Indian Institute of Technology Kanpur

National Programme on Technology Enhanced Learning (NPTEL)

Course Title
Basic Cognitive Processes

Lecture - 05
Foundational of Cognitive Psychology

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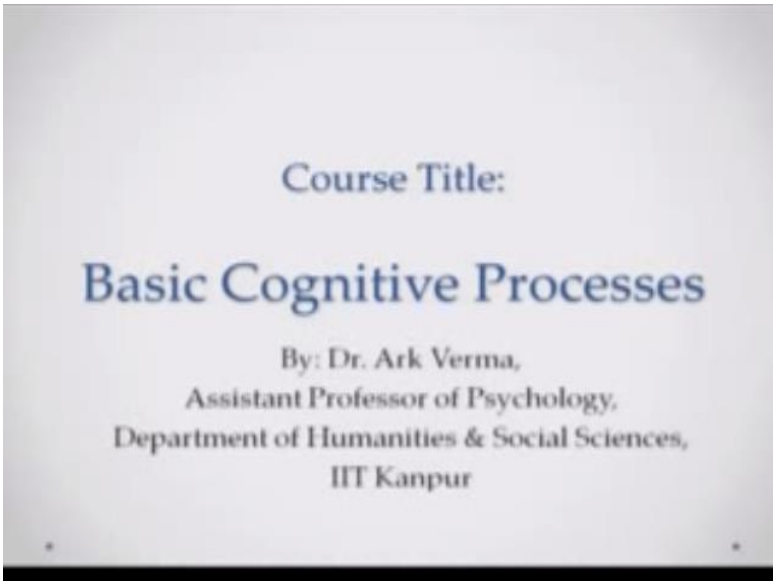

Hello, welcome to the second lecture of the serious of this course called basic cognitive processors. I am Dr. Ark Verma, from IIT, Kanpur.

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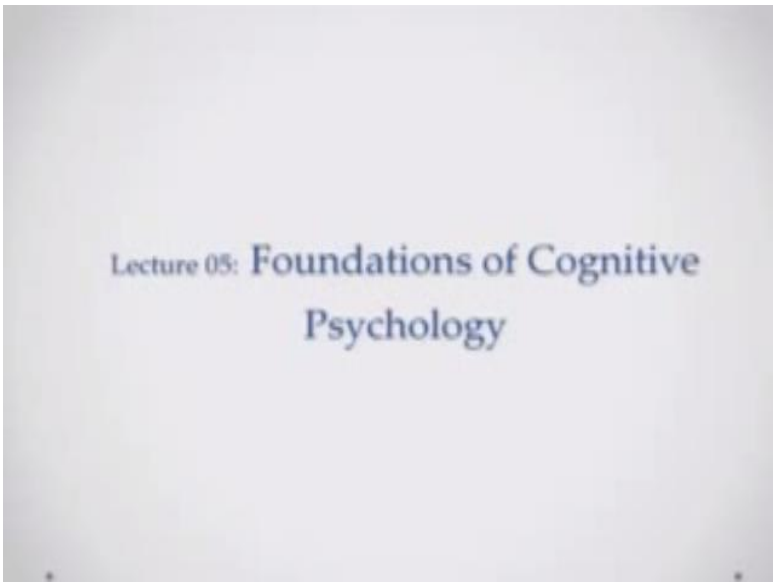

We are still talking about foundational assumption in cognitive psychology.

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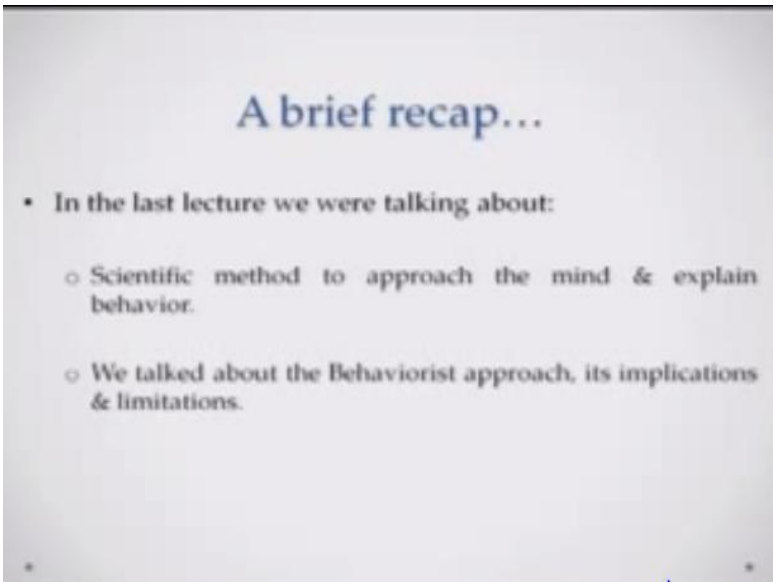

If you remember in the last class we talked about the scientific approach to mind and how that has been used to explain behaviour. Most specifically we talked about the behaviour used to explanation we talk about how this stands for behaviourism explains human behaviour.

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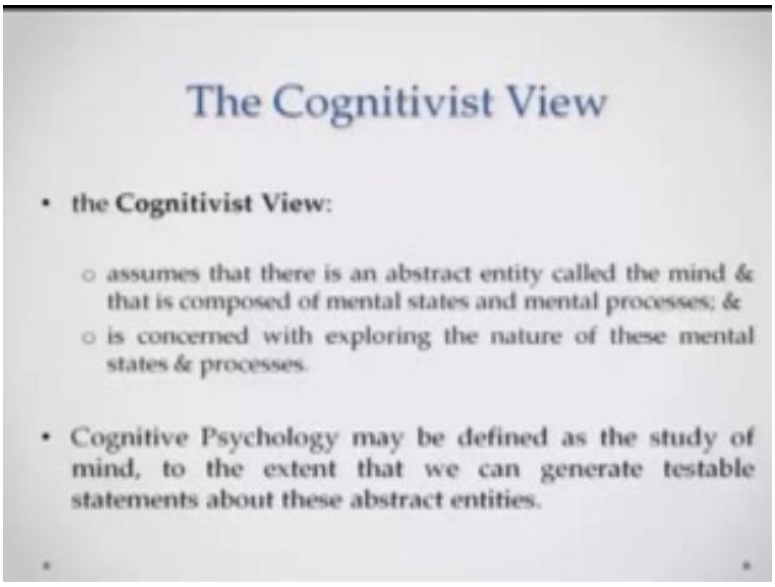

In today's class we will talk about the cognitivist view. What is the cognitivist view? The cognitivist view basically assumes that there is an abstract entity called the mind and that this abstract entity is composed of these mental states and mental processes. It is concerned with exploring the nature of these mental processes. That is what cognitive psychology is meant to do.

Cognitive psychology then may be defined as the study of the mind to the extent that we can generate testable statements about these abstract entities. Because you want to talk about these in a scientific manners you want to generate predictions, you want to test those predictions and except or reject them on the basis of those particular test.

