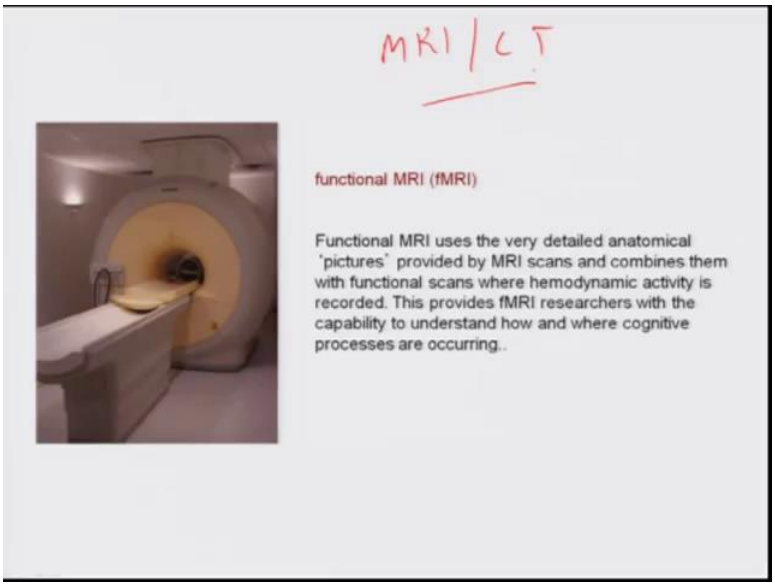

So, even before MRI, there was plane MRI and CT scan. They are simplest investigation. CT scan and MRI a simple, MRI has the basic principle magnetic resonance imagery you know all about that. Briefly you put the person in the scanner is a magnetic field and that magnetic field will orients the water molecules and into a certain magnetic field. You send pulse which disorients them, on the way back you release this thing, this whole

imagery is comes up. The improvement so, but that did help us, that told us about the illnesses. CT scan is again attenuated X-Ray. Functional MRI creates very detail anatomical pictures provided by MRI.

When there is a task that has been given and the blood flow changes. So, what we are looking at PET, which is very costly because of the radioactive tracer and all that. What we do here? We put the person in magnet magnetic field give a task.

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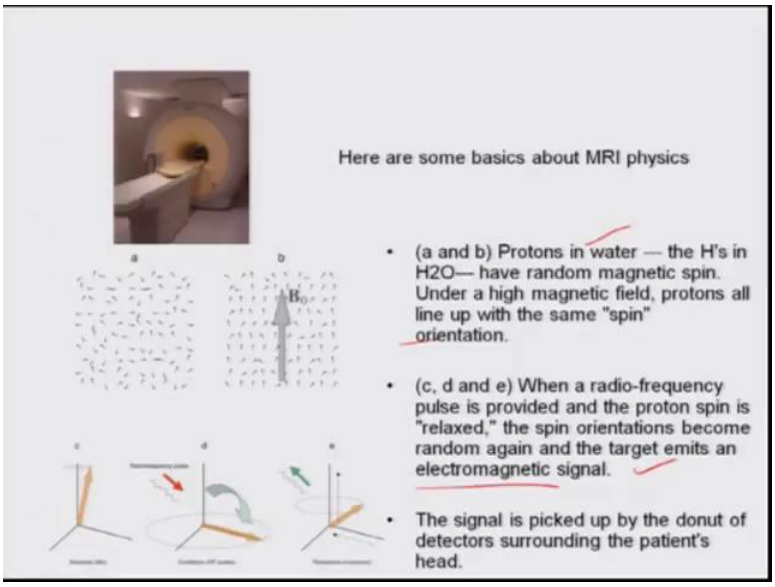

So, this is the basis as I had told you protons, in water they were random magnetic spin, they once you put in a field they all will orient when a radio frequency pulse is provided the proton spin changes. It again goes back to the same.

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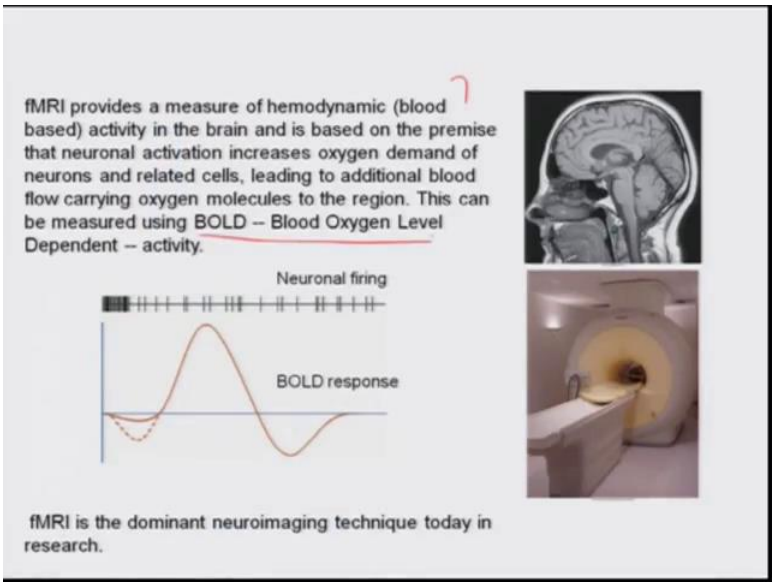

And this is the electromagnetic signal, while in relaxation it sense and this you pick up by the Donut of detectors. So, this is called blood base activity is called BOLD, Blood Oxygen Level Dependent activity. This is assumed that if you give demand to the brain, of a certain area and we assume that fine, we want to see which area of brain does mathematics. You think the MRI will tell you? No, because you cannot put a whole MRI into the whole length of the brain. These all takes slice by slice resolution you can change.

