Contemporary Issues in Philosophy of Mind and Cognition

Prof. Ranjan K. Panda

Prof. Rajakishore Nath

Department of Humanities and Social Science

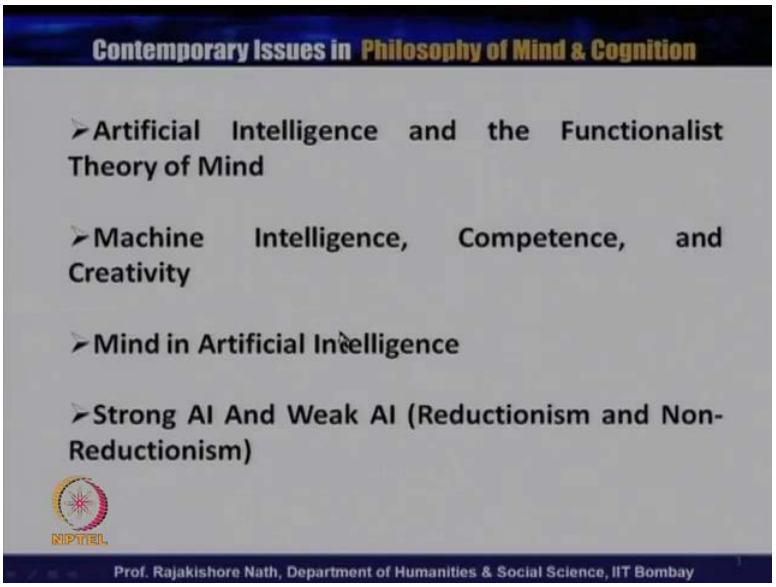
Indian Institute of Technology, Bombay

Lecture No. # 21

Artificial Intelligence - III

Hello everybody.

(Refer Slide Time: 00:29)



Today I am going to discuss about Artificial Intelligence and the functionalist theory of mind, machine intelligence, competence and creativity, mind in artificial intelligence, strong artificial intelligence and weak artificial intelligence, strong AI is reductionism and weak AI is non-reductionism. Let us see first, what is the relationship between artificial intelligence and the functionality theory of mind although; I have already explained the concept of artificial intelligence, and the functionalist theory of mind. But, here I will be drawing or discussing some of the main issues or the relationship between artificial intelligence, and the functionalist theory of mind.

Although they are going to whether or not, that I have going to discuss here, as you know that functionalism arrows, as a result of the phenomenon guides of interest in computing

machines, and artificial intelligence. All the functionalist says that, the mental processes are computational processes realized in a machine; functionalism is a theory that explains mental phenomena in terms of the external input, and observable output, it explains the mind as a machine.

This I have already explained in the lectures on functionalism, but here we have to see, how this functionalist model of mind is very much related to the AI model of mind. Let us see first, the functionalism and how it explained the concept of mind, functionalism as a theory of mind is supported by various scientific theories, like those of artificial intelligence, cognitive science and neuroscience, when you cognite fills cognitive psychology and many other thesis, which are related to mechanistic model of mind.

But, artificial intelligence advocates a computational theory of mind, which argues in favour of the functional similarity between the computations state of the artificial system, and neuro-physiological state of the brain. The hypothesis of artificial intelligence that machine can think, became will a very popular after turings article on computing machinery and intelligence; and this turing hypothesis, I have already explained extensively, while I was explaining the concept of AI. But, here I will be introducing some of the things how this turing during thesis also a part of the functionalist model or mind.

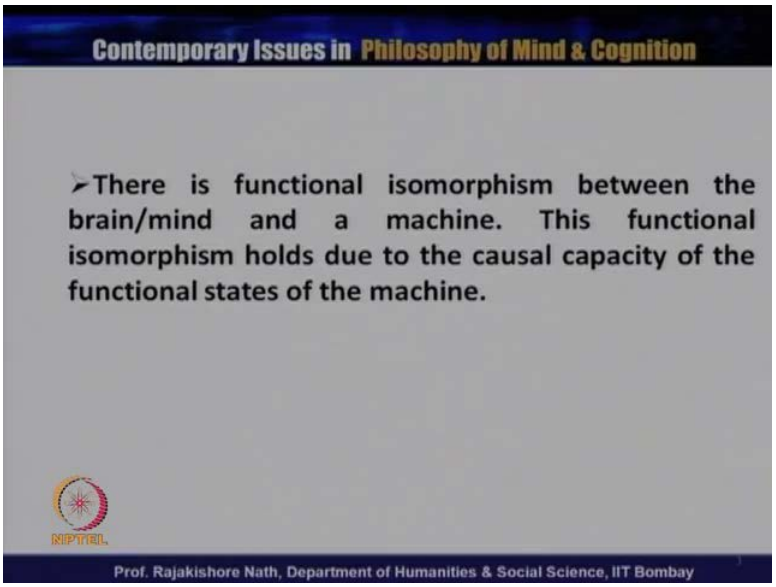
Because, turing thesis hypothesis that machines thinks intelligently like a human beings, but as we know that, Patnem is one of the thinkers or one of the propaganda of AI model of mind, as well as functionalist thesis of mind. For him probabilistic automation has been generalized to allow for sensory inputs; and motor outputs, that is the machine troubles specifies. For every possible combination of state, and a complete state of sensory inputs and instruction, this determines the probability of the next state, and also probabilities of the motor output.