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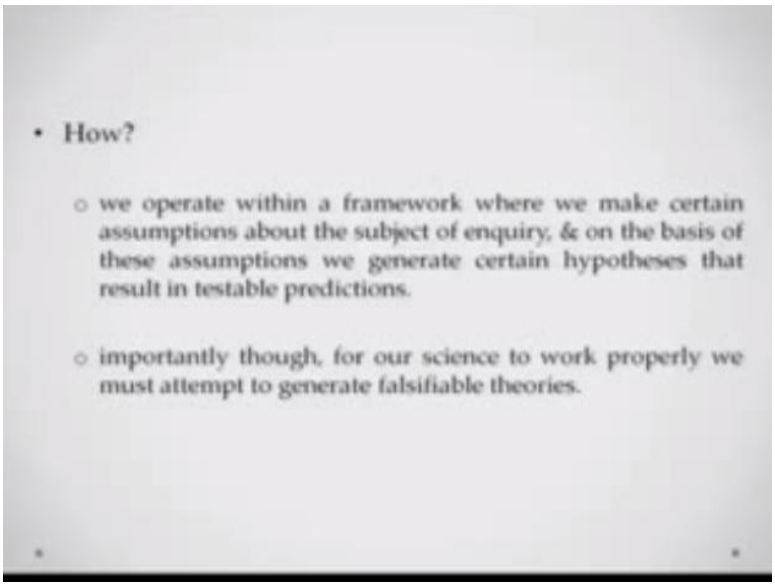

How do we do that we can do that if we operate within a frame work, where we can make certain assumptions. So we made a particular assumptions that this mental state leads to that kind of behaviour, and then what we can do is we can test these assumption we can create particular very specific hypothesis and go out and test them, importantly though however for a science to work properly we must attend to generate falsifiable theories. So unless are theories falsifiable we will not be able to test it.

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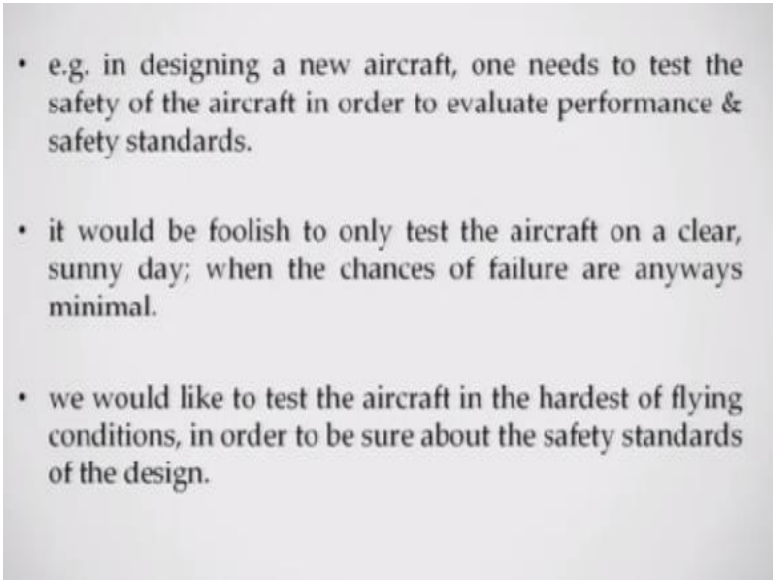

Say for example if you create aircraft, you want to market these aircraft somebody ask you that how strong your aircraft. What all these aircraft is capable of doing. So you would want to test and you want to really test it safely before really promising to your customers, so when do you chose would test it. So you do not really want to test it on a clear day or sunny day whether it is not wind and the chances of it failing are anyways minimal.

You would want to test it in the hardest of flying conditions and do want to see whether the aircraft performs well or it does not perform well. That is what we will give you some degree of confidence that if I sell this aircraft the person flying this will not any end up in an accident. This pretty much what we want to do without theory is we want to really make a theories which are open to testing and can be falsified.

And then we see that whether they stand it of a test or they do not stand of the test that is what we want to do in cognitive psychology.

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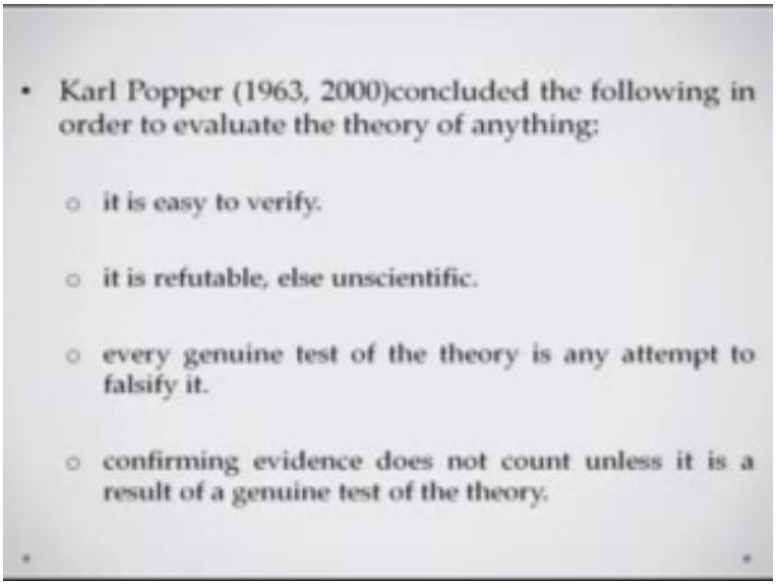

Karl Popper basically talks about attributes of how good a theory is or how do you really evaluate a theory. So he gives us a few points, he says that a theory should easy to verify. So if I go inside that the sun raises in the east. You might be just quickly turning your head towards the east see whether at a particular time obviously you see whether the sun is there are not. Or sun is raising from there or not. It should be very easy to verify.

Second is it should be refutable or else it will not be scientific. If I say something like say for example God has done something. It is not something that I can go and refute, I will never get the idea that God has done this or not. So then it is not really scientific theory, because it cannot be tested. Also a genuine test of the theory is any attempt to falsify if you really want to test a theory you want to attempt to falsify it.

You want to really test what are the conditions in which this theory will hold and what are the conditions and which this theory will not hold. Confirming evidence about the test or about any theoretical prediction that you make is not really counted it is not really given a lot of way unless it is a genuine test of the theory okay. Unless you test it and you find confirming evidence that is only acceptable in that case.

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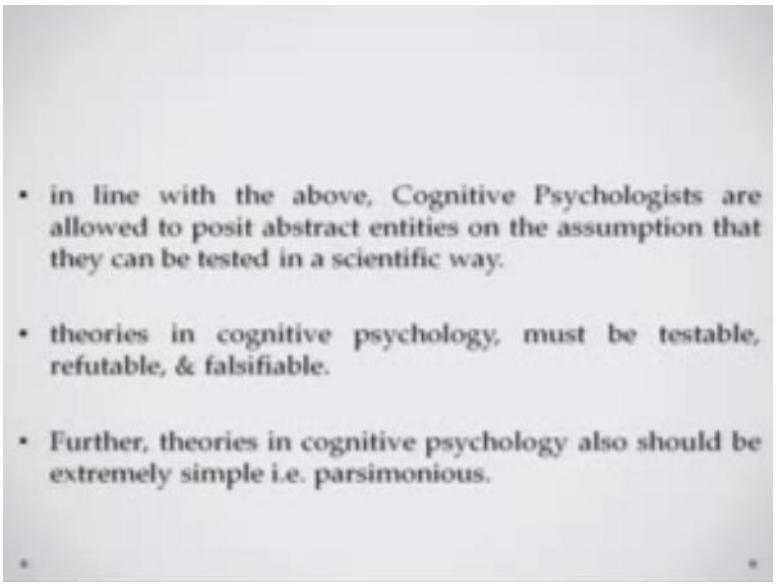

Let us move ahead in line with the above cognitive psychologist also try to do the similar things, they are basically allow to pose abstract entities on the assumption that they can be tested in this scientific way. Theories therefore in cognitive psychology must be testable, refutable and falsifiable. Further, theories in cognitive psychology should also be extremely simple that is again one of the things that Popper said that theory should be simple.

It should not have the X leads to Y leads to Z leads to D, then only you can say that X leads to D, they should not be so many conditions in the middle okay.