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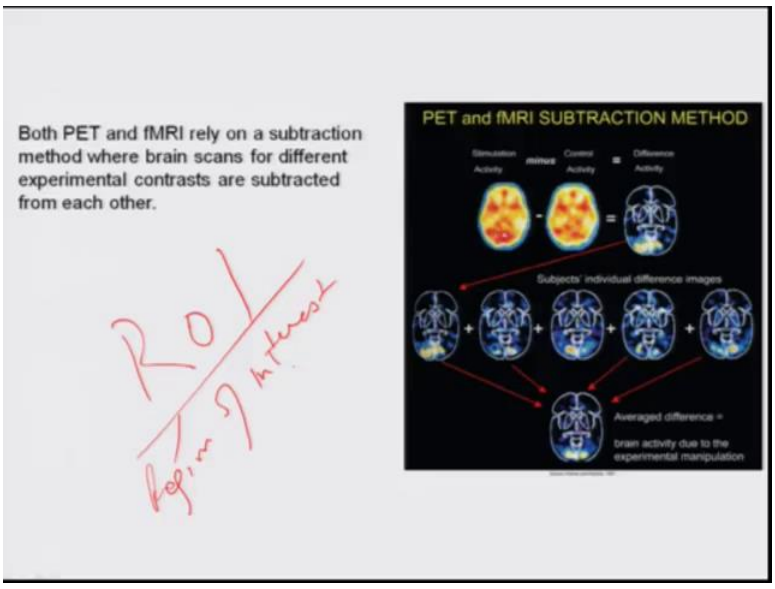

But then you have to have what you call ROI. This is called Region of Interest.

So, you have to think, I want somebody to read and I think frontal lobe is the place where the brain activity will increase. So, we give a task which is the appropriate to what psychological definition which you have used, give the task blood oxygen level as it. See normally in a normal situation Deoxygenated hemoglobin is more, but as the work increases a demand on increases, then the oxygenation also increases because you need more oxygen to work and that oxygen changes the whole magnetic thing because Deoxygenated blood has different type of magnetic thing and oxygenated as a different time of stuff.

So, they both rely on what is called subtraction method where is the certain activity which is going on you increase the demand and that increase the blood flow, but that you have to separate from the base line activity which is going. So, you have to subtract that imaginary from that base line thing. So, this is just an example stimulation activity con minus control activity gives you different activity. So, this is whatever saying the brain is a very, very dynamic thing.

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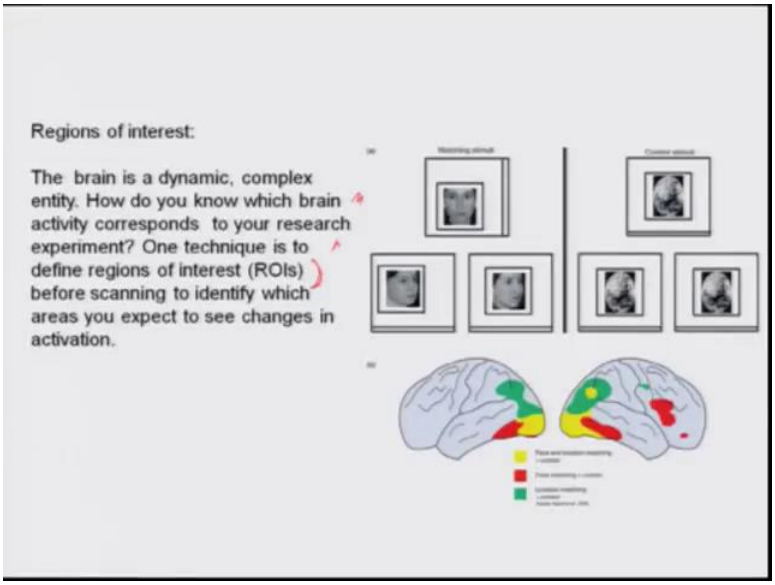

How do you know which brain activity corresponds. So, you have a region of interest and you except to see changes, if you do not find to you go to another region of interest.

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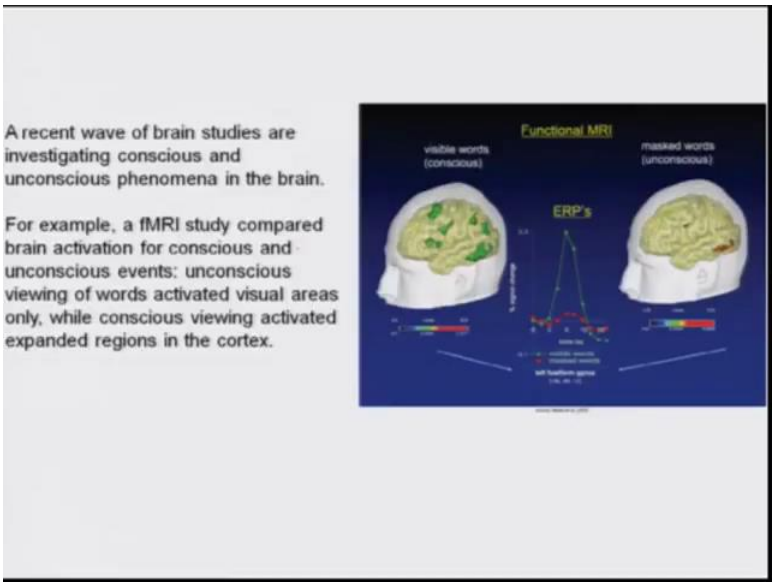

Now we will talk about conscious and. So, this is like this visible word, which I have seen consciously mass word. So fMRI, not actually fMRI is the in thing in research all over the world. In fact, in the last fifteen it actually came in u s may be 20 years back, but the huge data on brain, but the there are problems.

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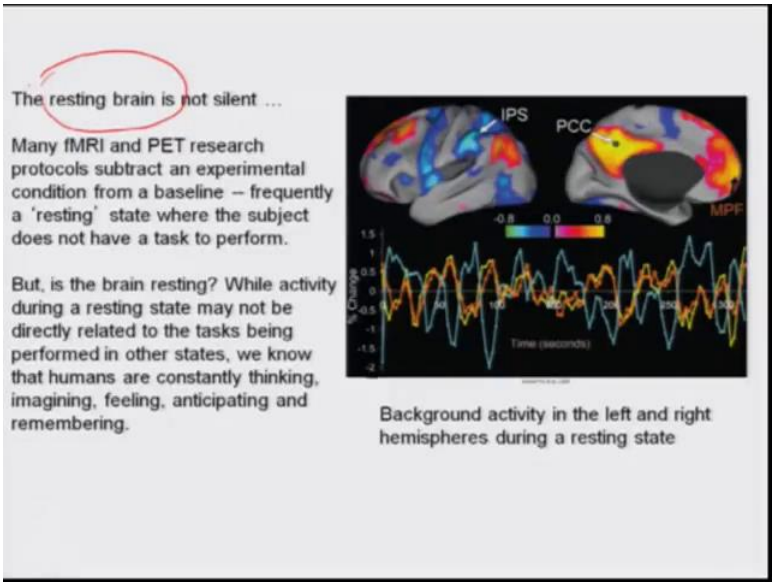

And let me address those problems before we really jump on to other things what is a resting brain the problem is the resting brain is not silent brain you really do not know what is happening at that. So, what is the resting it state taken you ask the person to rest

again that is the psychological thing where, the person is not doing any activity he is not doing that task at least which he was which we are going to give, but then we give the task and we assume from that base line.