There are some steps, which explain how a machine functions in general, whenever the AI scientist or even if a functionalist model of mind is explaining mind; there say talking about different states of the functions different states. Even if any functions, any kind of system, there are three states; input states, output states and hidden states are there. And we give some inputs and hidden units there and output sets; you can see, if the output states, you can see even if the input states, but you cannot see the hidden units. But, in

any case of any kind of all the states, its function is to follow some kind of procedure, and that the sequence of states, and that is your unkind of procedure. In that sequence of states, there has decisive of rules are there that you have to follow, some kind of rules. And that is rational of their entire procedure, the computing machine therefore, is a system constructed out of different sub systems that functions inside it to processes the inputs to hand the, hand to produce the output, once the input is simulated in the machine.

It tries to match the simulating state with the states already computed and mapped in the system, this mapping order follows certain syntax or rules; the syntax is responsible for the corollas of the total cognitive states, thus the entire process of stimulation can be called an intelligent process. This stimulation processes take place between the function of the two functional isomorphism system, this already I have explained, while I was explaining the different models of cognitions from the cognitive science prospective; and this model has been proposed by Hillary Patnem.

(Refer Slide Time: 05:57)

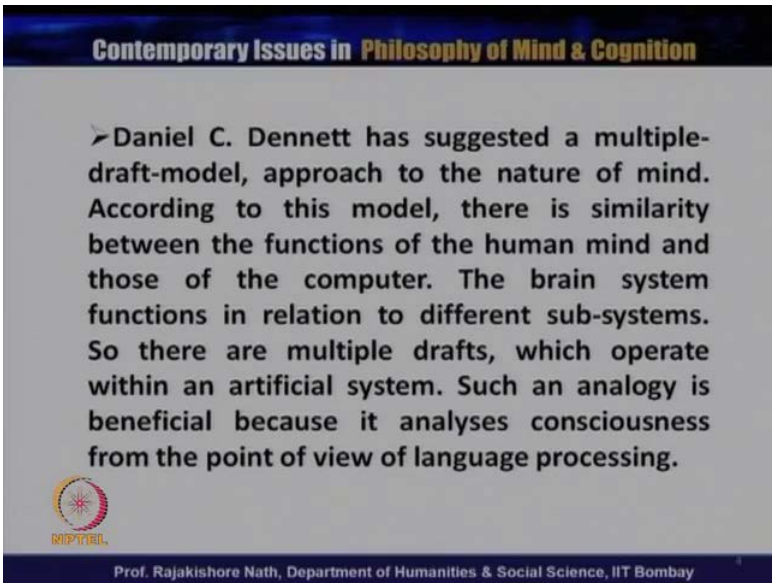


This model says that there is functional isomorphism according to Patnem, between the brain, mind and a machine; this functional isomorphism due to the casual capacity of the functional state of the machine. For example, when I have a pain, there is a neuro-physiological process corresponding to the mental state, because of the firing of the C fiber, the brain-mind the brain-mind, already follows as there is a functional identity

between the two, even if there is a earlier, we were talking about there is a identity between brain and body, brain and mind. Then now, we are talking about identity between mind and machines, and this kind of identity is there according to functionalistic model of mind.

But, identity between the mental states and the physical processes of the brain is established from the functional point of view; that is in the function terms, the brain strategy isomorphism in the mental state. There is an identity between software that constitute, the program and the hardware of the machines; which helps the software to be realized in the machines.