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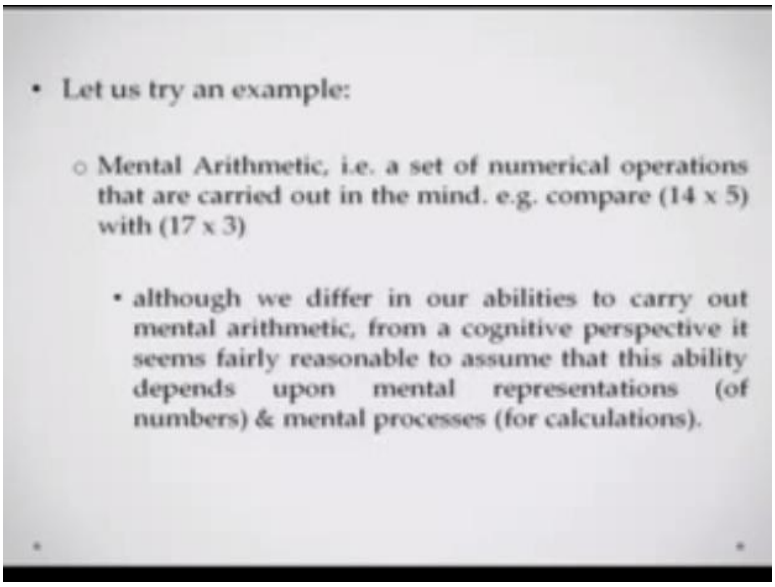

Now let us take an example if I want you to compare this two mental operations compare 14 x 5 versus 17 x 3. How do you do this comparison? Although we all differ in our ability to carry out this calculation from a cognitive perspective it seems fairly reasonable to assume that this ability depends upon some mental representations. So mental representations of what multiplication is, mental representation of what numbers are, these kind of mental process at least should be common to everyone.

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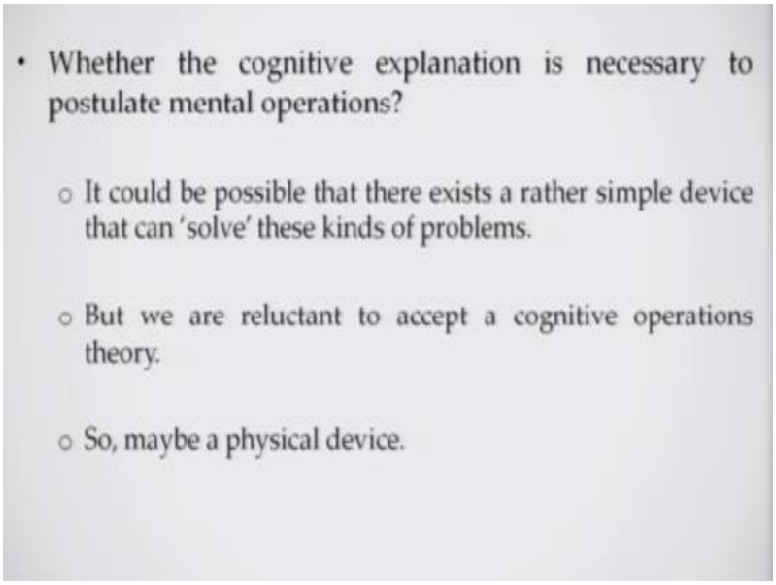

Whether the cognitive explanation something also somebody can ask us whether cognitive explanation is necessary for this kind of mental arithmetic. You could simply say that there is a physical device in your head which only does this calculation.

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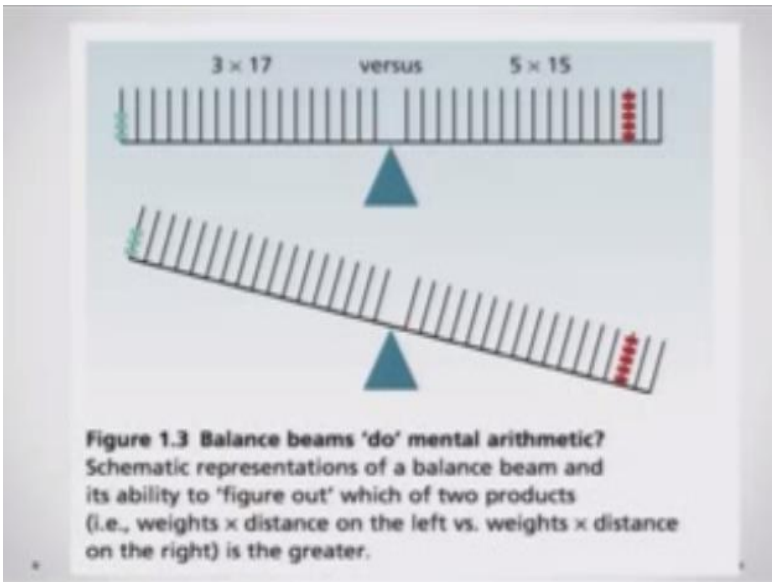

Figure 1.3 Balance beams 'do' mental arithmetic? Schematic representations of a balance beam and its ability to 'figure out' which of two products (i.e., weights × distance on the left vs. weights × distance on the right) is the greater.

So let us say if there is a physical device may be it is say for example like this balance b. if there is more way down one side then it is then the number is more than that is alternatives there is more weight on the other side result various.

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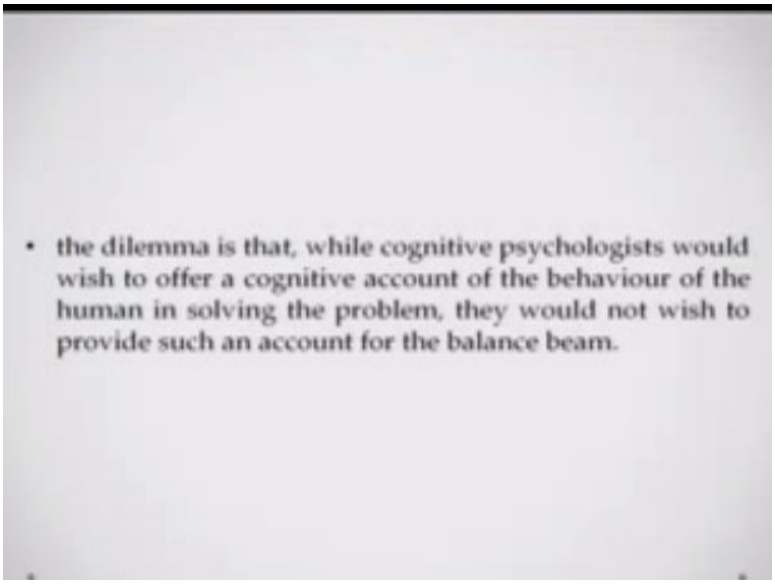

We can say that, but can we use this physical explanation for many other calculation as well, so the dilemma is that, while cognitive psychologists would obviously wish to offer a cognitive explanation for the brain for human behaviour, whether they would want to have describe this cognitive explanation to the balance beam as said. And how do you then solved how do you really say that okay the balance beam is a physical device and I want to give a cognitive explanation.

You have to understand that while the balance been can do some of your calculations, it can do some simple multiplications some other addition, subtraction, division something like that.

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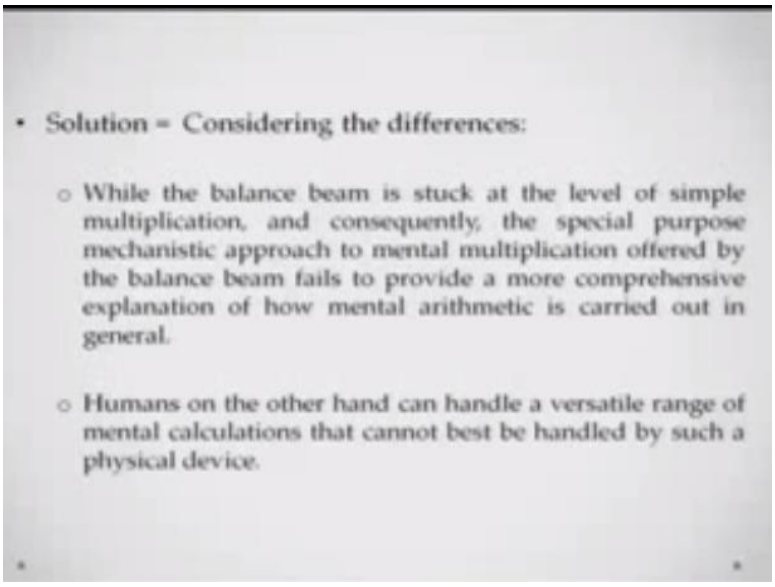

But at the level of the special purpose mechanistic approach to this mental multiplication which is offered by this balance bean actually fails to provide a more comprehensive explanation of how this is done, it does not really talk about how the numbers were represented, how exactly this process of multiplication took place. It will not be able explain that in entirety.