Now, if you see this is the type of left and right resting activity which you see, but the brain all this colour things are active. So, we do not know what are they doing here why the person may not doing the task which you are going to give him he may be doing a something else, now the correlate all that complex operational thing which are going on the brain and I have I showed you slide in the beginning, I said you do not think about monkeys. So, you will start thing about monkeys somebody may be remembering mother somebody may be bothered about the job or some paper or some mathematics.

How can you differentiate now you can tell the person you are not going think about your family I am sure the mind will keep pushing the images? So, that type of control is very difficult.

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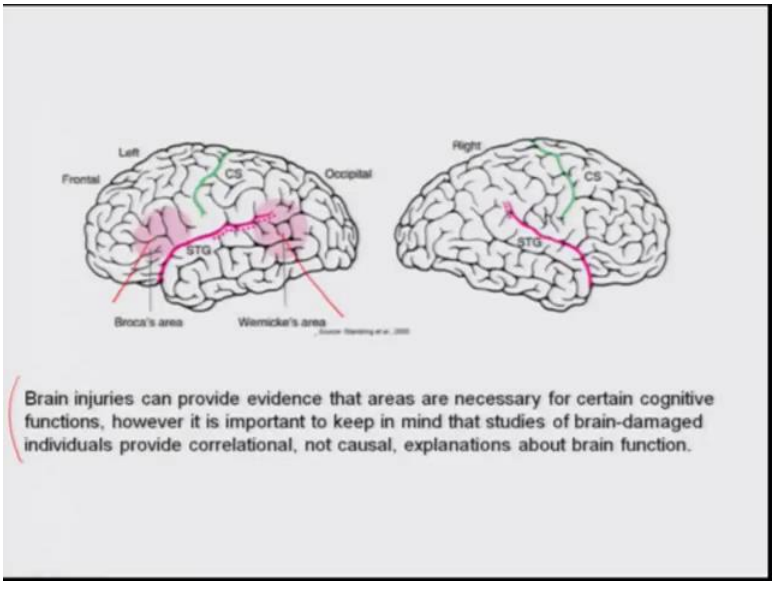

The other thing which was lesion I told you brain injuries you cannot create injuries to studied the deposit this was the old method Brocas Wernicke's aphasia whether the problem comprehending speech and all thing.

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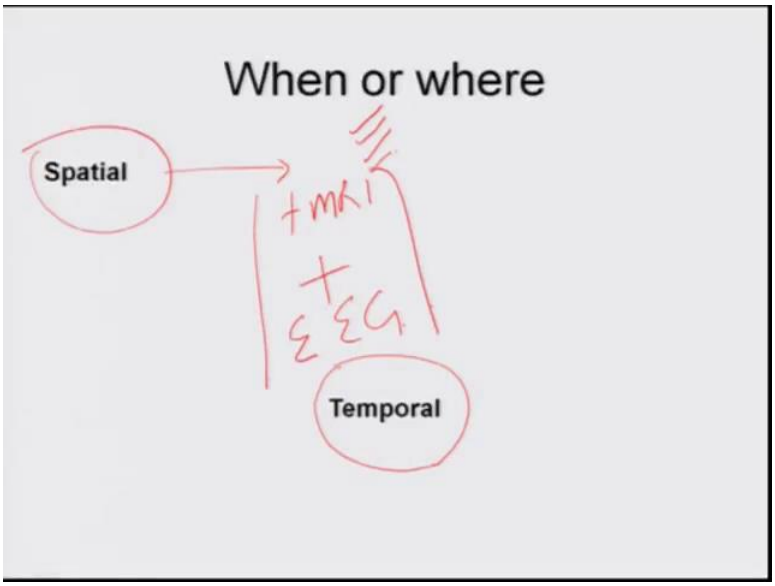

This is the big problem of all the mechanisms which we have to do research brain. What are you trying to do, are we interested in the space. See we exist in space time, is there any there any doubt about it this whole space time which is the forth the dimension which we exist in that our minds actually work that way if you and so end to end and that is where when the visual signals comes it differentiate into what and where that is space in time a. Let me give an example the example is if, I ask you to close your eyes and walk for a minute and after that I ask you how many feet you have gone you will be roughly we able to tell me, if your averagely educated person or if I ask you to walk and feet's in tell me in how minutes you have walk.

You will be able to do that this is space time in the temporal parietal thing is end to end what how do we investigative are we interested in a spatial yes we are interested in the spatial especially to look for the neurological illnesses tumors interested in which area of brain does what, which may have help us in developing or are we interested when does it happen. So, the best combination which has emerged which is emerging, but you will lot of technological limitations of feel and noise, and how that if fMRI plus EEG simultaneously people have tried, but they have lot of technological issues because the noise of the magnetic field will alter EEG and EEG is thing will alter plus you have to fMRI goes slice by slice you have to move the EEG machine also it. So, those I am sure it to be sorted out some day or may be something else will come up. So, these are type of thing which you this is the CT scan.

