Artificial Intelligence
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Module - 01
Lecture - 03
AI Introduction Philosophy

We are back. Having looked at the mechanical side of this history of AI, we want to now look at the philosophical side as you know; this notion of the mind. What is the notion of the mind? How did this notion of the mind ever come out? And how can we get it across to the machines, essentially?

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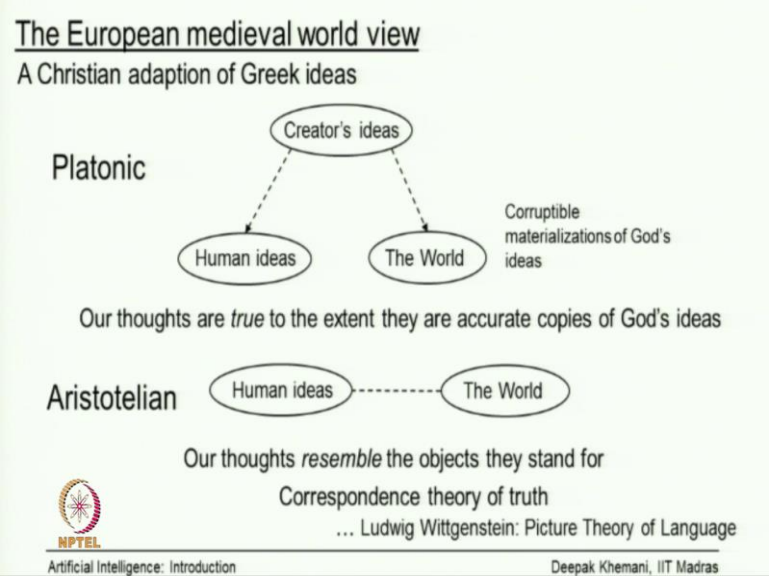

So, the medieval view, world view in Europe was basically, a Christian adaptation of Greek ideas, essentially. There was a big gap between the Greeks and medieval Europe, but the ideas that Greek started off with, eventually, ended up with medieval Europe. The view of the world was of course, that it was a very anthropocentric view of the world; humans were at the center of the universe, and everything revolved round the earth, essentially. We look at some of those ideas. What we are trying to see is how did human beings, as gentian beings, have come up with the notion of the mind? How would you even imagine that there is something called a mind? I mean, of course, you are there in

the world; you are immersed in the world, and you are interacting with the world. But how do you come to this conclusion that you have thoughts and ideas, which are in some sense, existing independently.

We start with the platonic view of the world; the idea of which came from Plato. He said that in the perfect world, there are this creator's ideas; the God's ideas. Our ideas, the humans' ideas are derived from God's ideas, and the world itself, is derived from God's ideas. So, it is a very platonic view of this whole world, and the world was corruptible materialization of God's ideas. You know, that is why things were not perfect in the world. Even though, God's ideas are perfect; the world is not perfect. Likewise, our thoughts are true to the extent that they are accurate copies of God's ideas; that was the first starting point; Plato.

When we move we move on to Aristotel, Aristotel derived the idea of the God and he said that the world is out there, and human ideas are human ideas, and they, in some way, correspond to the world, essentially. So, our thoughts resemble the objects at they stand for. If I am thinking of an apple, then my thought of an apple resembles the apple, essentially. This is known as the correspondence theory of truth, essentially, and one branch of philosophy, which was, it was taken up by Ludwig Wittgenstein, who in his early works, postulated something called the picture theory of languages; that behind every word, there is a picture; an image which is sitting out there, essentially. So, this is how the world as we saw it. The earth was flat at the center of the universe with the Gods, heavens, rotating around it essentially. The sensible world, the world at we could sense, was composed a five elements

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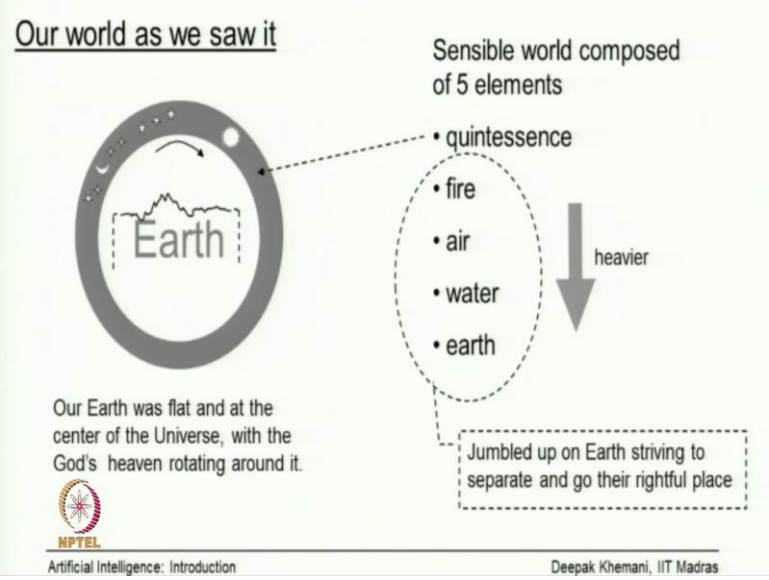

