Psychiatry an Overview
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Module-01
Brain and Behaviour-Approaches
Lecture-03
Imaging

Welcome again and the last two lectures almost like a continuous let is say we talk about the gross structure of brain and some micro structure, and how it actually functions so and I hope you got the idea of how actually the brain is creating behavior but how did we come to know of all this one thing which we discuss was like in the lesion patient people who had brain damage and the alteration of beavers one way of looking at it but as I said that the last 40 years.

We have known more about brain and really try to peep into the brain so it today will try to look at in this talk we will try to look at how actually we try to understand what brain is doing ultimate aim and ultimate desire, of every neuro scientist is to look into a live brain when it is functioning but that is not possible because of clear-cut ethical reasons so what are the tools to peep into brain.

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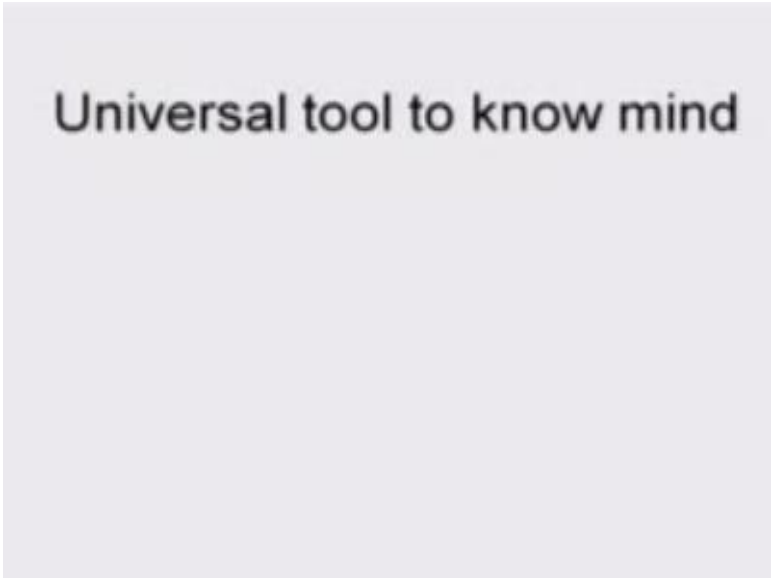

What are the universal tools to know the mind obviously?

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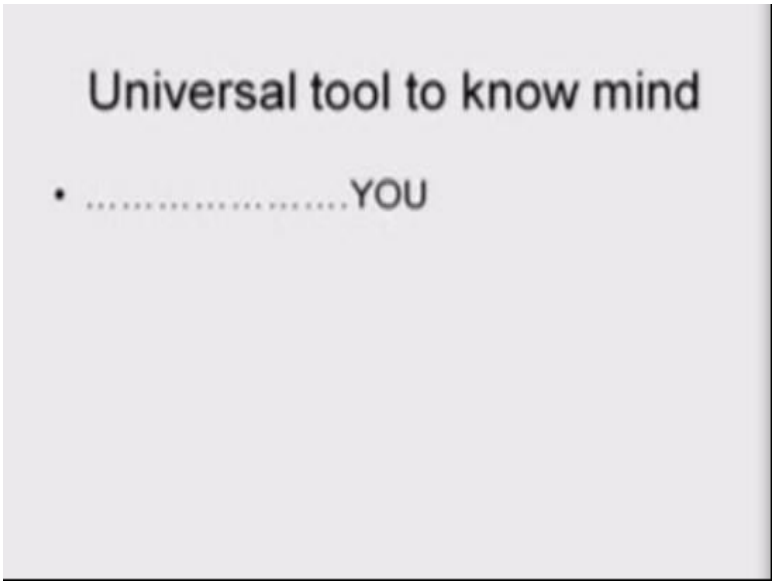

Is nobody better than you yourself and have the time we cannot observe our behavior because, I said lot of it is unconscious behavior which is propelling you to do certain things, but whatever we know consciously we know? So we tried to look at the behavior of others right.

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And what are the help does not looking at the behavior of other is a set of neurons which are more or less we have not been able to spot them clearly in the brain but we still know that there is a functioning of mirror neurons and mirror neurons are active all the time probably they have helped us grow as human beings because one quality, of Homo sapiens is that we were able to grow together unlike other animals they are the animals are grow in hard but and I am sure there the they understand.

And feel each other's emotion but the way human beings have this capability of looking at the emotions of others and anticipating and predicting the future behavior that is very, very unique and mirror neurons have had them a lot this is the other neurons which make you feel sad when you look at somebody sad face you can recognize anger by looking at the face of the other you can.

Even anticipate when somebody is getting angry because if it is just visual input and the brain does not make interpretation that, okay this facial distortion corresponds to anger then your mind will not even resistor and that, that is actually one that is the big problem in one of the lessons which kids have called autism the recognition of facial emotion is hugely impaired and that's what makes them socially.

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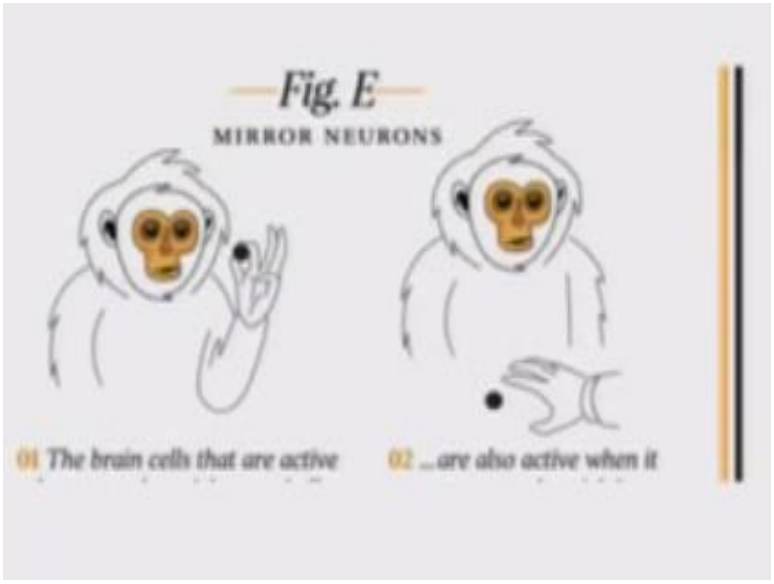

Haven't the restriction in this social behavior is partly arising from them.

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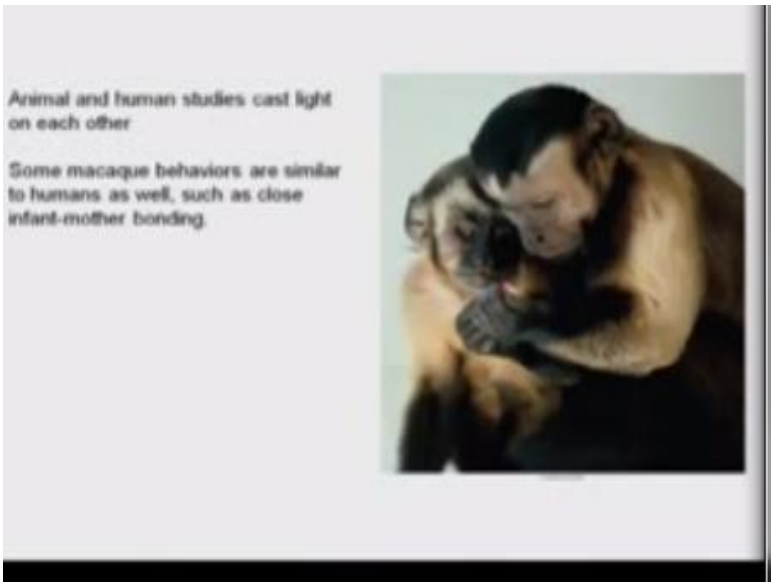

So animal and human studies is one of the ways to study we study animal behavior because the, the brain structure is similar in a lot of animals even the mouse has save and encephalization and the same type of network and.