(Refer Slide Time: 07:14)



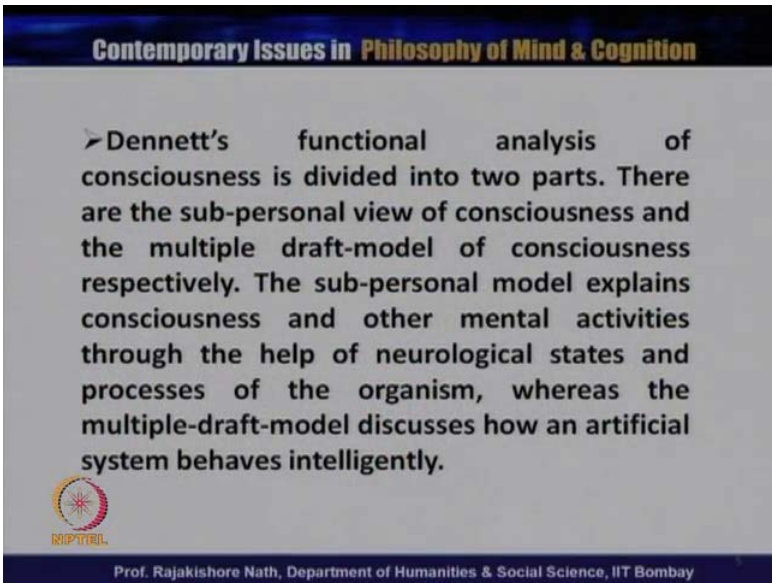
And but, if you see in the case of Daniel C. Dennett has suggested that, a multiple draft model approach to the nature of mind, and which is one of the functionalist model of the mind also; and this is the model says that there is a similarity between the function of the human mind, and those of the computer. The brain system functions in relation to different sub systems. So, there are multiple drafts, which operate within an artificial system. Such an analogy is beneficial, because it analyses consciousness from the point of view of language processing.

This is a given important processing in the sense that, a linguistic or a language speaking bin is considered not only as a conscious bin, but also a rational bin. Even the robot as a information processing systems, can also be characterized as intelligence systems by

Dennett, but Dennett says that we are also like machines, we human being are like machines. We are just very very complicated evolved machines, made up organized molecules instead of metal and silicon, and we are conscious; so there can be conscious machines like us, and the word Dennett is arguing that there is no distinction between mind and machines.

Therefore, all the mental activities can be explainable in terms of machines. So, the human thought processes and the language processing, in the artificial systems are analogous to each other; in the case of conscious thought process, we are aware of our thoughts, at the same time there is a hypo-chemical process, which goes on in our brain.

(Refer Slide Time: 09:02)



But, Dennett's functional analysis of consciousness is divided into two parts; there are the sub-personal view of consciousness, and the multiple model of consciousness respectively. Because, in the case of the sub-personal model explains consciousness and the other activities, through the help of neurological states, and processes of an organism, whereas the multiple-model discusses, how an artificial system behaves intelligently.

Therefore, Dennett provides or he is providing a functional explanation of consciousness, at the sub-personal level. But, in this sub-personal level of explanation of consciousness, tries to explain not only how the human beings how the human beings are system of organism, but also how the system is being constituted, and how the various functions involved in different physiological parts of the organism, functions together. And that

functional structure would help us in defining the capacity involved in causing consciousness or according to Dennett; he says that what we call as consciousness behavior.

A state of consciousness is simply, one which exhibits a certain characteristic patterns of causal relationship to the other states, both and to the other states; and those are the states are both mental and physical. We know that human beings perform various activities, there are languages acquire various knowledge states, belief states and there are changes in their belief states and shown many kind of belief state are there in the case of human mind.

And according to Dennett, for many thinkers all these activities are very much independent of the biological activities of human life. Dennett anticipates that, there would be a system whose program should be such that, it would be self-dependent in all its functions, that would be able to replace or stand parallel to human intelligence. Again even if in a kind of functional system, which helps in explaining the various mysterious feature that that are ascribed to the human life, as I have already explained in the concept of artificial intelligence model of mind.