Humans on the other hand can handle a versatile range of calculations we do a lot of different calculations. And those calculations cannot be handle simple physical devices such as the balance beam. So there is sum there is to actually have this cognitive explanation of human behaviour. We will go ahead and see how.

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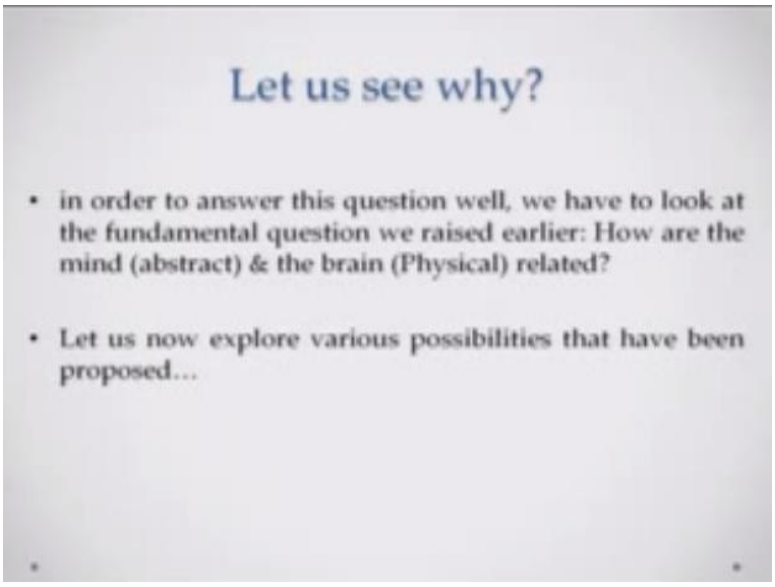

So why do you really want to talk about this. Why do you really want to talk about this mental explanation? In order to understand this we have to talk about how this mental and physical is related how the mind which as an abstract introduce related to the brain which is the physical. Let us look at possibilities.

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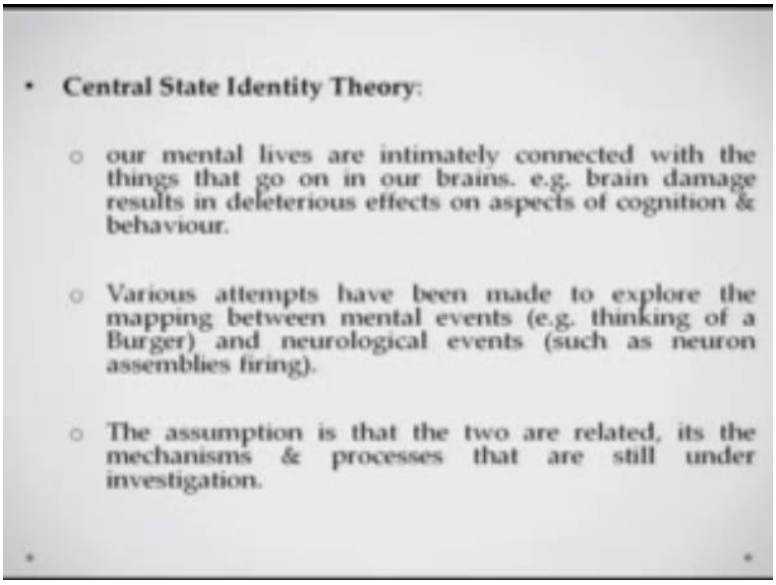

One of the possibilities is offered in this theory called is central state identity theory. The central state identity theory says that our mental lives are intimately connected with the things that go on in our brain. So anything that you do, any mental activity that takes place can be mapped back on to any neural activity that happens in the brain.

Say for example brain damage sometimes leads to loss of memory, loss of language, loss of understanding things like that. So that relationship can be made that part is at least clear various attempts that is why have been made to explore the mapping between this mental events and neurological events, say if we say people actually trying to do various investigations into how a particular neural event in the brain can lead to a particular mental event in your mind.

The assumption is the two are related and the only doubt or the only confusion is how are they related and that is what basically cognitive psychology, or cognitive neuroscience is really investigating.

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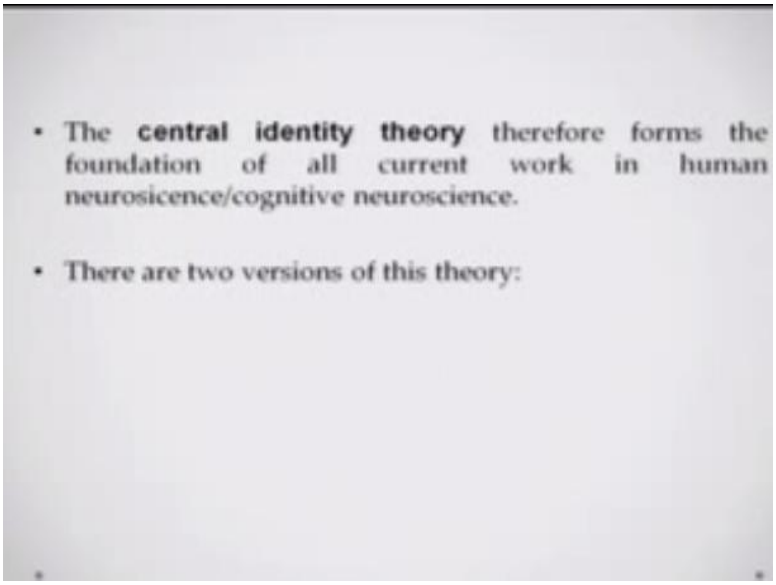

So the central state theory basically forms the foundation of all the work in your cognitive psychology, cognitive neuroscience, etc. There are two versions of this theory.

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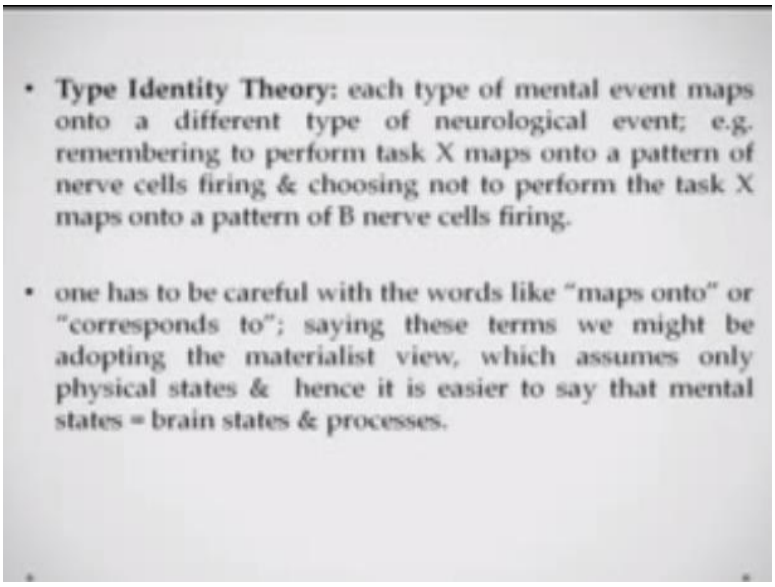

First is the type identity theory, so you can say that each type of mental event maps on to a different kind of neural event. Say for example, remembering to perform a particular task x correspondence one kind of event which is happening in the one kind of nerve cells firing and choosing not to perform the task x actually is basically based on the another kind of nerve cells firing.