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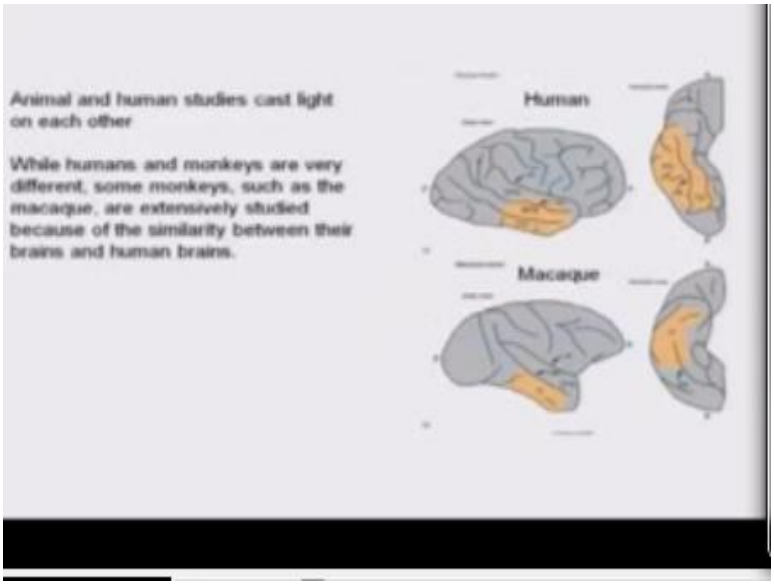

So while humans and monkeys are very different some like mochi are extensively city because of the similarity in the brain.

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That is one we have doing it, and I said the neurons.

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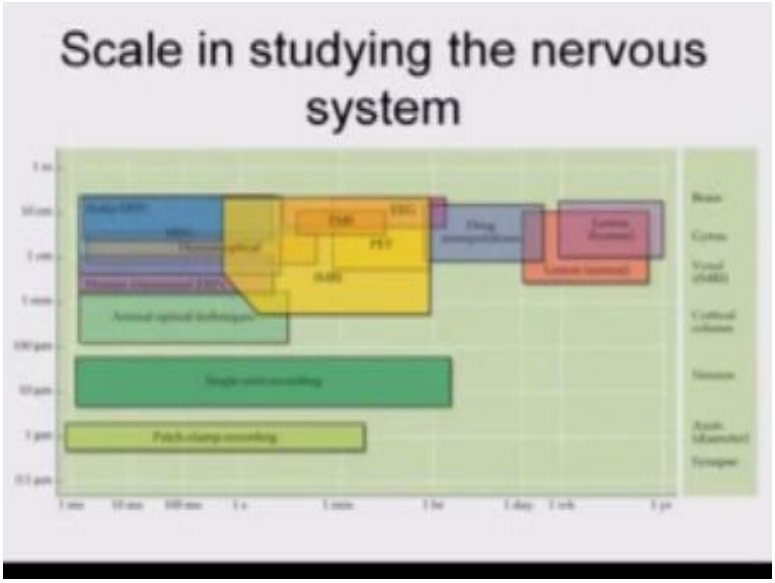

That shared the world so if you look at the scale in which we study the nervous system here is the size here is the time, what are the ways lesion is a longer is space-time one-

year months animals, weeks two years and the scale is very high within centimeter to meter drug manipulation again from days to hours EEG in minutes and hour practice can functional MRI scalp.

Earpiece patch clamp recording is when you really go to the neuron membrane and catch one of those transmitters other receptors micrometer, so this is just to give a broad idea this is the range within which we can study and within brain what we are studying sign ups here and when you are studying the whole human behavior with the lesion the patients are animal it is the brain.

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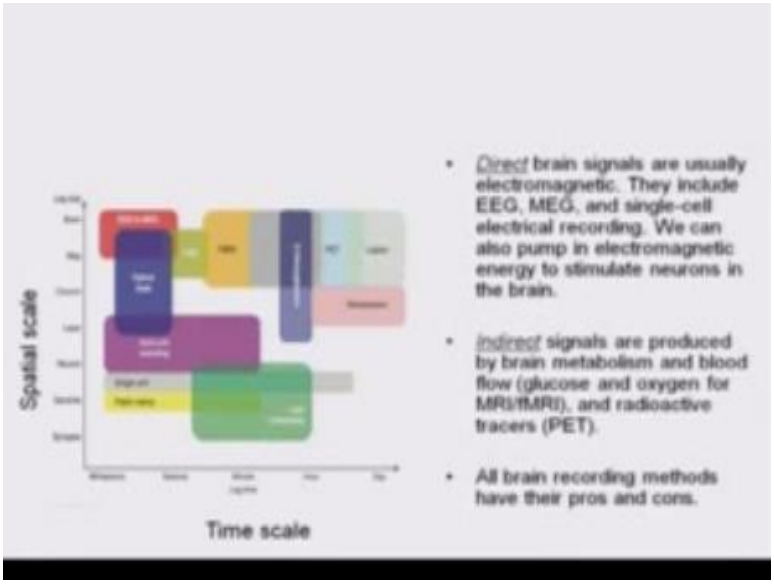

Again the same thing milliseconds to second to minute, to hour, to day lesions that scan MRI TMS so all these techniques the direct brain signals which use with or electromagnetic they include EEG, MEG and single cell electrical recording, we can pump in some electromagnetic energy to stimulate neurons in the brain the indirect signals are produced by the brain metabolism.

And blood flow the brain utilizes about 20% of the energy of the body to keep it functioning and to keep it warm glucose and oxygen with functional MRI and MRA and radioactive faces like pet positron emission tomography but they all have their pros and cons and as you can fit this into this study of the scales now if you look at the grass thing like lesions.

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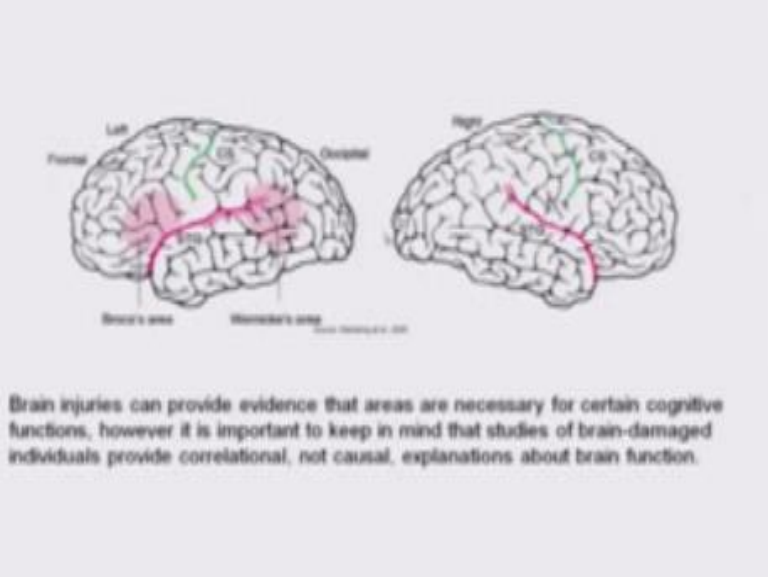

So as I said Phineas Gage if you remember from the previous lecture the brain injuries can provide evidence that certain area the necessary was certain functions but when you study these brain areas damage and the subsequent behavior ever changes imagine they we, now somebody has a injury in a hippocampus and has a problem with memory what you can best do either correlated you can say that.

Okay, this area damage to this area can cause to lead to this deficit or this derangement of function but whether it is causing that exactly.

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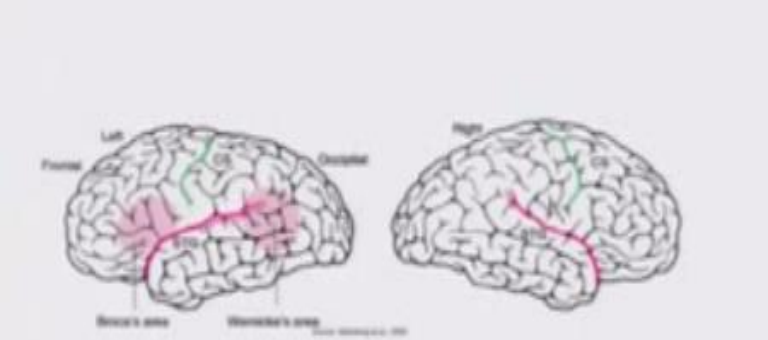

Brain injuries can provide evidence that areas are necessary for certain cognitive functions, however it is important to keep in mind that studies of brain-damaged individuals provide correlational, not causal, explanations about brain function.