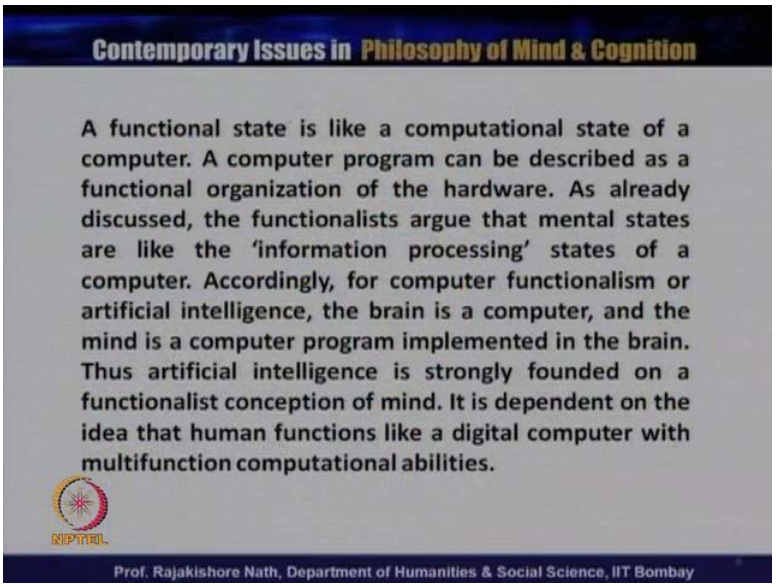
The main aim of artificial intelligence is not only to develop different kinds of program, to help our day to day life, but also to help in understanding the human mind. Therefore, the strong notion of functionalism advocate the identity between the mental state and the brain processes, it also explains and define, basic features of the human beings such as consciousness, intentionality, subjectivity and many other mental activities, which you can ascribe to only mind or to a conscious object; and which belongs to the self not to any other being.

And by bringing these features, the functional isomorphism in to account according to functionalistic model, this can also be brought into a isomorphism account. And this functionalistic model holds that, the mental states are abstract functional states, characterized slowly in terms of their causal relationship to each other, to input and to output. Human propulsive, behavior is then explained in terms of how this hypostasized system of states take the organism from sensor inputs to behavior outputs, because functionalistic insist upon a network of mental states. It insists upon the holism of the

mental upon the way, in which mental states operate to explain behavior, and it accepts structure of mental state, in which each is necessarily connected with the other.

The mental states do not function in isolation, rather the functions within the causal co-relationship with other mental sates, the function of mental states also takes into account the effects of the environment, in which the subject or agent is placed with the system that must be well occupied to receive the inputs from the environment, and to produce output. The functionalist program has been strongly influenced by analogies drawn from computer science, and artificial intelligence; both in its inner and outer look, and several of its specific applications to problem about the nature of mind.

(Refer Slide Time: 14:18)



Because, functional states like a computational state of a computer, a computer program can be described as a functional organism of the hardware. As already discussed, the functionalists argue that mental states are like, the informational processing state of a computer, according for functionalism or artificial intelligence. The brain is a computer, and the mind is the computer program implemented in the brain, thus artificial intelligence is strong founded on the functionalistic conception of mind; it dependent on the idea that, humans function like a digital computer with multifunctions computational abilities.

Therefore, in this way this functionalist model of mind is very much related to the artificial intelligence model of mind. (Refer Slide Time: 15:12) Now, we have to see

machine intelligence, competence and creativity. Although there is something called machine intelligence or a machine competency and machine creativity, can we say a machine is a creative or that a machine is something which can do better activity than human beings? But, the way of computer science or artificial intelligence doing the activities in the day to day life, which is 1000 better than any human beings.

Then the question is can we ascribe competence, creativity to machines as discussed, machine intelligence or artificial intelligence is a symbol system, is a physical symbol system, which has the necessary sufficient means for general intelligent actions. The above statement shows that, machine intelligence has the capacity of competence and creativity. However, the system that exhibits the general intelligence will prove up on analysis to be a physical symbol system. The physical symbol system of, any kind of physical symbol system has a sufficient size can be organized further to exhibit this general intelligence actions, the general intelligence actions, the same scope of intelligence as we have seen in the human actions.

Therefore, the symbol system in hypostasis implies that, the intelligence will be realized by a universal computer; it also asserts that the intelligence machine is a symbol system, when machine acquired enough memory to make it practicable to locate actual symbol system with the help of the programs, that produce intelligent behavior and solves many problems. Many machine intelligence scientists, use computers as tools to help them create things, they could not have created.

For example, many scientist use sounds, which no orchestra can produce, a visual artists may get ideas from a computer graphics, we are concerned those programs, which produce aesthetically interesting creations. There are number of programs, which explore artistically interesting spaces and a few, which produce aesthetically acceptable results, Borden is one of the most important philosopher, in area of philosophy of mind and Borden has given one kind one kind of famous example, and he has given the example of toning which is written by Harold Cohen.