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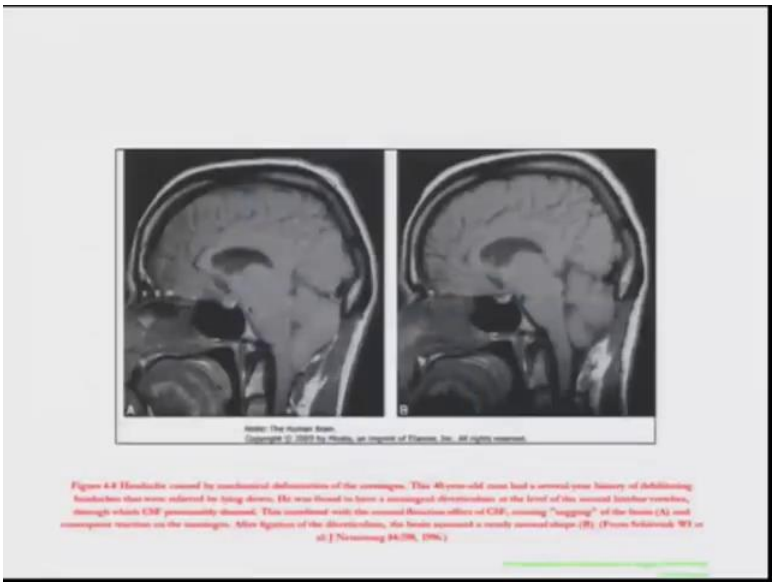

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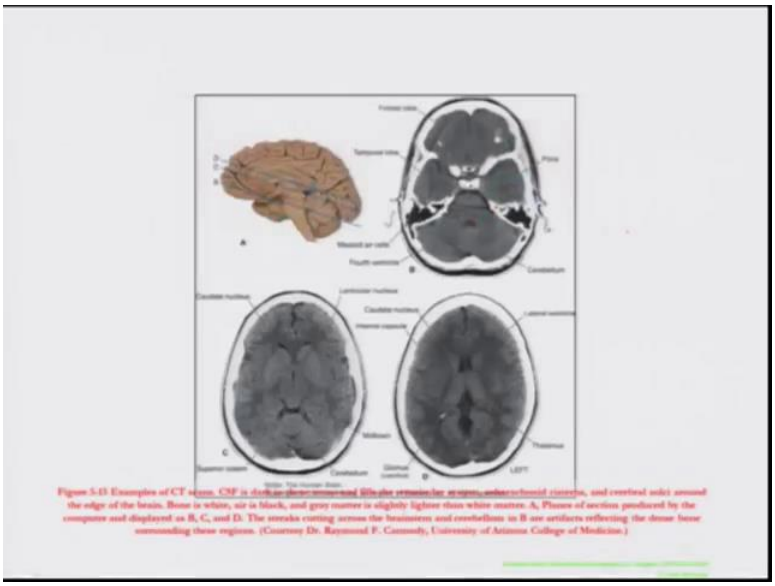

Simplest of investigation again this is a type of MRI images this is, what I showed you DTI in the beginning fiber stabling from occipital cortex.

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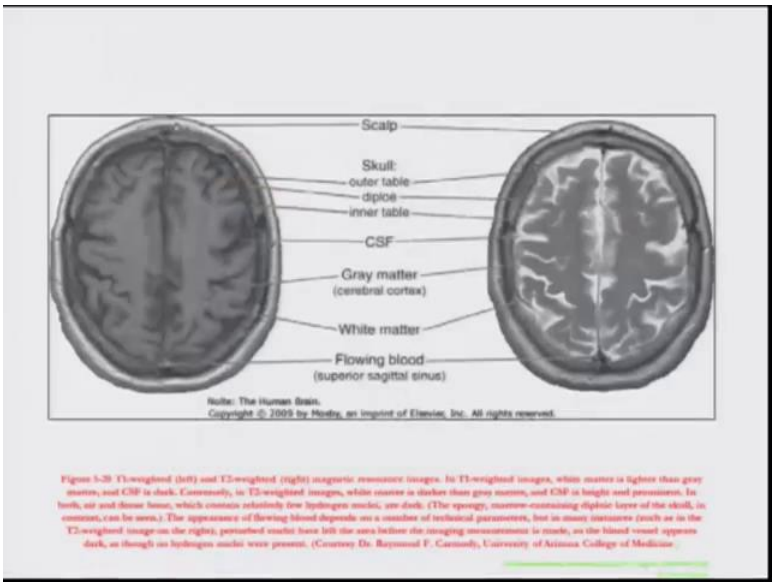

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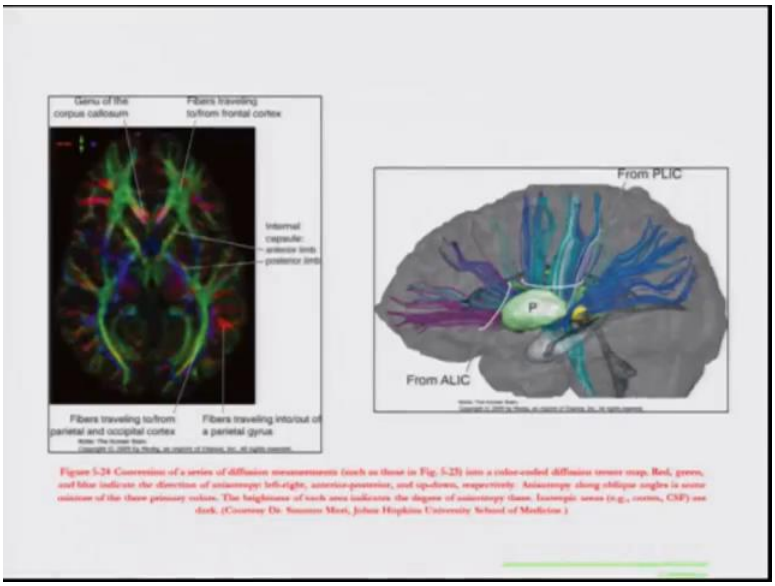

This is how you DTI appear diffused sensor imaging. So, just to wrap up this and this if you look at the whole thing that there is a continuous complex activity going on in the brain and the brain has to really keep integrating and differentiating the whole information input and then, we have limited tools to excess the whole dilemma between where and when and whether this something call brain at rest is.