Is not certain like in a stroke in broke Broca's aphasia there is a problem in creating language in a speaking but that we don't know whether that is the end protect there is a end point in a series of functions of language creation or they are, or it is the, they cause that is suddenly difficult to study in the brain lesion thing the other common the most.

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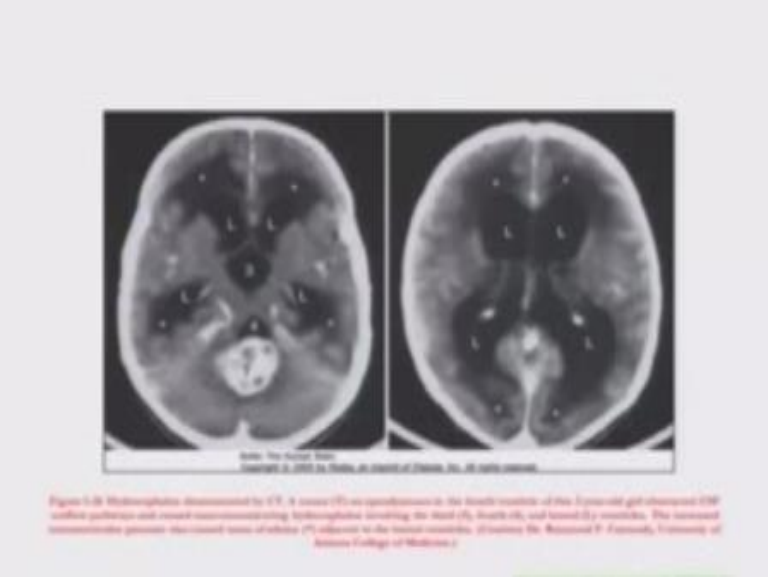

Popular investigation in brain has been CT scan of which is that tented x-ray but CT scan just gives you a broad idea of any existing damage in the brain like in this case there is something called hydrocephalus is more fluid in the in the ventricles.

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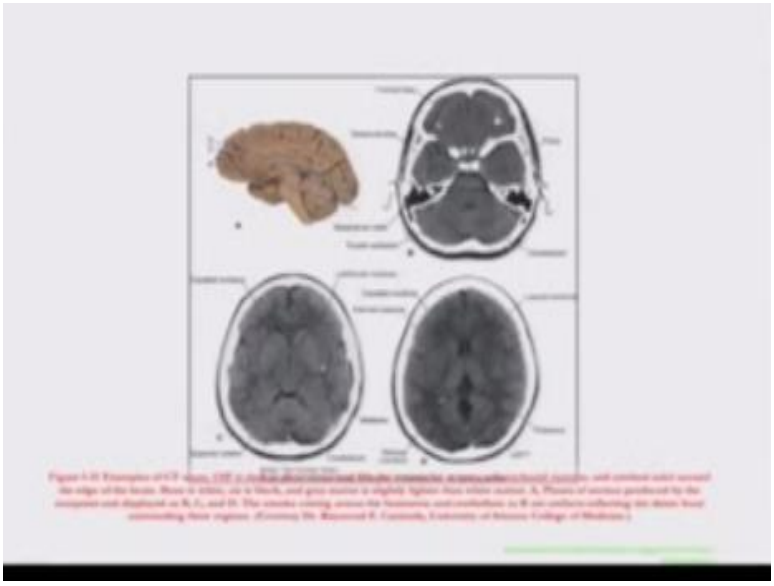

Again CT scan gives you a broad array of there is a tumor or if there is something called neurosis's are course is a are there is a stroke ways that damage to the area because of the demon blood flow CT scan is a good thing to take but nothing beyond that but is one of the most common is to use investigation especially in clinical settings to rule out immediate damage to brain when we see neurological science in psychiatry we do CT scan as a protocol are when we are suspecting some organic.

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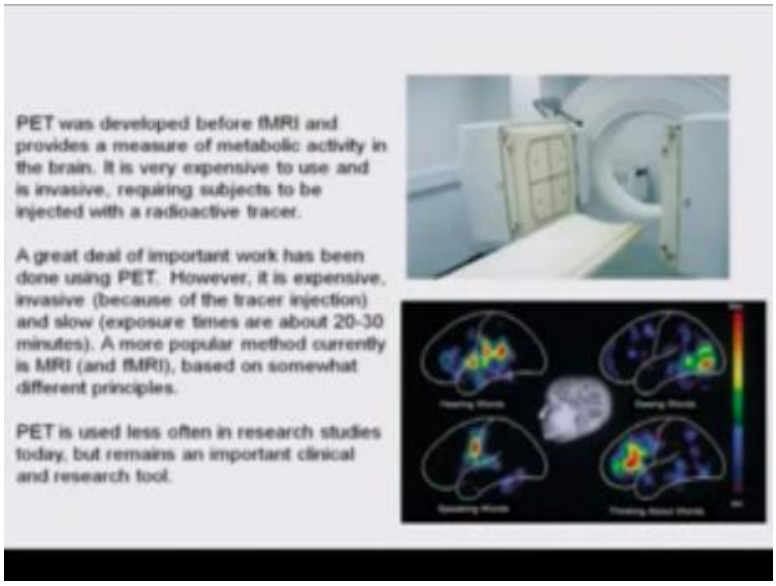

But CT has been surpassed by other investigations one of them is like positron emission tomography which was developed before functional MRI and provides a measure of metabolic activity the activity of the brain is very expensive to use is invasive that there is a certain amount of radioactive diabetes to be inserted and but lot of important work as it says has been done it is slope so fast activity in the brain cannot be got but what you can do is the if you give a certain task to the brain or if you suspect suppose in clinical settings are suspecting some tumor.

There if you give a radioactive tracer and the activity increases in that area like the dye the deoxy glucoses.

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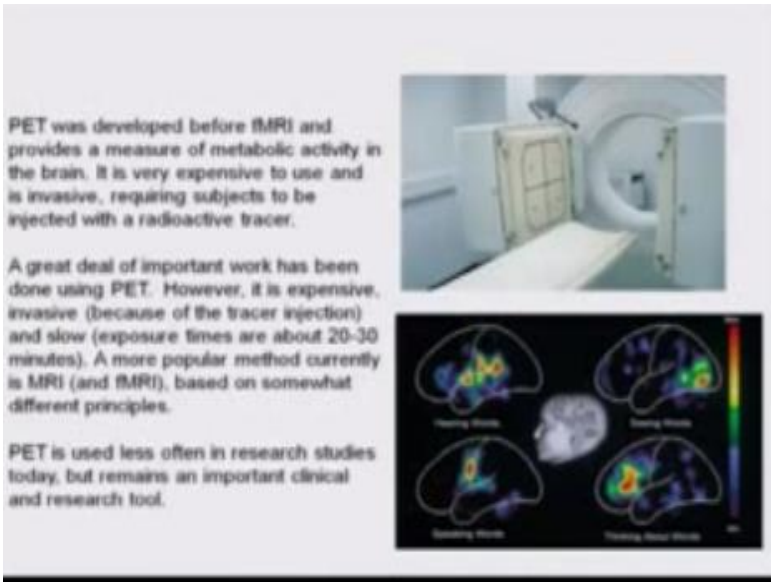

More glucose consumption in those areas that almost lightens up it gives your idea but like here you can see the hearing word this area gets lighten up here seeing words thinking about words speaking word of this is that, when after it infusing the radioactive tracer repeated slices of brain tissue were taken on imaging and the image was captured but these task said to be given for that person to do, only then that area will take up utilize more glucose and like almost lighten up.