And Cohen has written a series of programs, which produce pleasing and unpredictable line drawings, Cohen's programs explore a certain style of line, drawing a certain subject matter. As human artists have to know about the things that depicting, so each of Cohen's program need an internal mode of its subject matter, this model is not a physical

object, it is a state of abstract rules, which specify not only the anatomy of the human body, but also how the various body parts appear from a point of view. The machine intelligence programs that write stories are overfull inadequate compared with the human storytelling, but the best of them get vast strength the produces from their internal models of the general aspects of motivation.

For example, a program has to write a story with the moral, never trust flatterer, in this story there are two characters, one is a fox and crow. The story follows like this, once upon a time there was a dishonest fox named Henry, who lived in a cave and a Ben and thrusting crow named Jo, who lived in a tree; Jo had gotten a piece of cheese, and he was holding it in his mouth. One day as Henry walked from his cave across the meadow to the trees, he saw Jo crow and the cheese had become hungry, he decide that he might get the cheese, if Jo crow spoke. So, he told Jo that he liked his singing very much and wanted to hear him that song, Jo was very pleased with Henry and began to sing, the cheese fell out of his mouth down to the ground.

Henry picked up the cheese and told Jo crow that he was stupid, Jo was angry and did not trust Henry anymore, Henry return to his cave, and the story end. And here, there is a kind of trust not there in the case of Jo and Henry, but this kind of story program can construct hierarchical plans, ascribe them to the individual characters and according to the sort of motivations, one would expect them to have; it can deep one character of role in another plans.

But, These roles need not be elected randomly, but can depend on background, interpersonal relations and it can represent different sort of communications between the characters, which constrain what follows in different ways; all these matters are represented as abstract schemata, which are used to produce the story structure. Thus the ever programs shows that, machines have the capacity to produce creativity. Now, the question may be raised as either program have scientific discovery, programs design can find simple mathematical, and classificatory relations as rediscovered with the help of physical and chemical loss.

And net talk is another famous and important of machine creativity and competency also, as you know this net talk or this model’s goal is successful to negotiate the problem domain of text to speech transformations. Net talk took 7 letter segments of text as inputs

and mapped the target window of the data input, and to an output which coded for phonemes, a connectionist system is not trained but programmed. Let us raise questions, what does net talk know, according to Clark, net talk does not, in any sense understand what it is saying, but this is not the point.

Likewise, I might learn roughly how to pronounce science sequences without understanding them nevertheless, net talk has gone from bubble to an output, which is law fully disciplined with respect to its input; that strongly suggests that it has learnt something. The question is that, the automatic mathematics is a system that does not produce force nor produce mathematical programs, rather it generates and explains mathematical ideas, artificial machines starts with very primitive and artificial intelligence.

Mathematical concept draws from a set theory including sets, least, equality and operations, these concepts are so basic that, they do not even include the ideas of eliminating arithmetic. To begin with the program does not know what an integer is, still less additions, subtractions, multiplications and division. Therefore, artificial machines answers like human answers are sometimes wrong nevertheless, it has come up with some extremely powerful notions; it produces many arithmetical concepts including integer, square root, addition and multiplications.

It generate the fundamental theorem of number theory though did not prove, it suggest that interesting ideas that, every even number greater than two is the sum of two different primes. It has originated one major theorem of which no one had ever thought of before, here artificial machines appears to be p creativity or psychological creativity or psychological creative. According to Borden, there are two sense of creativity one is psychological creativity or p creativity, and the other is historical creativity or h creativity; these p creativity and h creativity I will be explaining in the next lectures.

Now, let us see, how p creativity and h creativity is related to machine creativity, and idea is that p creative if the person, and idea is p creative, if the person in whose mind it arose could not have added before; it does not matter how many times are that people have already had the same idea. On the other hand, an idea is h creativity, if it is p creative and no one else has ever had it before, those artificial machines, creativity is p creative or psychological creative. And another example, in the case of copycat program,

which can generate many different analogies, where contextually appropriate comparisons are favored over inappropriate ones; it does not rely on readymade text differentiation, but constantly its one differentiation in a context and (()), it is a new analogies and new perceptions double off together.

As we have seen, cognitive science tries to provide computational models of the mind that is computational simulation of human cognitive process. If creativity is not a computational process, it might still be possible to simulate it computationally, just as it is possible to simulate, the digestive processes without simulations itself being a digestive processes. It might be possible to have the machine models of human creative processes, even if machine themselves cannot be creative, but there are many scientists, even if many philosophers, they said that machines cannot be creative, because there is a significant sense only which they cannot be intelligent.