So, they are questions which arise out of this brain also has lot of other things when you look at when we are talking about this specialization you have heard of debate of right

and left brain. So, it is it just not that it is just a specialized plus all these areas which are specialized are not the only center which are doing that there are lot of associative areas. So, when we will talk of networkable, I will mention you they whole as business of association in the brain is the trick. So, you heard of left brain is more rational analytical planning interface with the world and right is the most intuitive artistic they some truth in it not full truth, but brain also can you see this.

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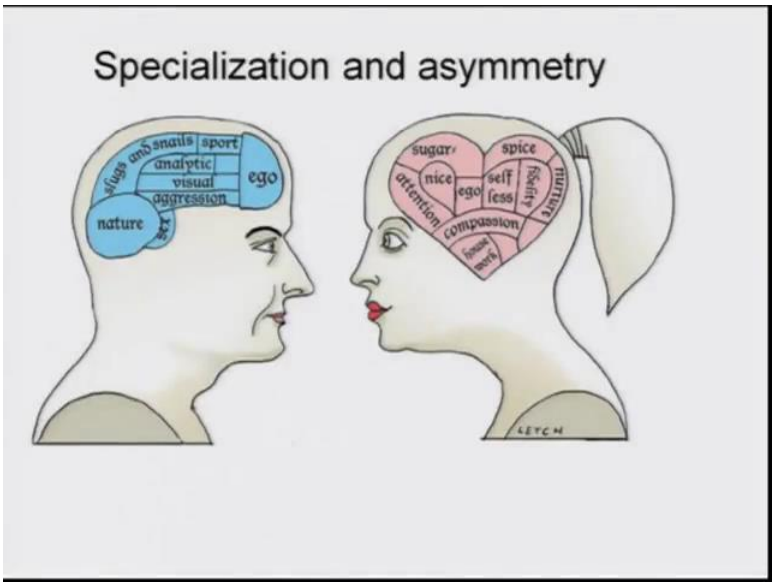

So, brain has lot of process which are going on which may not be aware, but brain also has lot of. So, does brain decide what it wants to do this is question of will and what is the bottle neck when this.

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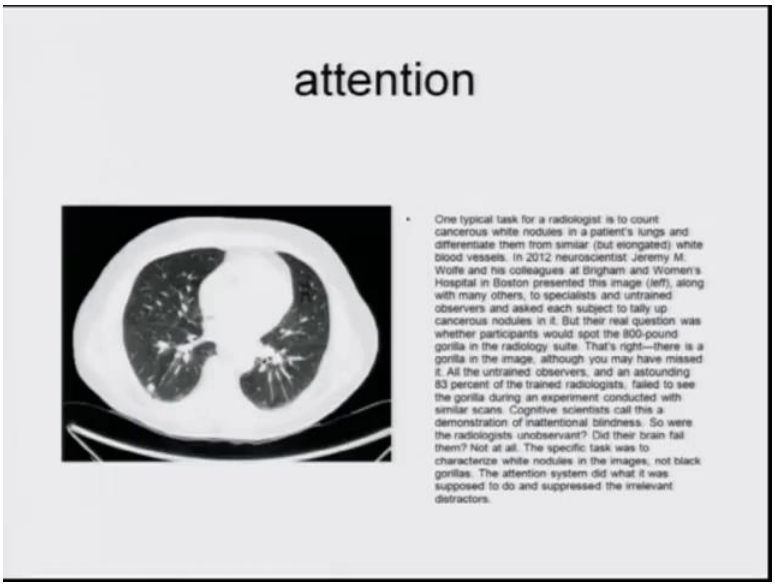

So, many stimulus which are going on in the brain at the same time, but a still by experience if you look at it, you are able to look at one thing at one time and may be something else in different time.

How is something called attention seems to be the bottle neck of the brain and that is you look at it do not read it just look at it what can you see for a average radial this, you will see a x ray, but if you look at it.

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You can find may be some people look at it is the huge gorilla 800 pound gorilla sitting like this you see this image between the checks you see a face. Now a brain is able to differentiate this.

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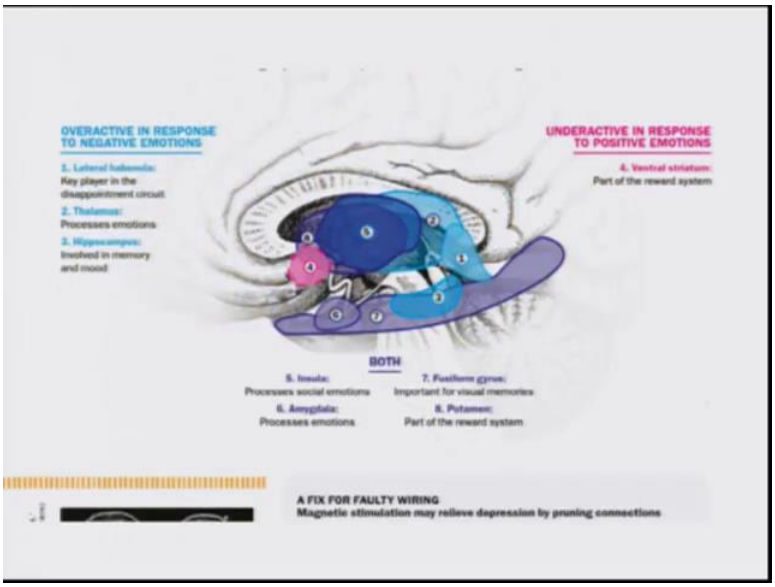

That means; brain is tricky in the sense the trick of the brain is that, even if you give partial information to the brain the brain will use it is own maps and memories and make a composite image out of it.

Why because brain does not want any uncertainty and that to why because, to be certain of whether the external thing is the threat full situation or the external situation is a pleasurable situation. So, it uses this mechanism of guest ouch brain also at the all the time it keeps comparing the in a thoughts the inner images that determines your action and as I said emotions the positive emotion and we always here in the self ell books, but these emotions are the one which sometimes determine your attention level. Remember, 10 things happening in front of you and there is the fire which is just behind your feet your brain will always it will not ask you it will turn your attention to the fire if you brain circuitry is firing well.

So, this is this is how it goes now even if you know even if a get a huge data out of MRI and all this stuff of EEG how do you decide at the end of it that whether this is a conscious process, whether this is a unconscious process how do you decide the data which you get correlates with the exact behavior these are some of the pressing problems

of studying brain. So, let me let us do some exercise before we really move on to. So, we have taken some we have taken the micro model where a micro level of brain, where we are talking about neurons we have taken a looked at the behavior which is not concern of this course.