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Functional MRI is the improvement on MRI which you all know but in just to reiterate.

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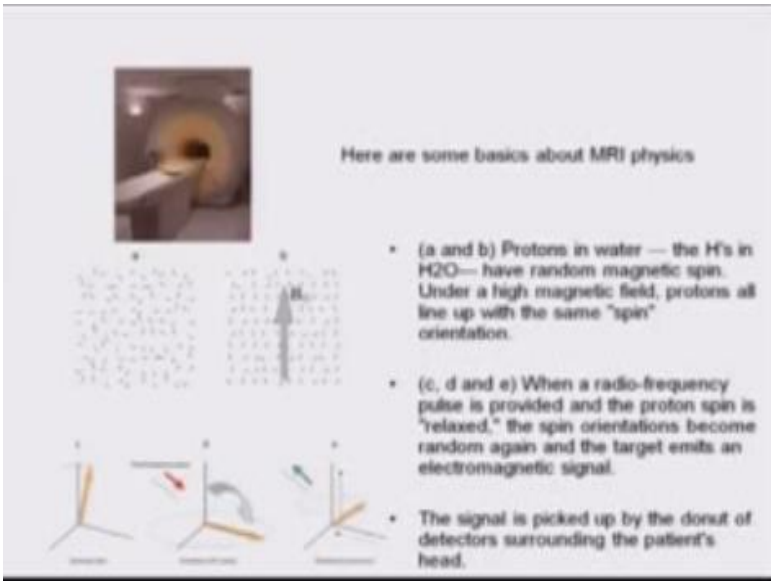

So this is as a basics amount of MRI physics there protons in water hydrogen's in h2O they have a random magnetic spin so the body part the brain in this case is put in the high magnetic field so they all protons line up with the same spin orientation they all line up according to the is, is like here's the baseline so they line up according to the magnetic field right.

After that there is another pulse radio frequency is send which actually shift them from that align magnetic field so that is called position and then it again relaxes back to the original alignment these signals these signals are got these are electromagnetic signals which are cot and without surrounding detectors and that.

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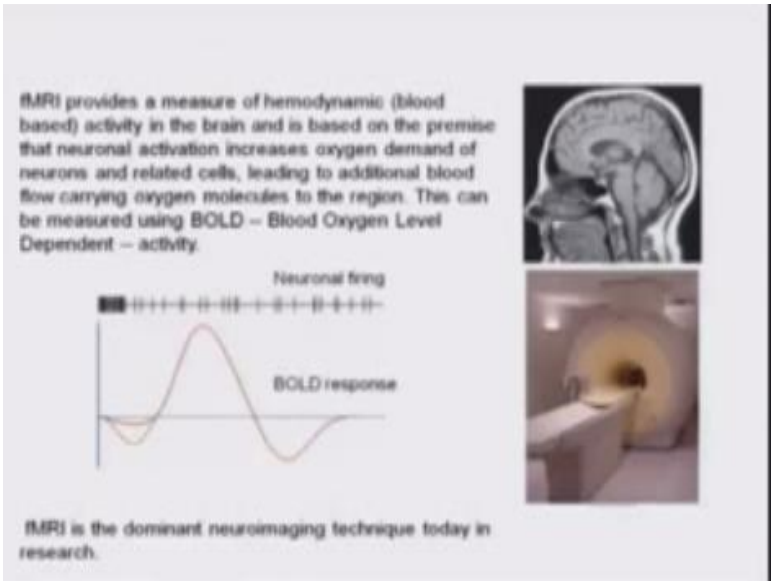

Construct the image.

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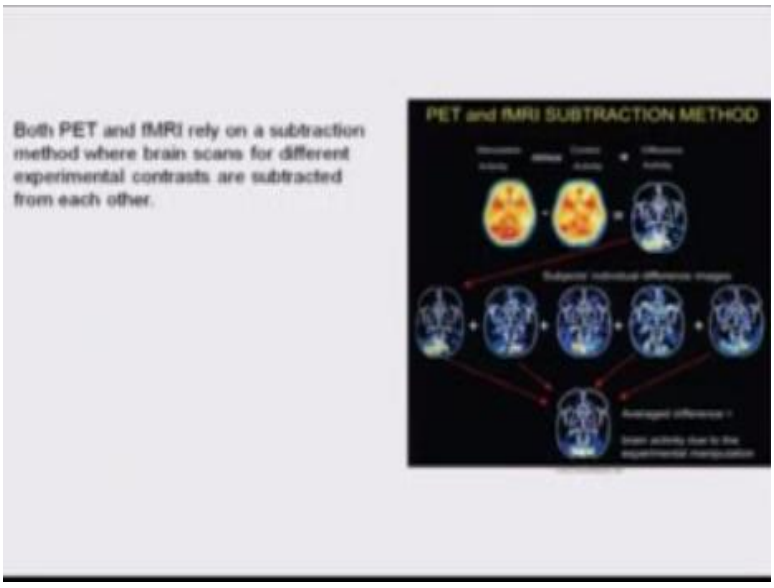

They both rely on the subtraction method so the thing is that maybe if you put a the detectors around the slice of the brain obviously a live brain and we put a magnetic field the protons will orient but it will be different from adjoining areas because their alignment may be different so the image is formed.

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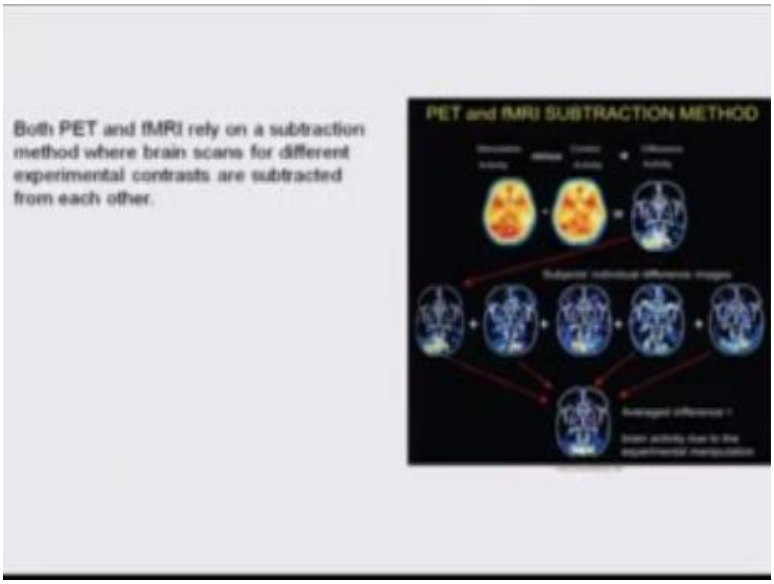

In comparison to the, so it is like subtracted from the adjoining areas both pattern MRI work on subtraction method so you can see it here it is, it is stimulation activity- control activities is like a difference activity so what you are seeing is one slice of the brain for which the magnetic field has been the detectors are covering that field the magnetic field disc has realigned the protons in that slice and you send a radio frequency in the process of precision and relaxation.

The signals record in that slice and then you move on another slice but this slice may have different from the rest of it.

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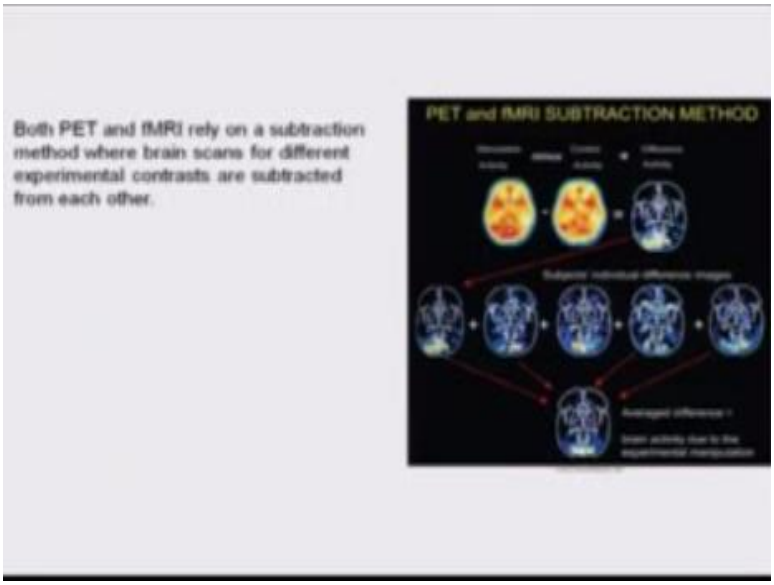

So that is the subtraction method.