So each type of event is related to different, different types of neurons which fire in the brain. This is one explanation. One has to be very careful when we use words like maps onto or corresponds to because saying these terms we will actually lead us to the materialist thing. There is a one to one correspondent between neural events and mental events. We have to be a bit careful with that and we will see in the next slides how.

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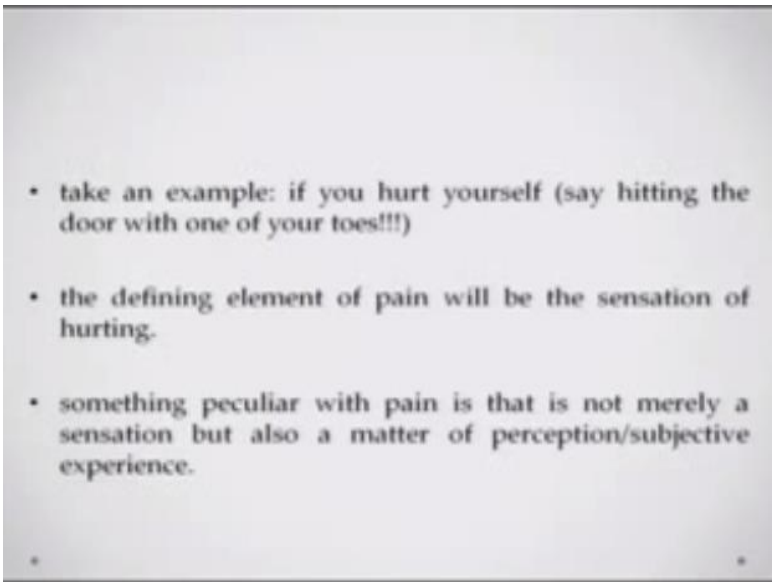

Now if you take an example, if you hurt yourself the defining element of pain will be the sensation of hurting. This peculiar thing about pain is that pain is not merely a sensation, but it also matter of perceptions. Some people with the same degree of hurt will might not feel that amount of pain. So pain is also it is not only sensation it is also perception, you will be sensing that certain degree of tissue has been damaged or something like that has happened.

But your perception of that entire pain actually directly corresponds your pain tolerance. If a tolerance is rather high you might feel less pain with the same amount of hurt as somebody who is got low tolerance of pain. Now this is something which is rather interesting and kind of creates problems for the type identity theory.

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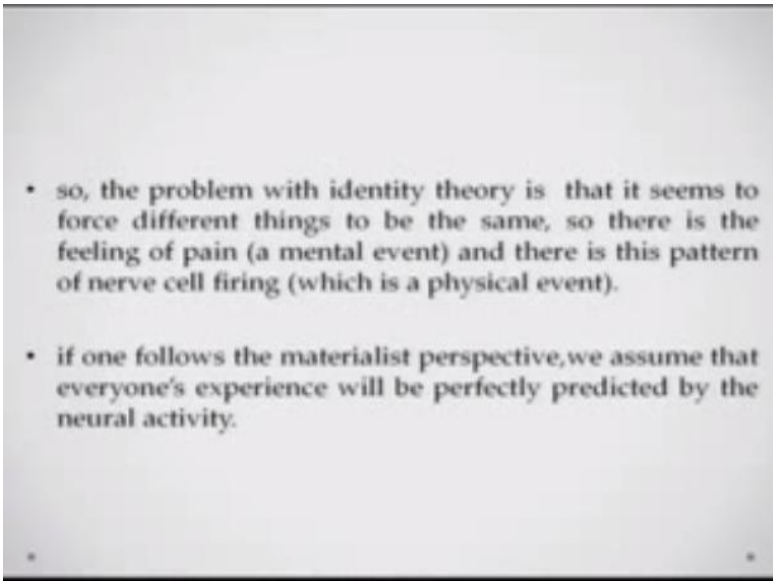

So the problem with identity theory is that it seems to force different things to be the same. So there is a feeling of pain which is a mental event, and there is a pattern of nerve cell firing which is a physical event. We are trying to have a one to one or the same basically trying to say that these two are same things. If one follows this perspective this materialist perspective we assume that everyone's experience is perfectly predicted by everyone's neural activity whatever is happening in each of our brains.

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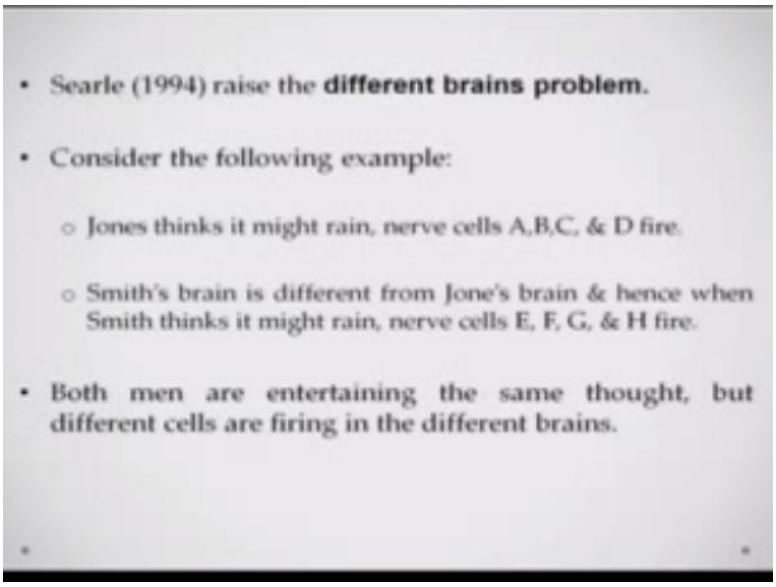

Now Searle basically created some objections for this kind of position, he says there is something called the different brains problem. Now take this example, Jones thinks it might rain, and then nerve cell A, B, C & D fire, Smith thinks that Smith's brain is different form Jones brain, there are different kinds of connection of the structures that there is obviously a lot of individual difference in the brain, book neuroscience will tell you that.

Now the point is say for example Smith is thinking the same thought that it might rain different set of neurons are firing E, F, G, & H. The point is this is the problem we are talking about, both men are actually entertaining the same thought but different neurons are firing for the same that this cannot happen within the frame work of the type identity theory.

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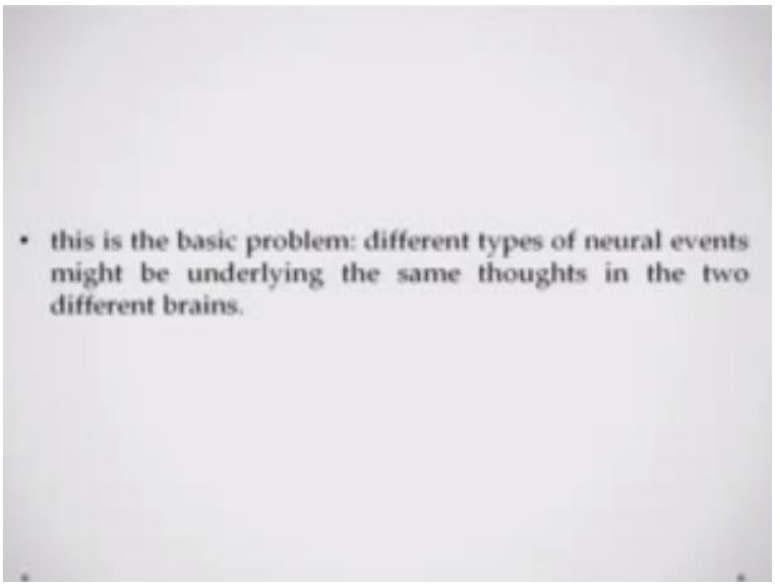

This is the basic problem.