But, it obviously comes in because all about behavior the gross structure of brain we know briefly about the tools which we know we have, we know the dilemmas whether we want the space. Whether you want a time whether you wants the functionality or the structure what exactly do you want and the whole complexity of conscious and unconscious which we will discuss later on.

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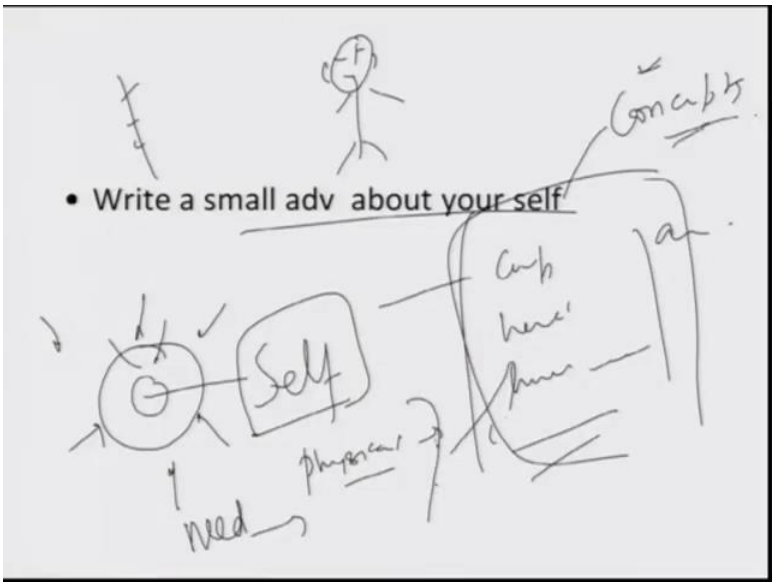

The attention span of the brain let us start let us do a small exercise for the rest of the few minutes for this lecture write a small advertisement about yourself you can take a minute write it and then automatically see it later. Why I am asking you? If you write I asked you question I think in the previous lecture that have you have you tried this one was that information transmission how does thoughts travel faster than these thing, but try something else you are seeing a face of your friend or you seeing friend or somebody standing out fully if you close your eyes and half a minute, you imagine you can still imagine that person is full length, but have you ever tried to close your eyes and imagine your full body at that instance not any of your pictures not any of your camera images

just close your eyes sit and try to imagine the way in whatever posture whatever close whatever expression your it till be very difficult try it.

Why that is the brain can see external things in the full imaginary, but it cannot create your image although it is receiving sound. So, the trick is like the sound is going in sound vision touch pain position pressure on my feet everything one part of the brain, I told about the forty hertz gamma oscillation it unites all these things to get you what you call self now? If I ask you to write advertisement about yourself you will write good things I am competent hardworking honest or some people may write not honest or ambitious caring whatever I am a good psychiatrist I am a good engineer whatever.

Now, what does it all this mean what is this? All are what you call concepts the your brain has already formed a concept about yourself, but if you ask your brain to close your eyes and see yourself when you are full glory you will create a caricature of yourself you close your eyes either you will see half of a face or you will see body, it is where it difficult to get your immediate full standing posture or sitting posture exactly like you are in this instance, but if you open your eyes and you ask see the other person close your eyes and ask your mind it imagine the full person it immediately do.

Why is it so? We give it a thought probably again it comes to the same thing because your own image although it is giving your concept of self, may be it does not actually require your imagery to survive. Whereas when, you are seeing a external world, that imagery is useful for deciding the threat value your own body is not a threat value and that is why it is the reason that like Ramachandam, writes that some people who do not limbs often feel it. Now if brain area is firing it some people said say that the hear voices like even your there is something (Refer Time: 22:27) and (Refer Time: 22:28), when you are very, very emotional you may actually hear voices of the people whom you loved or when you are going you will suddenly you feel somebody calling these are normal phenomena.

So, brain is like all the time it is active it is taking all information it has your own image, it has your own concepts about yourself, and it takes all that images forms first the security in it. So, that you are safe you are standing well you are not falling down creates that physicality of the process. So, that you first your physically existing in the brain and that also inclusive. If feeling thirsty if feeling hungry brain keep telling you bring water

it sending although those need based. So, physicality is also complemented why need at that time.

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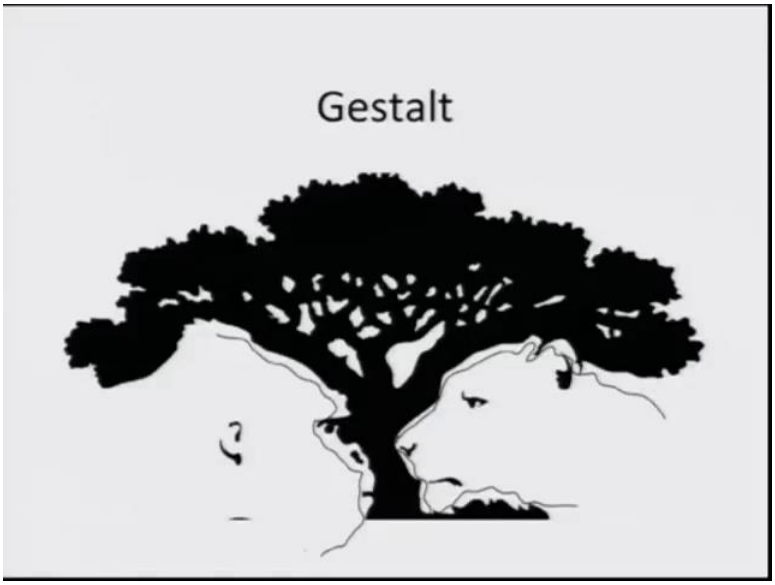

Once these things are done they are always then, you go want higher level about image for yourself and this concepts will help you in. So, whatever is telling you is about gestalt can you see this what do you see? You see a tree there is something else here yes what is this? And there is a chimpanzee only information is a tree. But your brain has use that empty space also to create imagery and these are familiar things this is a familiar things.