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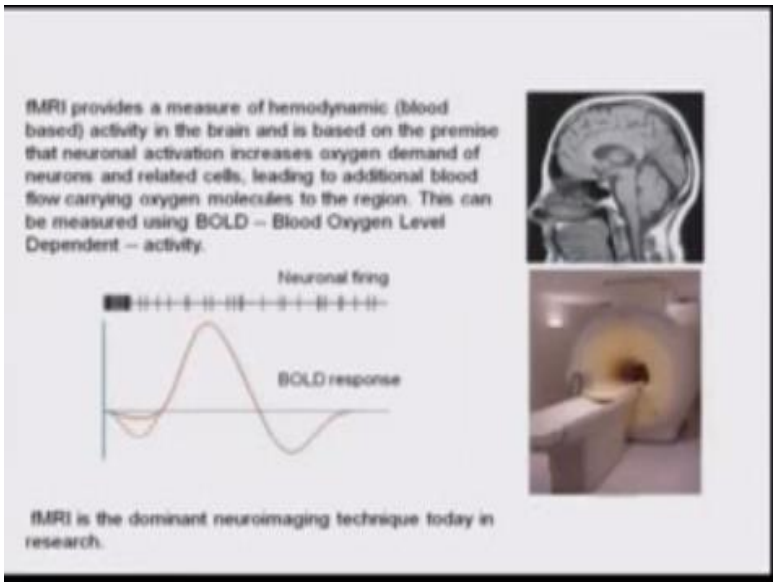

So that is MRI which is again use clinically is like more of a static investigation you keep seeing slice after slice does not tell you that the metabolic activity tells you the structure like CT scan right , where as tells you the function functional MRIs.

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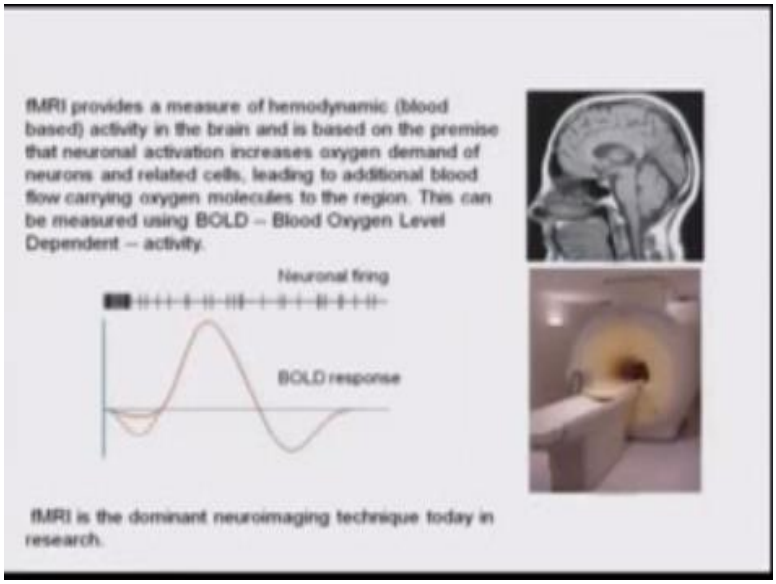

Improvement which uses something called bolt blood oxygen level dependent activity it is on the premise that if you, there is a certain activity in certain area of the brain it will use more oxygen so normally if you put the person and the brain is at rest brain is never at rest in one but if you compared with the activity level it can still be addressed the oxygen that there's a deoxygenated hemoglobin oxygen level is less and there is a certain activity .

And shorts has certainly image but if you give a task so you should know what tasks are you giving and what are you suspecting , and what are you expecting which area will get activated so you give a task according to the possible function of that area where you want to look at which is called region of interest and then there with as the oxygen level increases the signal changes because it will utilize more oxygen so it will for a moment it will go down and then as you blood-flow will increase their.

As the blood-flow will increase the oxygen will go up that will give created difference between the resting a state and the activists it so this is the most popular Neuro imaging technique use in research and so reason of interested I told .

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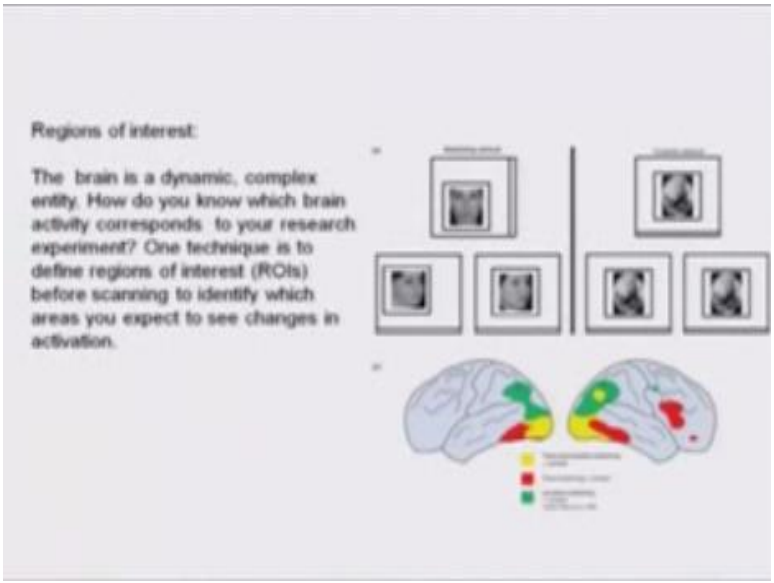

Is a dynamic complex entity how do you know which areas correspond one technique is defined before he scanning to or identify the area where you expect to see the change like face and location matching area or phase matching .

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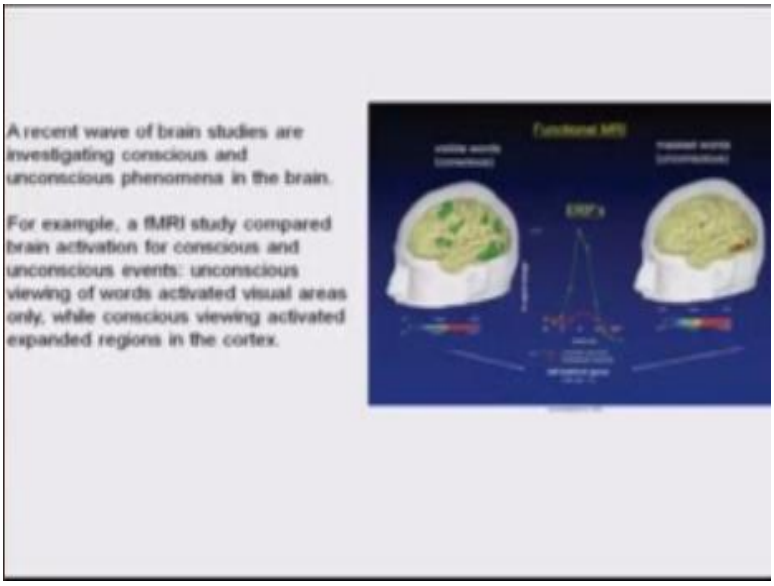

So recent wave of brain studies lot of it on his right from cognition to water movement to understanding emotions function memorize the in thing a lot of research is being planned around that even to extent of coupling it with EG like for example it this study compared brain activation for conscious and unconscious events unconscious viewing of words activated visual areas where is the conscious being activated expanded region that cortex so this is unconscious so you not putting your brain into it and you really see this area activated .