And because, if the machines have their, if you say that machine have, mind machine can do creativity, then we can say machines have minds of their own. And can we ascribe this kind of concept machine creativity; there are many kinds of limitations which limit machine creativity, machine competency and machine intelligence, and those things I will be explaining in the next lectures.

And now, we have to see the place of mind in artificial intelligence, as you have seen that functionalist model of mind and AI model of mind, a mind in AI explores the state of mind in artificial intelligence, as you know that, the main aim of artificial intelligence is to reproduce mentality in machines. That it is to say that, artificial intelligence aims at producing machines with minds. If we say that machines have minds, then we have to ascribe certain beliefs, knowledge, revel, intentions, observations etcetera to machines.

In that case, machines will perform intelligent acts, and that will behave like human beings. You may raise a questions now, why should we want ascribe mental qualities to machines at all, but there are AI scientists, they are said that there are many reasons to ascribing belief, and other mental qualities to machines. We may know a program, but it states at that given movement, it is not directly observable; and we can explain performance of a machine only by ascribing belief and goals to it. Ascribing belief may allow to derivation of a general statement about the machines behavior, that could not be obtained from any finite number of simulations. The difference between this program

and another actual hypothetical program may best be expressed as a difference in belief structures. But, according to Hoagland, thought itself is not static and random, it develops in which that obey different rules and inferences, Hoagland says that since correct applications of the rules of region to particular thoughts, depends on what those thoughts had mean.

It seems that, this must be some active rules applier, which understand the thoughts, everyone understand the rules also, and which apply the rules to the thoughts as well as it can. If the activity of this rules appliers, following the rules of region is to explain the rationality of our thought processes and then it must be regarded as, a complete little person or Homunculus in Latin, which is sitting inside the head.

And like same way, according to Hoagland, that is you that is you will say campanulas, which is exiting in the human mind, and this little computer is there, as you know that, cognitive scientist can be materialist and mentalist. At the same time, they are materialist, because they support the view that the mind is a complicated machines or matter, on the other hand, some support that mind exists along with body and mind is not dependent from the body and mind is identical with the body; there is some of them are supporting. They can offer explanations in terms of meaning and role calling without (()) and unexplained homunculus.

It would be peculiar to start assigning geometrical shapes and locations to the internal program routines and operations of the systems, these same decisions clearly cause physical behavior, yet no one is ready up that the laws physics are being modulated. But, Hoagland says that, while the machine plays, it follows rules in at least two senses, it always abides by the rules of the game and it employs various reasonable rules of thumbs to select plausible rules. Though these rules are in a way laws of nature, the machine's behavior is explained by sighting themselves, yet no one explained (()) is presupposed, like the there is no one explained homunculus is there.

Thus these explains will necessarily invoke the systems internal reasoning processes, yet it is far from easy to figure out processes, that will consistently lead to the observed behavioral observed behavioral response. Then it rightly says that, human mind is a semantic engine, that is to say that the way human mind handles the meaning of words or sentences, in the same way a machine handles the literal meaning of a word or sentences.

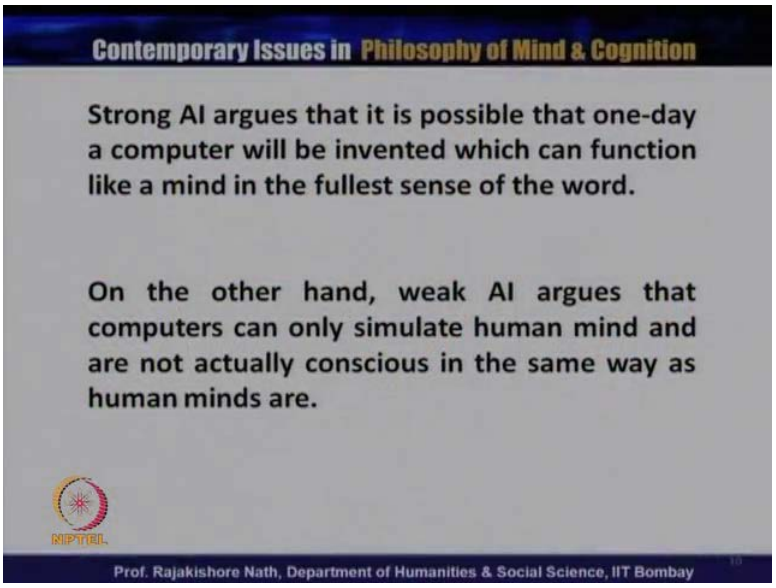
Dennett's view, which we have already seen in the functionalistic model of mind, but he said that human mind is a machine like ordinary machines, because both mind and machine has the same quality, the difference is only apparent. Therefore, this kind of analogy shows that, the place of mind in artificial intelligence is completely mechanistic place or mechanistic explanation. Let us see, the next last session or next successive in this lecture on strong artificial intelligence, which is completely leads a reductionism and weak AI, which is a non-reductionism.