Quintessence, which was constant in the heavens, did not change; constant in that sense. Four are the elements, which are fire, air, water and earth; listed in decreasing order of weight, essentially. So, you can find similar ideas all over the world about, you know what are the basic elements of the world, essentially. So, if you ignore quintessence, which is there in the heavens; we have fire, earth, water and air. They are all jumbled up on the earth, trying to find or striving to find a rightful place; rightful place, meaning by order of weight, essentially. The earth should be the lowest, and then, there should be water, and then, air and then, fire. Different materials had different amounts of these four elements in them, and that is why, they behave differently. For example, wood had more water, and therefore, and some air, and therefore, it floated on water, essentially. Whereas, iron had more earth and therefore, it sank in water, essentially. So, they could explain why wood floated, whereas, iron sank and so on. If wood were to catch fire, then you know, it tries to escape into air. So, there are this kind of explanations about the world, essentially.

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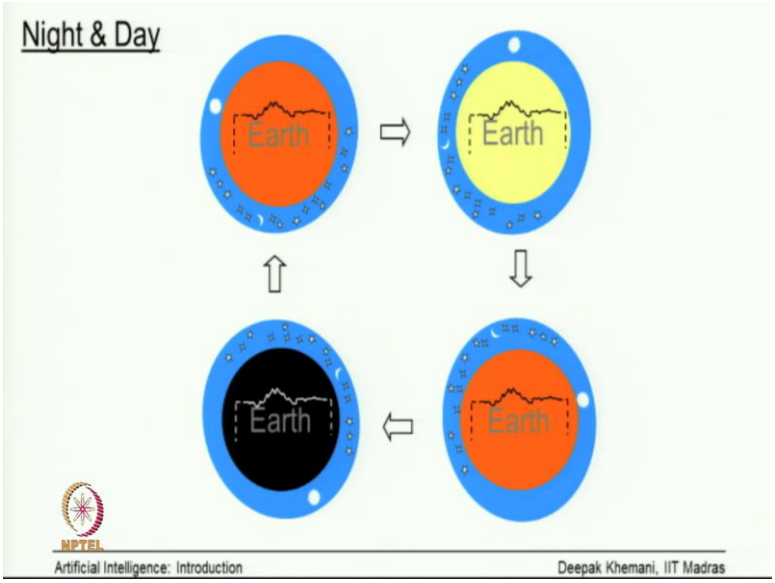

This is how; the color inside this circle is supposed to represent the color of the sky. So, you know, we have morning, day time, evening and night. As the sun; it depends upon the position of the sun; as the sun rotates, our day changes, essentially.

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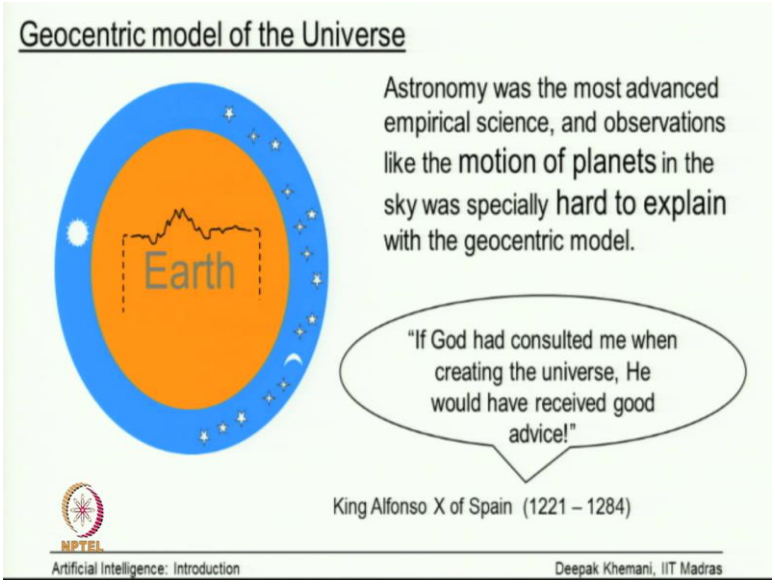

So, this is a small animation I created of what we thought about the world to be like. This

is how the world was; all the heavens were rotating around the earth, and the earth was the center of the universe, essentially. Now, in those days, astronomy was for many reasons, are very important science, and to very empirical science; but it was difficult to explain the motions of the planets. For those of you, who are interested in astronomy, you would know that the stars are always in the same position; the constellations that we see, Leo or Virgo or any of these. The constellations, they always appear in the same fixed pattern, throughout the year. It is only the planets, which you know, move from one constellation to another, and it was very difficult to explain; how they were operating, essentially.