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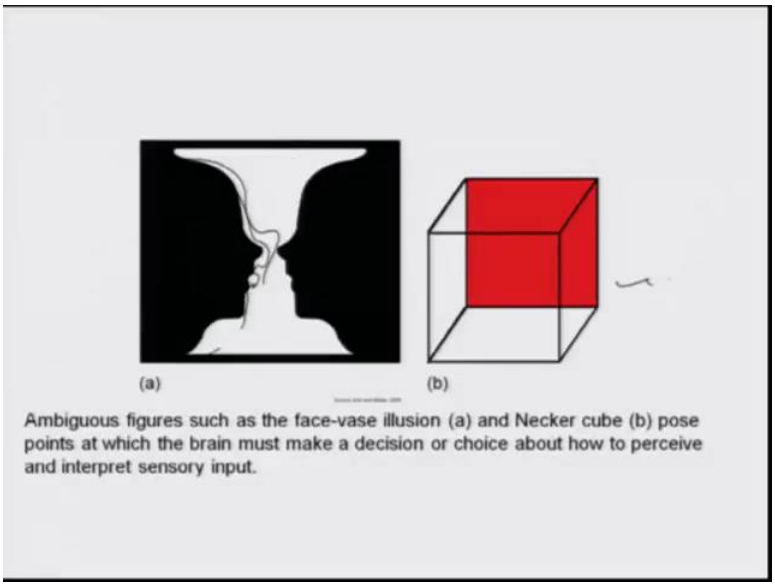

Like this you see a vase or you see a face is a Necker cube, you observe it closely you will see the whole red and white will change observe it for some time you can see it always get images on the internet.

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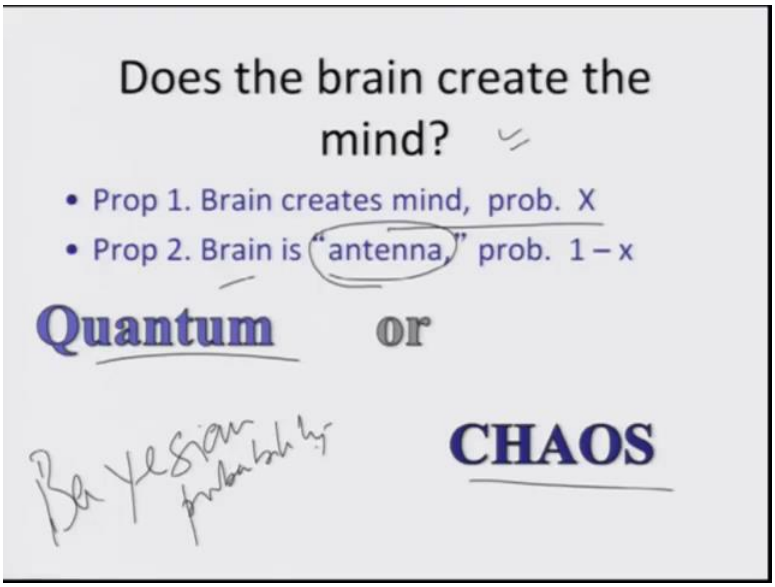

So, we come to the basic question with the whole title of this talk, but this four and half hours necessary because otherwise you would have been guessing like lot of there is nothing wrong being philosophical and this spiritual, but then the purpose is different. So, does the brain create the mind there is a lot of philosophical debate which went on

the cart who said the brain and mind separate dichotomy dualistic thing. So, when once it happen people became very happy because then people could really jump one to the psychical research of the brain and they said, forget mind we not bother about mind research on this they were people who said that there is nothing in the brain is just in antenna to your brain will only know what it perceives what it perceives even you will cant knows more sensible who said probably is the readiness of the brain and it deal. So, brain creates mind in problem one or it is antenna.

I think now this is again you can answer this question in a superficial way and brain is not antenna creates mind or the some people will say, it is antenna whatever comes through; obviously, is network grow under the influences of experiences, but networks also grow with genetic influence. So, what we understand the 4 5 4 models of brain, one is the quantum model coming from quantum physics the chaos non-linear there is one module which is a Bayesian probability and what we will talk about in detail, I will not teach quantum physics as it applies to the brain while keep mentioning.

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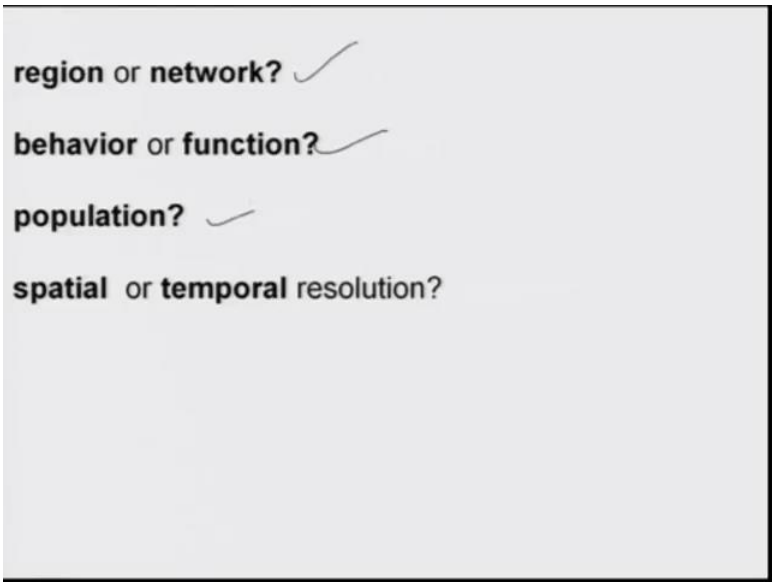

So, what are we looking at are we looking at region and networks or we will looking at behavior or function or will you looking at the a population of neuron or a I will looking at spatial or temporal resolution with all this is one layer.