In this section, I am going to discuss about strong artificial intelligence and weak artificial intelligence, strong artificial intelligence leads to reductionism and weak AI leads to non-reductionism, as you have seen that, main thesis of AI is that human brain behaves like digital computer, and the human mind is just a computer program. It tries to prove that the relationship between the programs and the computer hardware is like the relationship between, mind and brain.

Some supporter of artificial intelligence argues that, we have every reason to believe that computers have intelligence, at the same time some others argue that the computers intelligence is limited, where human intelligence have no limit. Now a days, computers have achieved some model structures in proving theorems, guiding missiles, sending mails, deriving assembles; and many kind of kids like robotics, diagnosing illness, predicting about weather and economic events, and many other events and activities.

Computer receives, interprets, processes, stores, manipulates and uses information, thus intelligent behavior is programmed into the computers on the contrary, we have no idea how the brain functions, but we have an idea of the general relation between brain processes and mental processes. Mental processes are cored by the brain activities, which are function of the elements consisting the brain.

(Refer Slide Time: 35:01)



Strong AI argues that it is possible that one day; a computer will be invented, which can function like a mind in the fullest sense of the word. In the other words, it can think region, imagine and do all the things that will correctly associate with the human minds. On the other hand, weak AI argues that, computers can only simulate human mind, and not actually conscious as same way as human minds are.

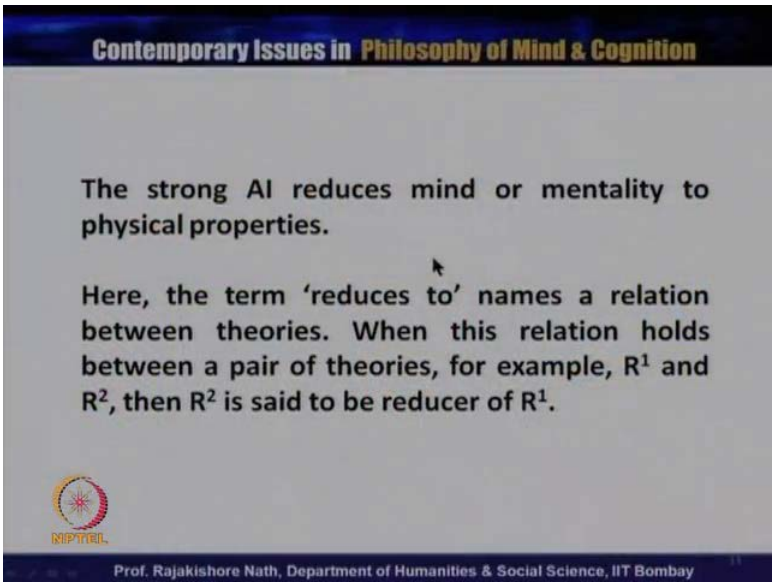
According to weak artificial intelligence, computers having artificial intelligence are very powerful instruments in law hands of man, whereas strong artificial intelligence holds that computer is not merely an instrument in the study of the mind but, that the appropriate reprogram of computer is really mind in the sense, that computers can think and do listening like the human beings.

In strong AI, the programmed computer has cognitive states, so the programs are not only simply tools that allow or to test psychological expansions rather this programs are themselves the explanation of the mind. Strong AI, according to Shawl, basically claims that the appropriate reprogram computer literally has cognitive states. And programs by explaining human cognitions and this is the view of strong AI according to John Shawl. And John Shawl is one of the philosopher and he has drawn the distinction between mind and machines and he has shown the importance of the mind especially in the science room argument, which I will be discussing in the further lecture.

But, as we know, the main aim of artificial intelligence is to provide mentality in computational machines. And it tries to prove that functions of machine as similar to the function of the human mind but, the question is, could a machine have mental stress for artificial intelligence? There is nothing essential biological about the human mind. Because, the brain just offers to be one of the indefinitely large numbers of different kinds of hardware computers that could sustain the programs, which is made of human intelligence. On this view, any physical symbol system may be whatever that had the right program, right inputs would get the right output.