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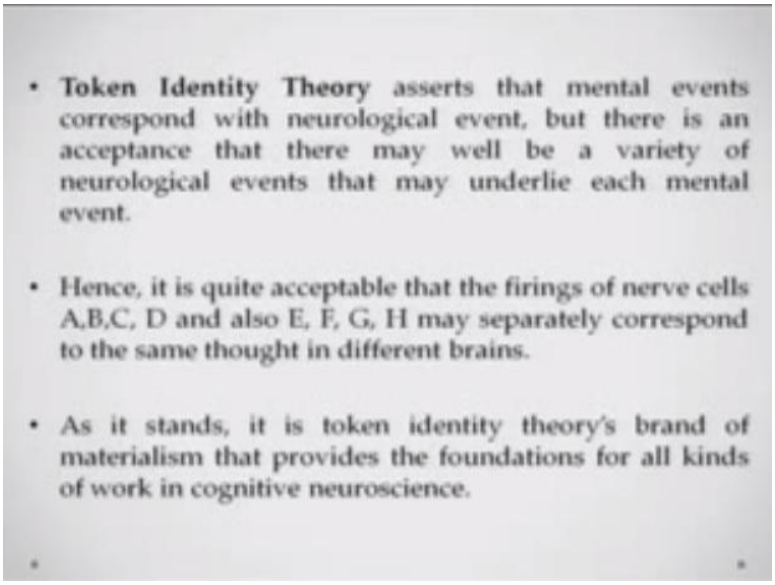

So from this problem actually comes another version of this identity theory which is Token Identity Theory what does it say is asserts that mental events correspond to neurological events, but there is an acceptance that there may be a variety of neurological events, that may lead to the same kind of a mental event. Say for example in this frame work then it becomes really possible that different sets of neurons like A, B, C and D or , E, F, G & H or actually leading to the same kind of a mental event that is thinking of brain.

As it stands, token identity theory is brand of materialism is the one which is providing the foundations for all kinds of work in cognitive neuroscience. That is where the field of cognitive neurosciences really based. We will talk about cognitive neuroscience in more detail in probably our second chapter.

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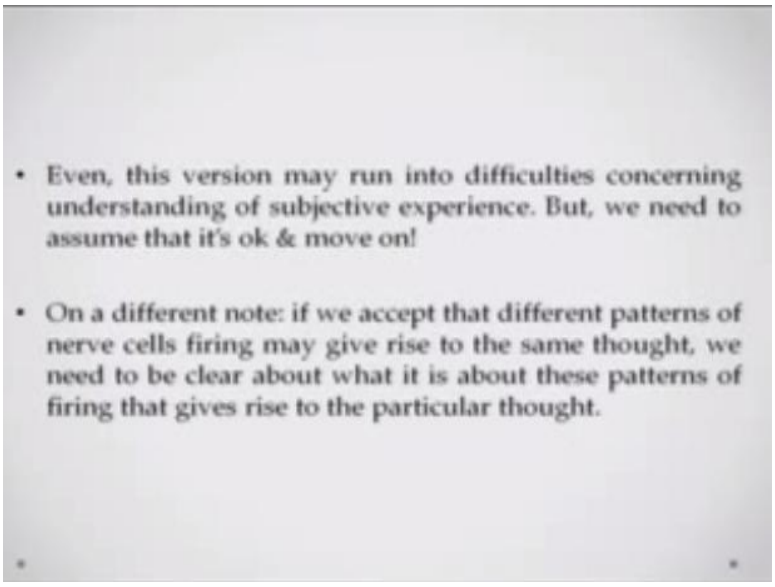

Even this version actually if you really examine closely may run into difficulties concerning the understanding of subjective experience. So what we will actually not going to much more detail we will stop here and we will assume that this is okay and we will need to move on with other things. On a different note if we accept the pattern of nerve cells firings may give rise to the same thought. We also need to be sure about what is it in these nerve cells firing that is leading to a particular kind of a thought. That is also we will need to investigate and we will see that in the coming lectures.

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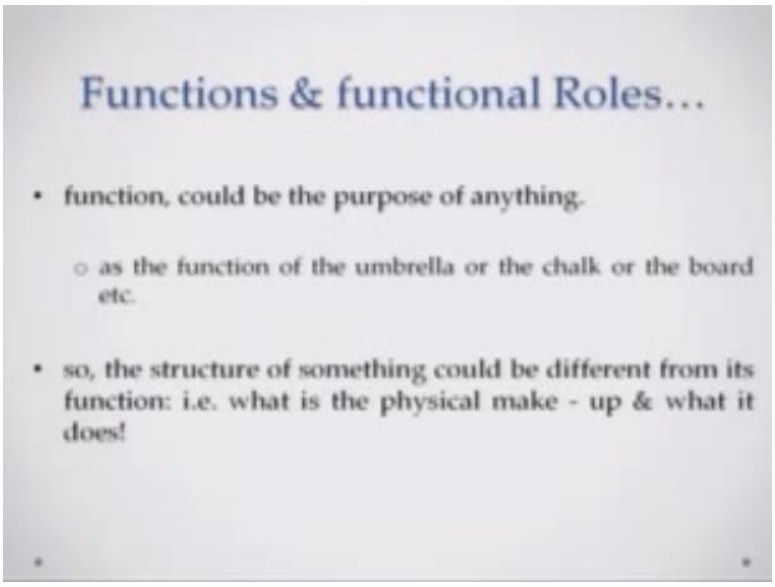

Now moving to a different question, functions, what is a function? Function is basically the purpose of anything or what something does. Say for example the function of the umbrella is save you from rain or the function of the chalk is to write on the black board. Now there are two things there is a concept of structure and the concept of function, so the structure of something then could be different from its function. What is the physical make up of something and what it does are two slightly different things.

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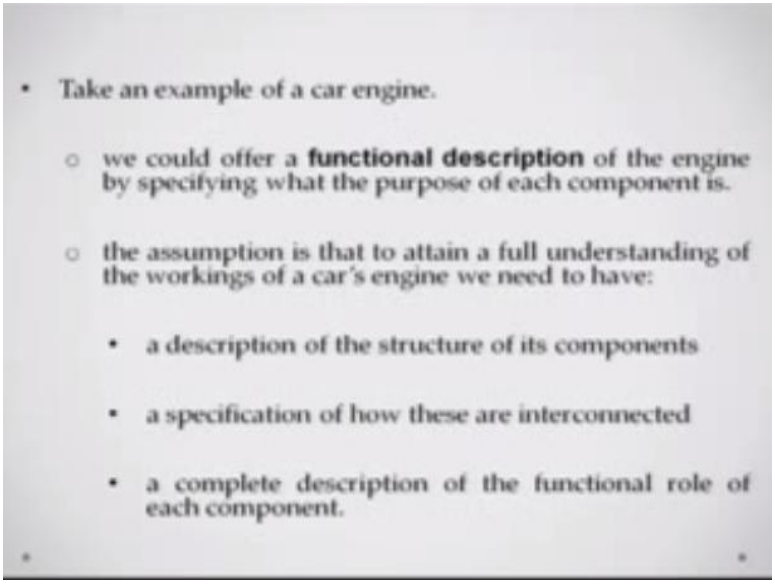

So when do we talk about function, let us say when we want to have functional description of something so if you want to have functional description of let us say car's engine what we really want, if we want to full understanding of what a car's engine does you would want to know the structure of its components, you would want to know how these are connected and you want to also know what rules each of these components are playing.