But a moment to put your brain to it and you want to look at it that means you put your attention span so the whole activity level increases to the whole Cortex ERP is even related potential event is trying to respond to the words we will talk about it when you talk about EEG.

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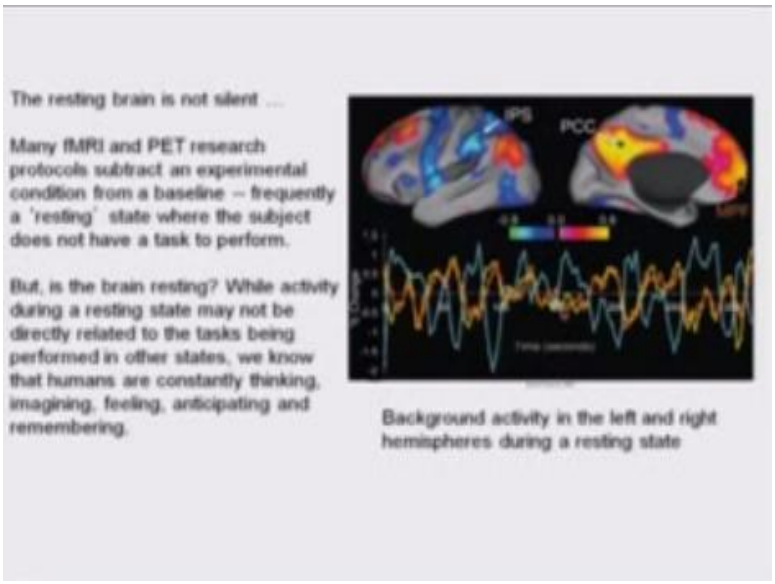

And I said resting but is not silent so from the baseline the protocol subtract and experimental condition frequently what is called arresting state while activity may not be directly related to the task there is not ask being given to the brain but brain in itself even interesting state is just not resting , it is we are constantly thinking imagining memorizing feeling that the brain is firing electrochemically all the time to keep assemblance of order to clip keep the sense of unity to keep you oriented to time in a space to keep you feeling life right so as you see it here .

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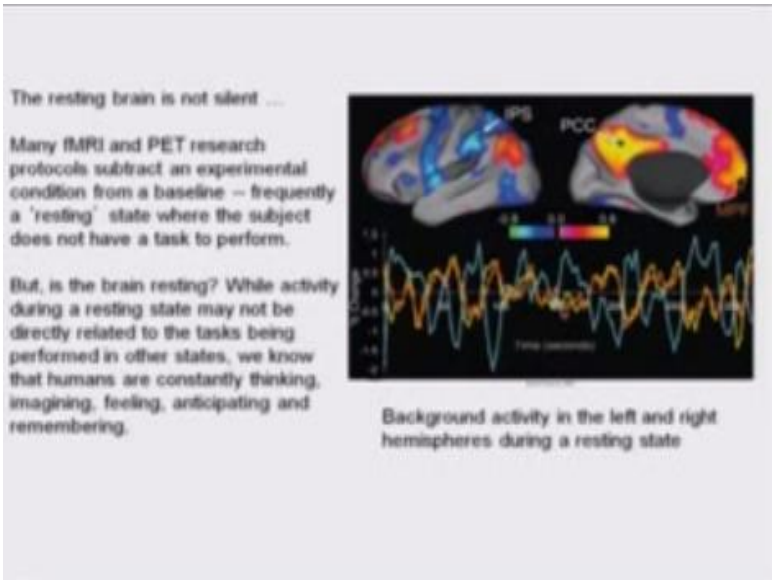

Is the background activity is going on investing a state left and right so the source of activity is really but we can call and default mode Network it is a arresting state when you are not voluntarily intending to do any task.

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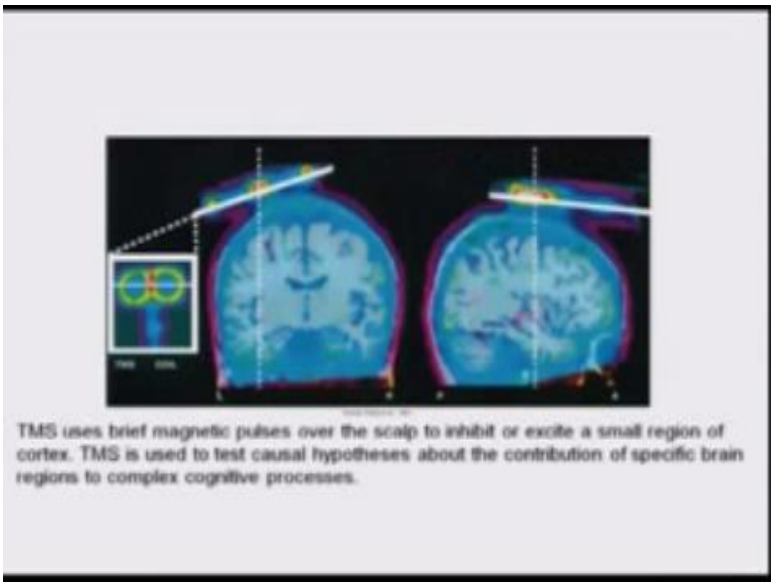

These another way of imaging something called transcranial magnetic stimulation we put a call and stimulate certain areas of cortex again this is also need to have a region of interest because we should know what where are we stimulating and attributing what function to that area so this is that is the contribution of a specific brain regions to complex cool so if you think that okay, this is the area where mathematics the area where mathematical abilities.

Are going from and is stimulated that and see the effect of it effect of this disruption of natural electromagnetism of brain through a pulse of magnetic wave and see the impact on it to a hypothesis it confirms what you're thinking okay and but if it does not then obviously they has to be in some other area.

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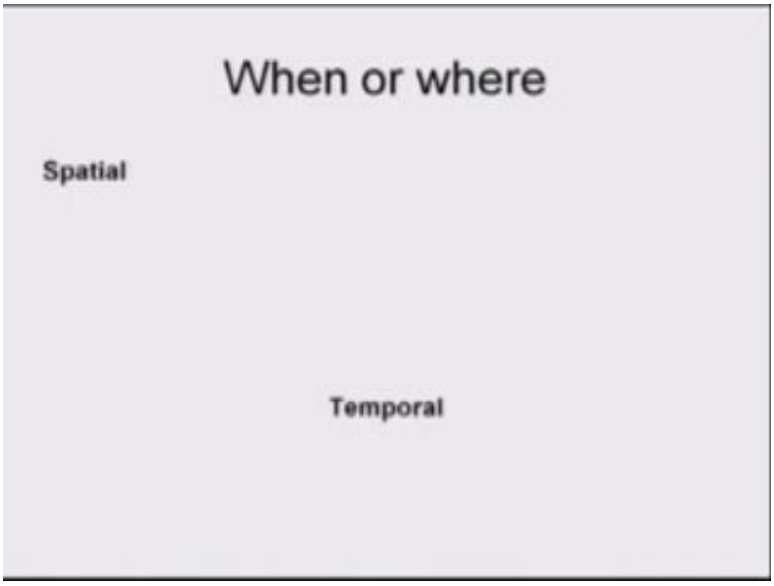

The big question in imaging in the brain and peeping in the brain is when or where what is important you want to look at the area where it is happening.