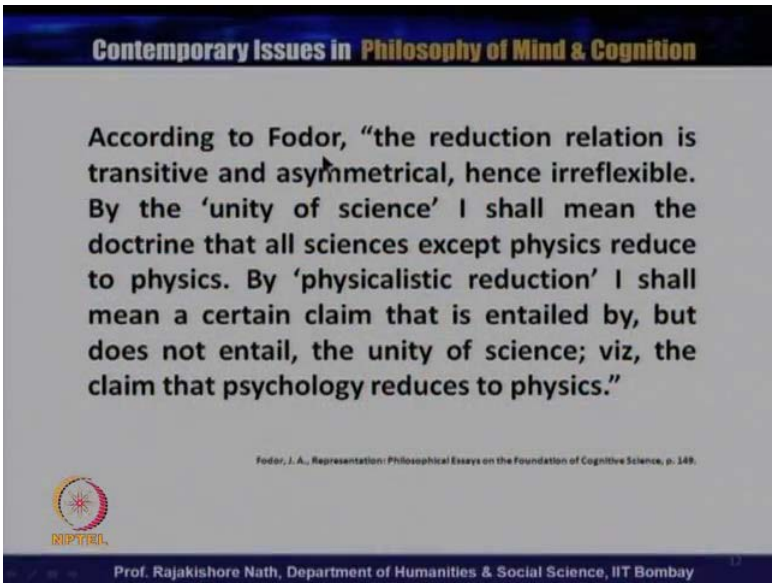
And that right output is exactly in the, what the mind you mean arrive in it, I mean on what you mind and I have minds also. But, this physical symbol system has the right program, which right inputs and that can give right output exactly which our human mind is doing; this is the view of cognitive scientist. And they believe that perhaps they can design the appropriate hardware and program artificial brains and minds that are comparable to human brain and mind, this is called strong artificial intelligence, and this strong artificial intelligence is a kind of reductionist thesis.

(Refer Slide Time: 38:43)



Because, strong AI reduces mind or mentality to physical properties, here the term reduces to names a relation between theories, when this relation holds between a pair of theories for example, R 1 and R2, R 1 is said to be reducer of R 1.

(Refer Slide Time: 39:11)



If we see in a case of Fodor's experience of reductions that will be very clear about the reductionist thesis of strong AI. Fodor says that reduction relation is transitive and asymmetrical, hence ire-flexible, by the unity of science; I shall mean the doctrine that all sciences except physics reduce to physics, by physicalistic reduction I shall mean a certain claim that is entailed by, but does not entail the unity of science. Therefore, the claim that psychology reduces to physics.

And this kind of reducibility involves a good deal more than a ontological claim that thinks that, satisfies in the vocabulary R 1 also satisfies this issues in the vocabulary of R 2. This condition is stronger than the ontological requirement that, whatever falls on the general AI relation of R 1 should also fall under the theories of R 2. On this view, there is an important sense in which syntax is preserved on the theory of science; that is to say that reduction permits as to re-describe the event in the vocabulary of R 2.

Therefore, according to strong artificial intelligence, mental states reduce to the computational state of the same. On the other hand, weak AI is a non-reductionist, because this theory is not reducing the human mind in terms of machines, but it can only simulate human mind and this does not mean exact replications, the above statement shows that weak artificial intelligence is non-reductionist.

For the physicalist, life is higher order property, which emerges out of the physical properties having in the case of Jumbai world, there is an absence of consciousness, in

other words the logical possibility of a Jumbai world is considered as a world physically identical to our world, but conscious experience is impossible in this world. The Jumbai may be physiological or phenomenal Jumbai or psychological Jumbai, which are physically and functionally identical to human beings, but lack experiences and this is the view of David Chalmers.

And He said that, there is a logical possibility of the Jumbai's seems equally obvious to me a Jumbai's just something physical identical to me, but which has no conscious experience, all is that inside. The Jumbai and human mind have identical physical properties, but differ in high level properties that are consciousness. The Jumbai lack consciousness therefore, the high level property being conscious cannot be logical, supervenient on physical properties.

In the same way, according to weak artificial intelligence, mind and machines have some identical properties, but differ mainly on some higher qualities. Here weak artificial intelligence is non-reductionist, because unlike strong artificial intelligent, unlike because, it is strong artificial intelligence. Whereas, in the case of AI is non-reductionist and strong AI is reductionist, because strong AI is reducing the entire mental phenomenon in to a physical phenomenon. And now, I will conclude this lecture here, some of the limitations to all these functionalistic mechanistic AI model of mind, which I will be discussing in the due course of mind lectures, thank you very much.