King Alfonso of Spain in 13th century got so upset; that he said that if God had consulted me when creating the universe, he would have received a good advice. You know, why have this planets move around in erratic fashion, essentially. It is a quotation I have got from book; I should have mentioned it there.

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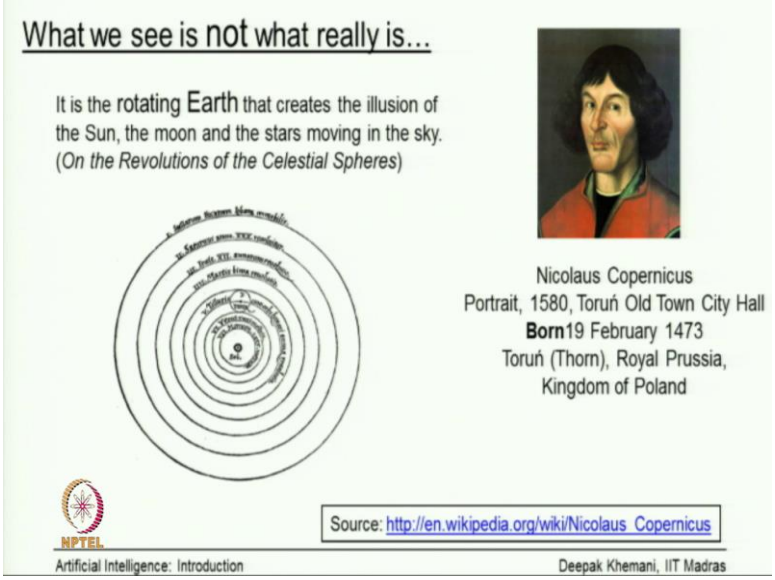

Then, along came Copernicus. So, this is the first, and this what (Refer Time: 07:15) says; the verge between thought and reality, the first verge between thought and reality was inserted by Copernicus, who says that what we see, is not what really is. So, up till now, remember, this picture theory, the truth, the motion of correspondence that our

thoughts are in the image of what we see around us, and that kind of a thing, that our thoughts reflect the world as it is. Copernicus was the first person, who came and you must be familiar with his book on the revolutions of the celestial spheres. He said that our Earth is not at the center of the universe. In fact, the earth revolves around the sun, and earth rotates, and creates the illusions of day and night, and that kind of stuff, essentially. The important thing from our point of view is that what we see, is not what really is out there, essentially; so, the verse as hogelensay between thought and reality.

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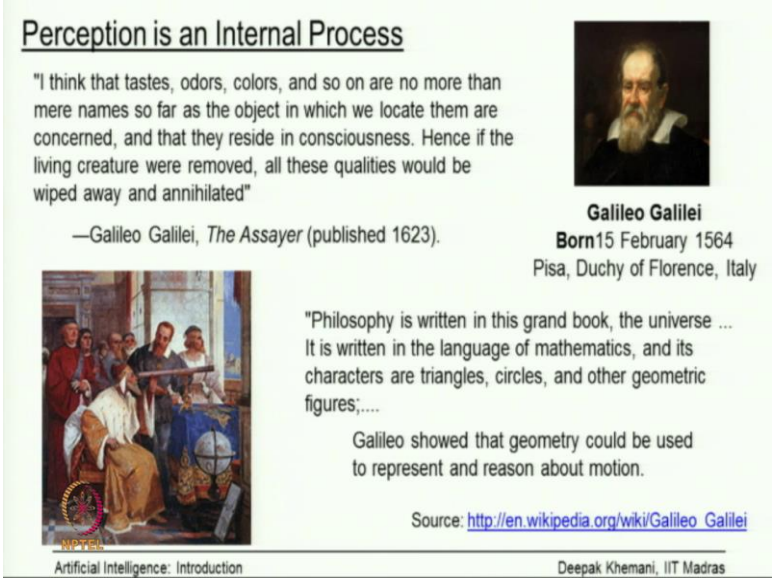

So, all these famous characters; you have encountered them in one way or the other. We know Galileo Galilei, because of the equations of motion, for example, we always attribute them to Galileo; v is equal to u plus a t, and you know, that kind of stuff. But Galileo made this very important observation. He said that perception is an internal process. He says, and this is quoted to him; I think that tastes, odors, colors, and so on, are no more than mere names, so far as the object in which, we locate them, are concerned. So, if you are smelling a rose and you feel that the rose smells nice, it is nothing to do; the notion of the smell of the rose is not located in the rose, but it is located in our minds.