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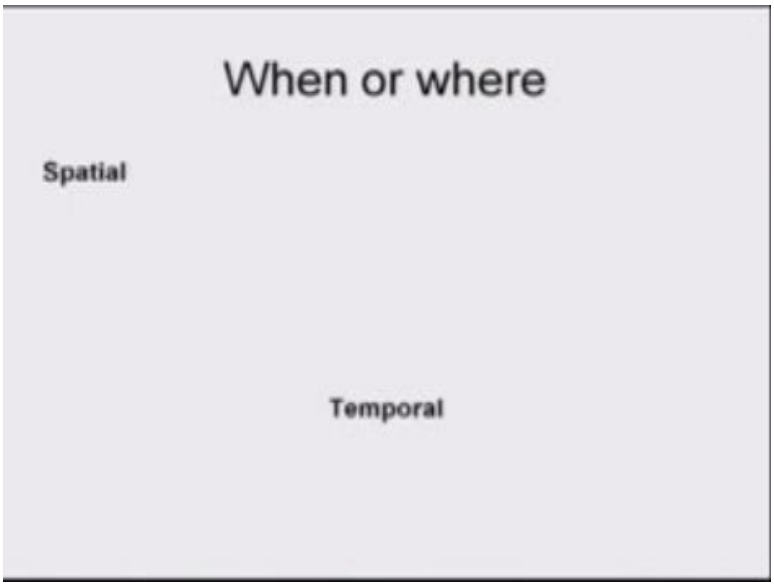

Are you want to look at and when it is happening because obviously when and where is the orientation of space and time so the imaging has to answer, answer this question like MRI CT scan tell you the special where is the functional MRI also tells you the special in a more conformed way in a hypothesis driven wave, where it tells you okay, you give a function result suspect that this area's x area x is causing function why so you look at X give a task which will Evoke function Y.

In function where I, I have to give a task if you do not give a task and I said resting a state you can see here.

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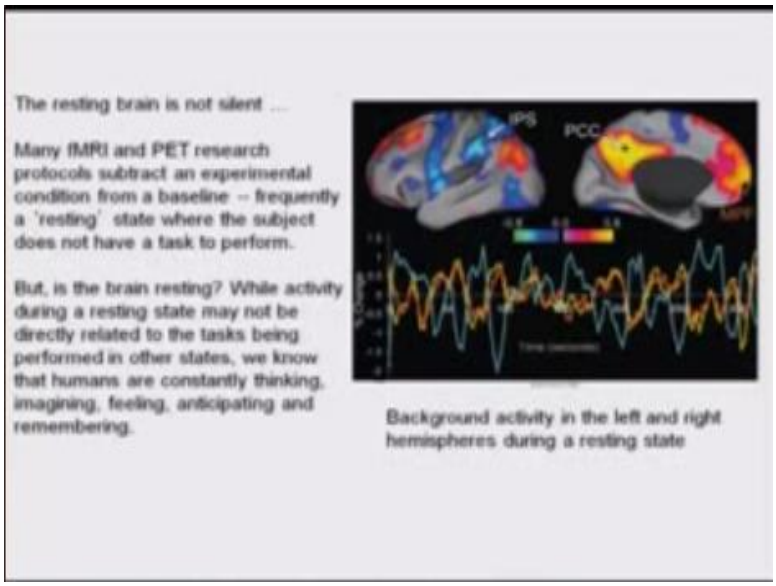

But if you give a task you must see things like this.

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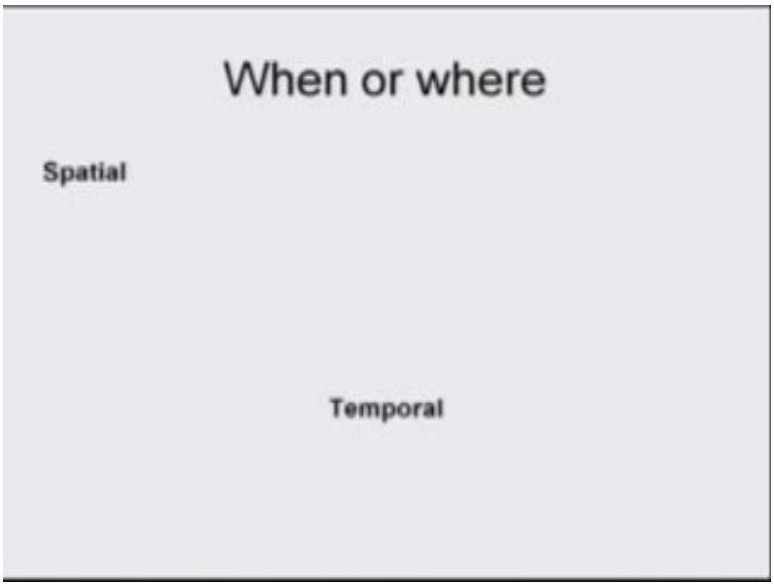

So sometimes what becomes important is to look at when it is happening that is a temporal think.

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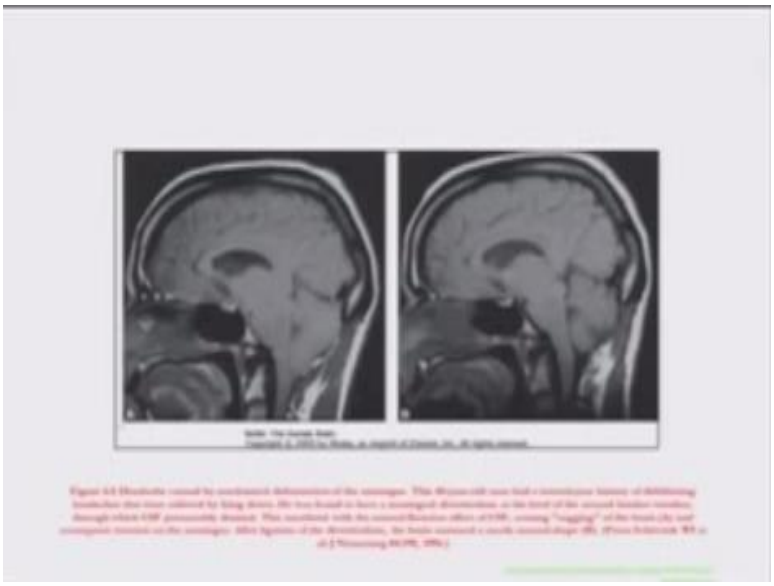

So this question is still new techniques are being evolved where functional MRI and easy both are being use together to look into the when and where but it has its own limitation and not all of them is clinically useful.

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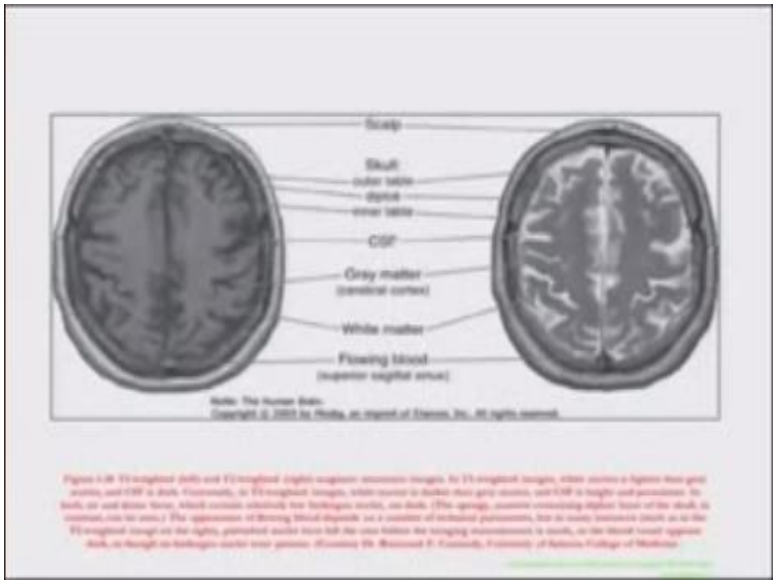

Okay this is again to that T1 and T2 weighted images.

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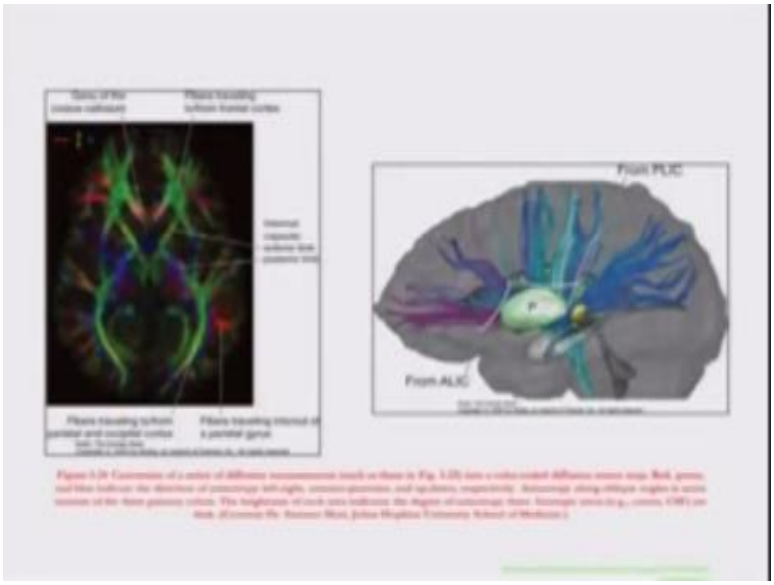

There something which looks at the movement of water in the white metal, white metal is that if you remember from the initial lecture the white metal other eggs on bodies which are covered with Mylons and which actually from the neuron but this is diffused.