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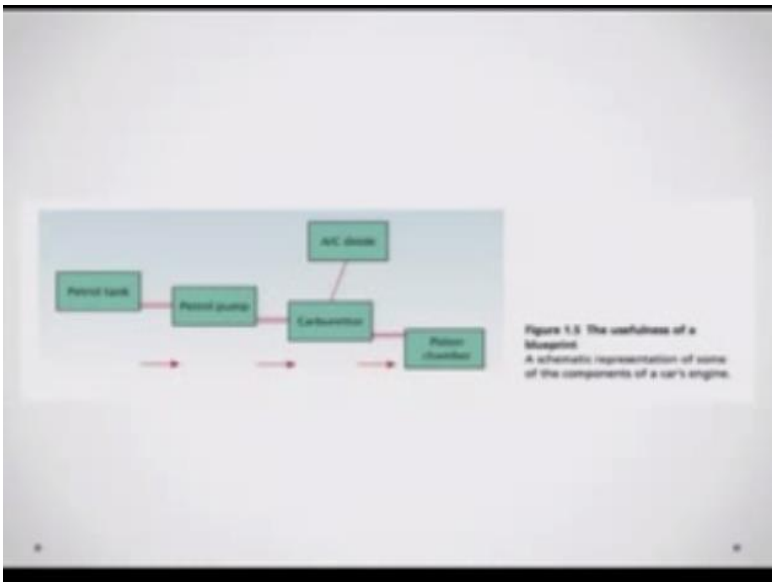

This right here is pretty much what is the functional description of the car's engine. So there is a petrol tank leads it is connected with the petrol pump, and the carburettor, and the plastron chamber which is connected in AC diode. But you do not find this explanation complete unless you know what each of these thinks does what is the function of the petrol tank, what is the function of the petrol pump, what is the function of the carburettor, unless you understand those things you will not understand what basically a car engine does.

Pretty much it is too for the human brain as you might know the structure but you need to know the functions more importantly.

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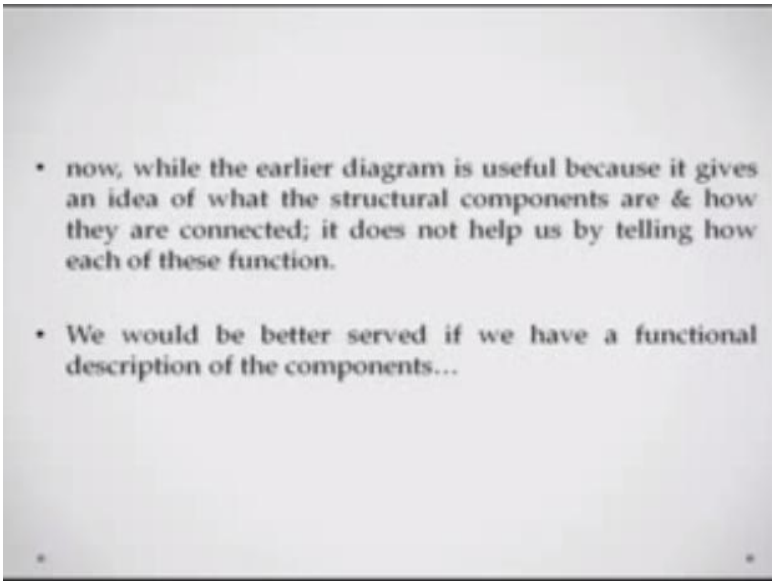

So that is why it helps to have a functional description of the account. That is what we will actually really further your understanding. Traditionally such a design eventuates in something which is called a schematic diagram which we just saw. Such a diagram specifies each components and shows how each component is connected with other components also such a diagram reveals the flow of control between various components, what is link to what in order what is the hierarchy.

Let us say what does the brain control your limbs or the limbs control your brain. Those kind of questions can be asked.

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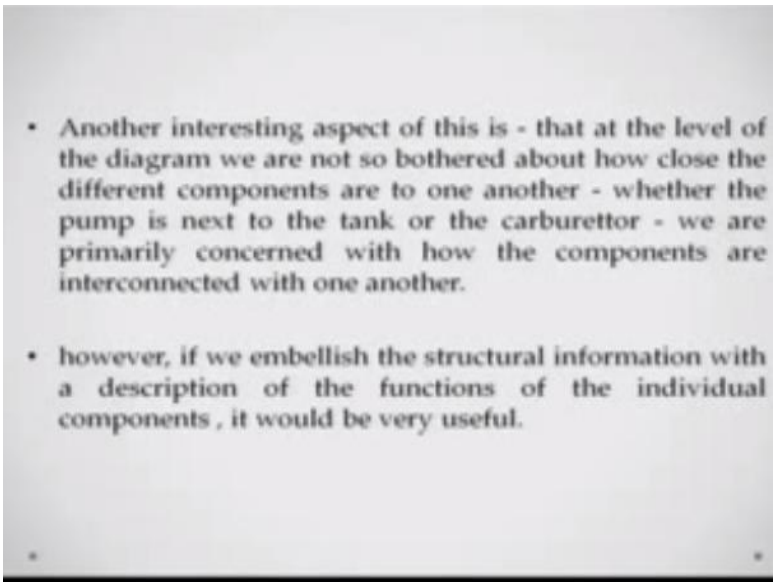

Another interesting aspect of this concept of functions is that at the level of the diagram we are not so bothered about how close the different concepts are to, whether the pump is next to the tank or the carburettor we just want to see how they are connected. However, if we embellish the structural information with the description of the functions of the individual then the diagram becomes much more useful for us for understanding the car engine.

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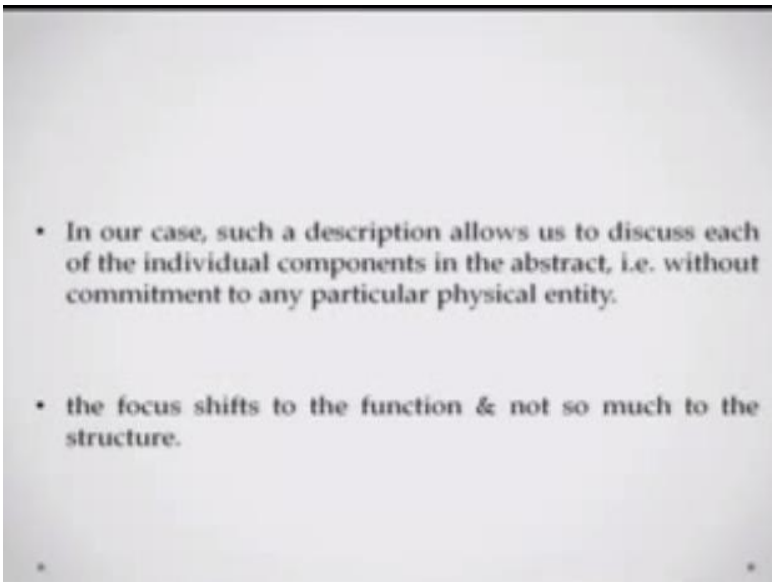

In our case, such a description will allow as to discuss each of the individual components in the abstract without committing to the physical entity. So we can say there is a petrol engine which does this there is carburettor which does that. And all explanation could be purely functional explanation. There is pretty much what we attempt for the brain whiles you talking about the cognitive psychology part. The focus basically shifts to the function and not so much to the structure.