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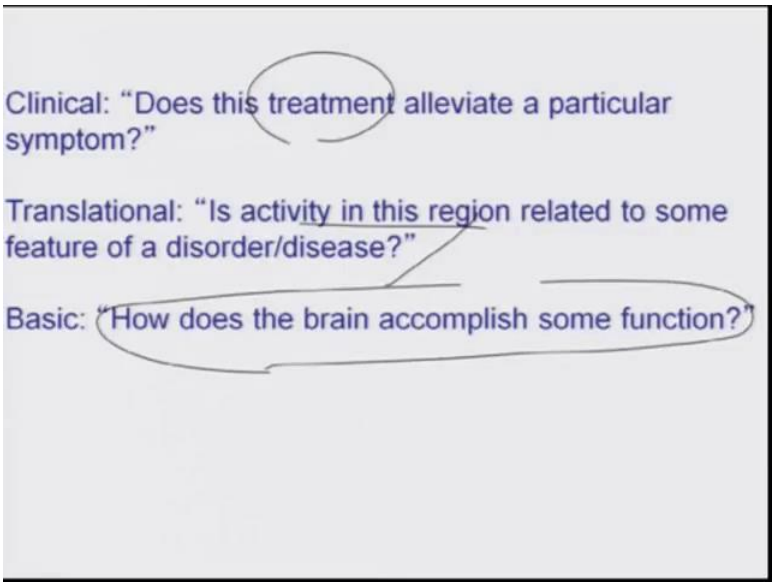

When investigate thing clinically we have to look for treatment translational is activity in this region related to some feature of disorder or disease biggest question, which everybody will ask how does the brain accomplish some functions.

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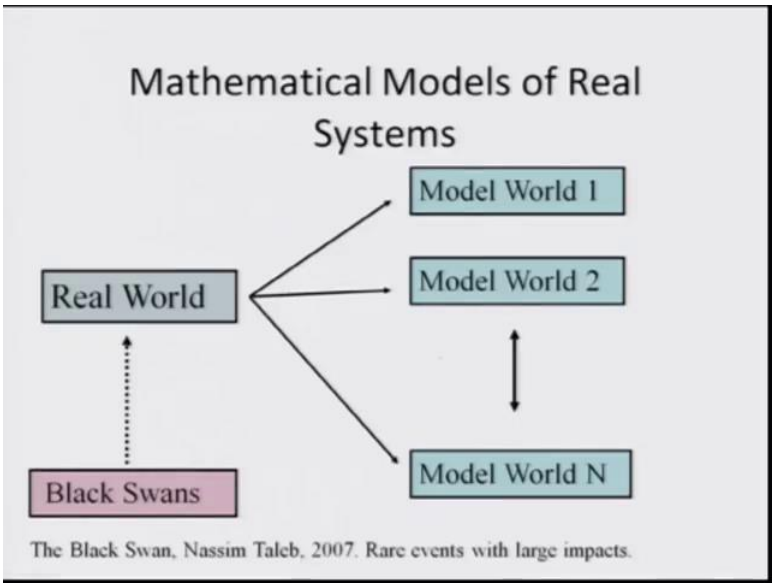

So, I will end this, in this lecture and maybe we will see how it goes just to end with decides you can see this.

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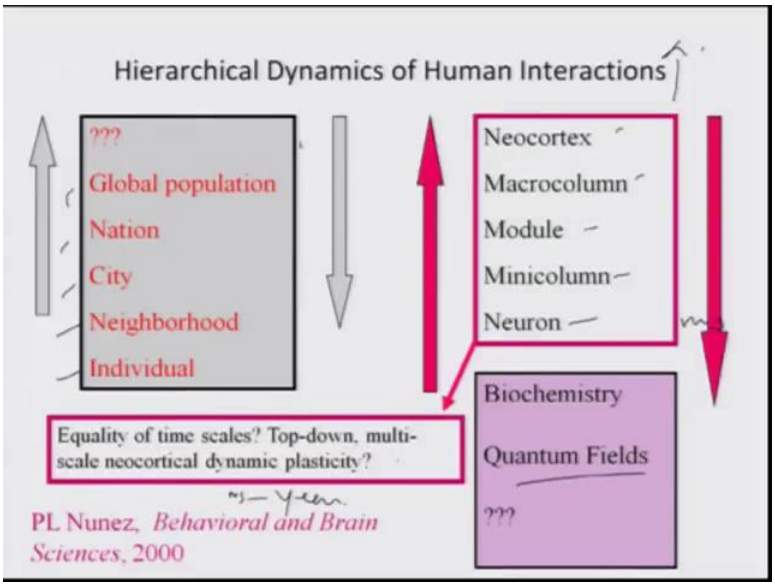

This is the hierarchical dynamics of human life, you compare societies individual neighborhood city nation here you have neurons mini columns, module macro columns neo cortex time is skills millisecond to how many years we will live in years. So, this is millisecond and we go on to live our life goes on a years we do not whether the quantum fields or there is a biochemistry.

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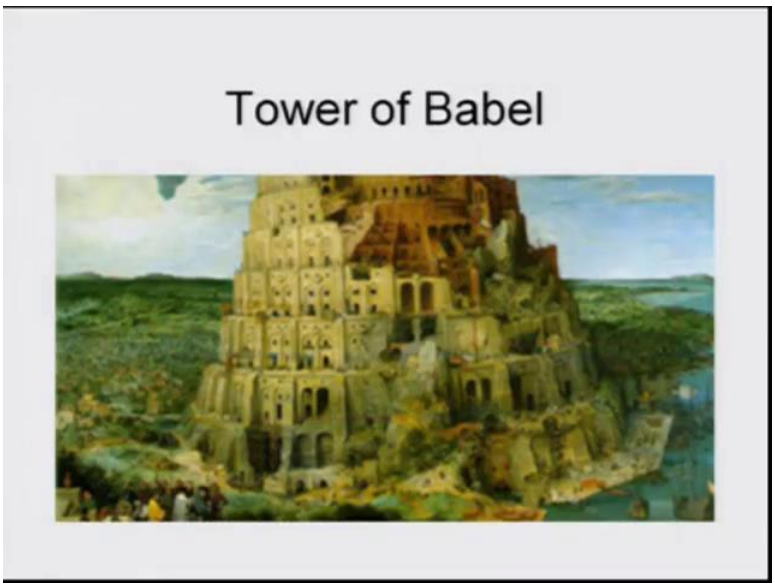

So, let us stop at this with this slide, and then we will continue because now the things will get interesting.

Thank you.