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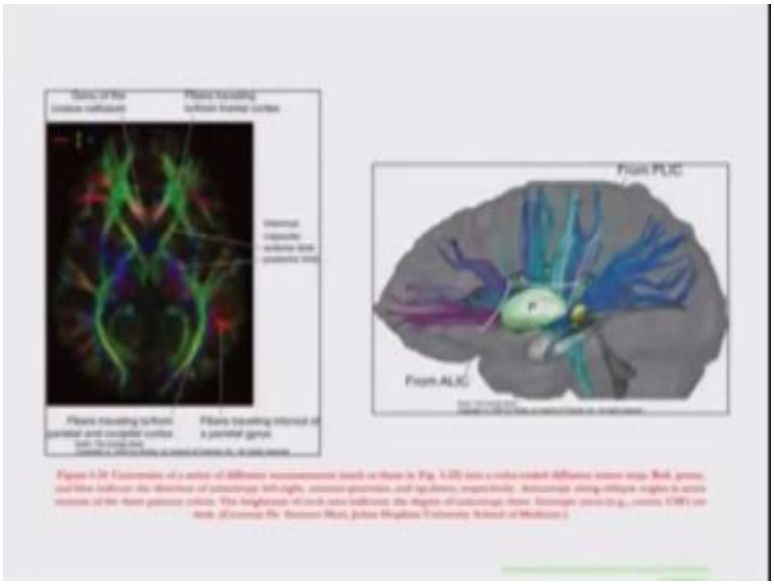

Sensor imaging we look at the water molecule movement so this is all if you look at it this is a diffusion sensor imaging through the movement of water molecules eliminating almost the white matter within the brain you can for this image into the network images which I showed you, initially.

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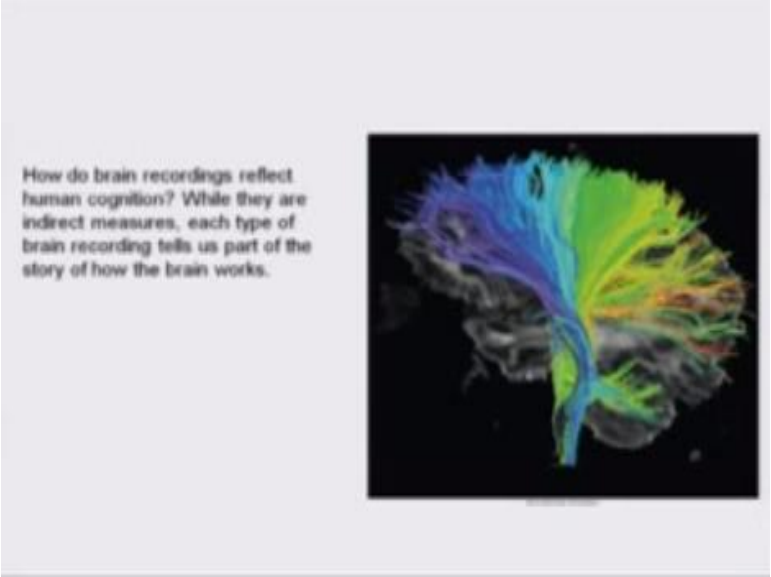

So the big question is which is important for psychiatry now as we go more deep into human behavior by their brain recordings tell us how humans behave they are all indirect measure like as it said MRI looks into the subtraction method each type of brain recording tells us part of the story like MRI in functional I would tell you the special orientation.

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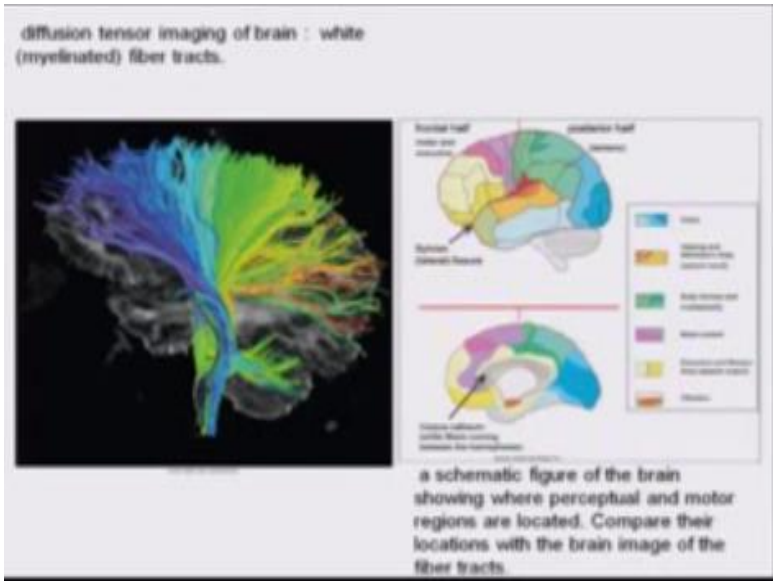

The fuse sensor imaging's that these another image of the whole the way white metal comes down to form the spinal cord if we look at this, this is vision hearing in one case area it all fall from the previous images executive in broadcast area if you so all faction right, so this is a white myelin of that you saw the myelin sheet which increases the speed of another wave impulse transmission so essentially if I sum up till now is that we have learned about the brain by looking at the lesions people who have had brain damage correlating it with the functions which have been altered through animal studies through technology in the last 40 years by CT scan and MRI which give you a structural image of the brain.

Through postmortem studies by dissecting the brain after somebody is that and looking it maybe we have not been able to look at the legion while person was alive but post-mortem told us okay, the behavioral changes which he had in the lifetime where partly because of this area and as technology that wants to functional MRI where you give a task and look at the images subtracting from the background that diffuse sensor imaging with gives you a damage to the white metal.

All these things are used clinically and in research but so largely what we know about the brain is that brain with 10 to the power 11 neurons is organized into almost parallel processing modular re structure where there are functional networks like default mode Network add resting certain areas involved in that there is a central executive network various alien Network and through which the all the cerebral cortex the various cerebral called areas of cerebral cortex.

And both the cerebral hemisphere to corpus callosum are united brain is electrically active all the time action potential is the basis of all electrical activity between neurons synapse as synaptic information transfer happens to neurotransmitters which are multiple dopamine systems, and really exists that in a lean system the serotonergic system which have cell bodies where there is a maximum concentration of these cell bodies and they have diffused projection.

But these and they keep firing the cell assemblies are the neurons that fire together they may be located in different geography but at the same time when they are activated they will create the same function again and again functions are divided in various cerebral atmosphere and they coordinate with each other largely unconsciously the brain is taking a stimulus information, processing, integrating, comparing with previous memories maps putting it into the 11th hierarchy of emotion presenting it to the conscious mind within 200 , 250 milliseconds and the brain deciding on whether to act or not what has to go into the memory is potentiated through into the short-term memory through firing in hippo campus and purpose circuit and long-term potentiation by synapse an synaptic changes .

So all that is for the whole complicated behavior which we have created now we were looking till this point that how do we peep into this space into the area where we want to look at it now we will switch to , I also said that when are things happening is also important to know so and in the next start and the last of this first week module I will tell you how do we look at when and that would probably cover up more or less broadly about how the brain behaves and then also introduce you to almost a sister branch to psychiatry that is psychology that in the next thank you.