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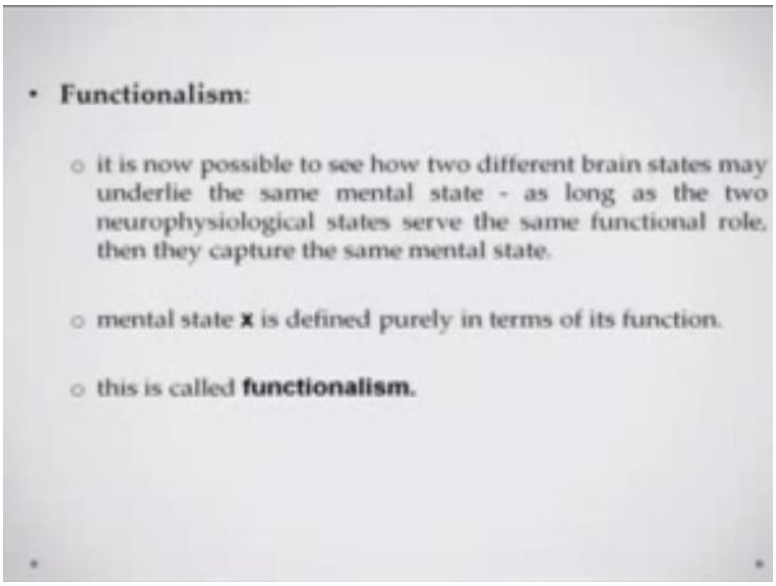

This stream of thought in cognitive psychology is what is called functionalism. It is now possible to see that how two different brain states underlying the same mental state. Because it concern about functions of those states, which basically is to lead to particular mental states. So as long as is two neurophysiologic states serve the same functional role then they can obviously capture the same mental state.

So mental state x can then we defined purely in terms of its function. This basically is what the crux of functionalism is.

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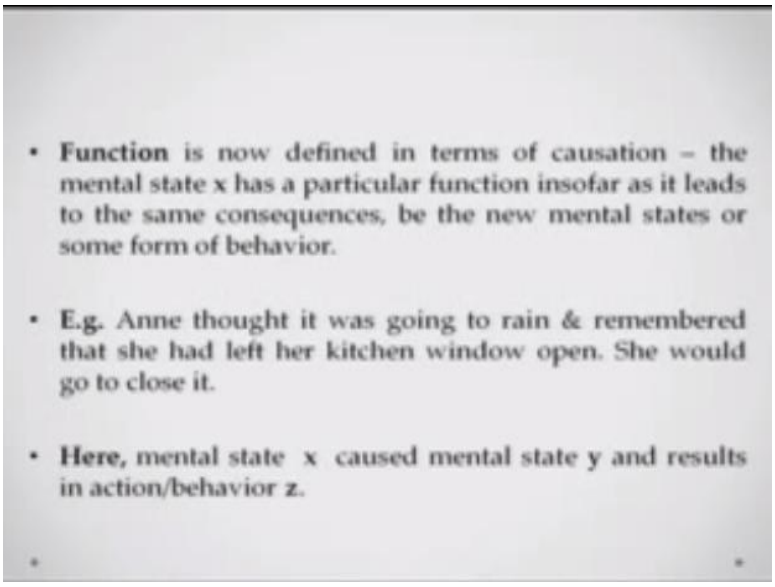

Function is then defined in terms of Causation. What leads towards, so mental state x has a particular function in so far it leads to the same consequences, be the new mental states or the same form of behaviour. So mental state x could lead to new mental states or it could lead to some particular form of this. So you feel happy leads you to eat an ice cream something like that.

For example, Anne thought it was going to rain and remember that she had left her kitchen window open. She had to go in and close it. So here the mental state of thinking about rain leads to the mental state of remembering that she had left her kitchen open and it leads to the physical behaviour of action Z.

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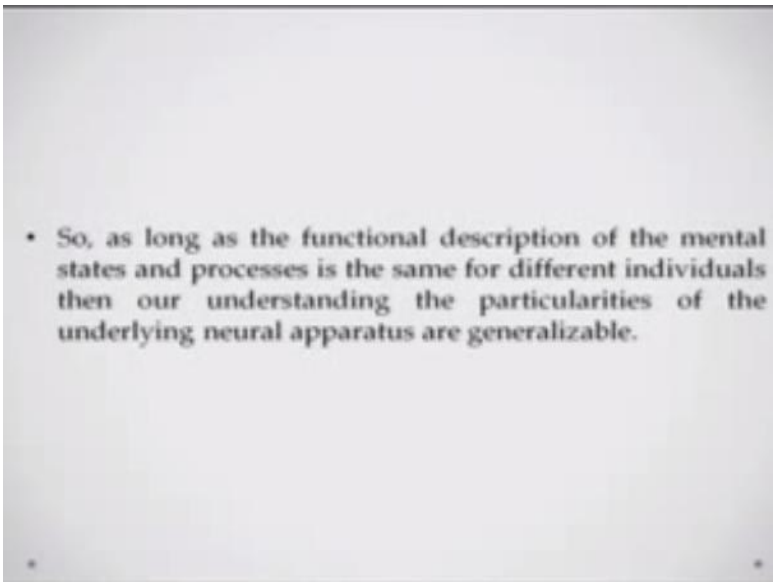

So as long as the functional description of the mental states and processes is the same for definite individual then our understanding of the particularities of the underlying neural operators will be generalizable. So as long as we know that function of this area is this and the function of this particular brain is that to that extend we will be successfully able to explain or give theoretical models or theoretical explanation of particular kinds of human behaviour.

So somebody has higher memory, somebody has lower memory and that can lead to somebody remembering more information and somebody remembering less information. Remember in this explanation I am not really talking about somebody having more brain cells or more neurons or less neurons, or better connected neurons or less connected, I am not really referring to that at all.

I am just talking about memory, see the entire description then it just rested on something which is rather abstract. This is pretty much what we doing cognitivist psychology.

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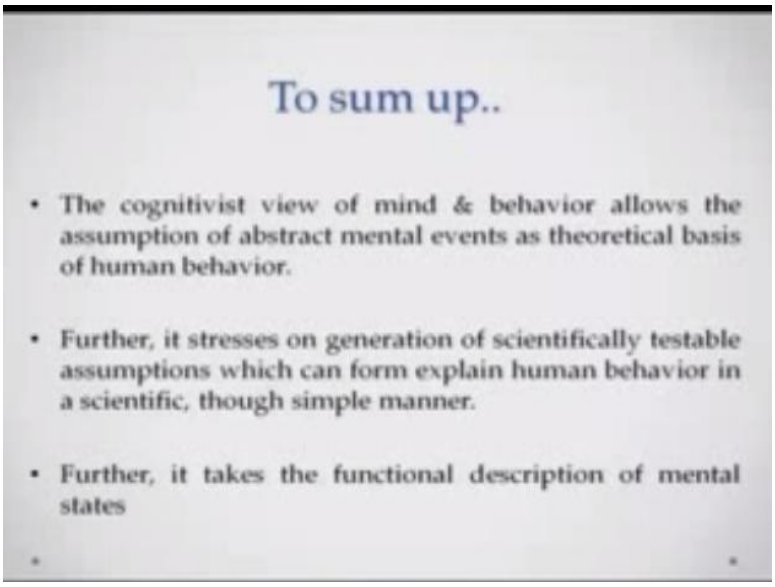

So to sum up the cognitivist view of mind and behaviour basically allows the assumption of abstract entities as theoretical basis of human behaviour. So you assume these abstract mental entities, mental functions and you use these abstract mental entities to actually talk about human behaviour. Also it stresses also this cognitive view point basically stresses on the generation of scientifically testable assumptions.

Whichever assumptions you generate should be scientifically testable that is how it will remain the frame work of cognitive psychology. And this basically need to used to explain human behaviour in a simple and testable scientific manner. It is not really as deterministic as the behaviour, but it still does not good job of being tested or being falsified and then being excepted or rejected.

Further it also called for a functional description rather there is a material description of human behaviour. Now this is this last point is the most important point which you would like to mind when we are talking about cognitive psychology when we are talking about different mental functions in cognitive psychology, more of them we are not actually only talking about the function aspects.

We are not really talking about you the neural aspects, we do talk about the neural aspects to some detail, you in every cognitive psychology paper there is a reference to this, this, this

happens and this happens because of this, this is activating the human way. So this is something which you would to keep in mind. So here I will close the lecture for today, and we will talk about another aspects of another assumptions in cognitive psychology in the next class, Thank you.

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