So, he says tastes, odors, colors and so on, are no more than mere names, so far as the

object in which, we locate them, are concerned and that they reside in consciousness in our minds, in other words. He says that hence, if the living creature were removed that we as a perceivers of this tastes and smell and odors were removed, all these qualities would be wiped away, essentially; that this notion of taste and smell and color is something that we have in our heads; it is not the property of the object. So, he goes on to explain, for example, he imagines that the notion of smell actually, happens, because they are this particles, which are impinging upon the inside of our noses, which results in certain sensation, which we call as smells. It is very accurate as you can see, but Galileo said that in the 17th century that perception is an internal process, essentially. So, we are exploring this notion of thinking; how the notion of the mind evolves? So, all these are European history, because AI, as we know it, came out of European thought, essentially. Even though, for example, other civilizations like Indian philosophy, has a lot to say about some of these concepts, like knowledge and so on, but we are not, I mean, AI did not come out of that, essentially.

Then, Galileo says that philosophy is written in this grand book; The Universe. It is written in the language of mathematics, and its characters are triangles, circles and other geometric figures. So, when Galileo was doing all these reasoning, algebra had not been invented, essentially. In fact, his proofs of the equations that we attribute to him, like v is equal to u plus at; are essentially, geometric in nature. So, if you look at Hoggland's book, you will see some idea of how he draws triangles, and says that this side represents this; this side represents that; and the area represents this; and that kind of thing. All these reasoning were done; for him, mathematics was geometry, and he says that the whole world can be described in mathematics; the language of mathematics; and its characters are triangles, circles and other geometric figures. So, you can say, this is another step away from the fact that our ideas are reflections of the real world out there.

He is saying that you can think of motion; the laws of motion are about moving bodies, using the language of mathematics. So, the very already, the representation has moved to something, which is different from the real world out there, essentially. Next, we look at; so, Galileo showed that geometry could be used to represent and reason about motion; this is what we just said.

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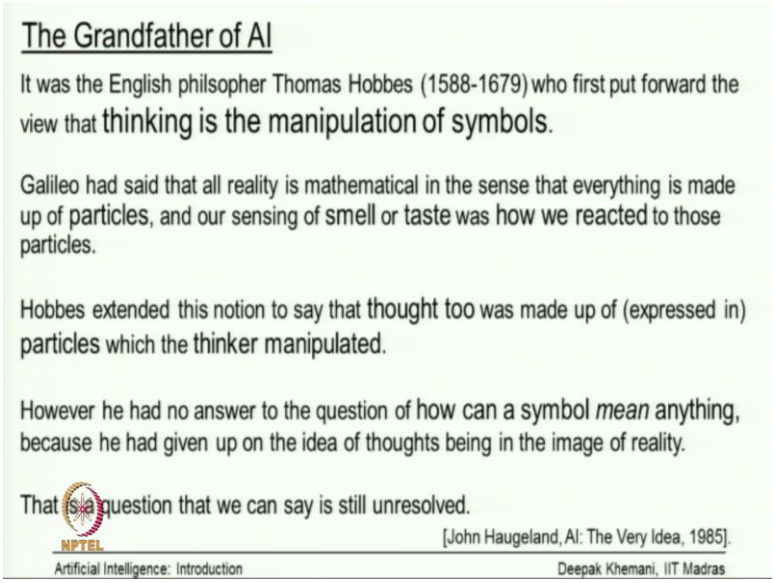

Then we come to the person, who Haugeland calls as the grandfather of AI. It was the English philosopher, Thomas Hobbes, 1588- 1649, who first put forward the view that thinking is the manipulation of symbols. This is fundamental to AI, because after all, we are talking about representing symbols and manipulating them, and creating intelligence out of them, essentially. So, Galileo had said that reality is mathematical, in the sense that everything is made up of particles, and our sense of smell or tastes as, how we reacted to those particles. Hobbes extended this notion to say that thought too was made up of, or expressed in particles, which the thinker manipulated. So, Galileo was talking about the external reality, and how we can represent, think about that, or talk about that. Hobbes is talking about the internal process of thinking and saying that even thinking is basically, the manipulation of something, which we called as particles, which we now call as symbols, essentially.

However, he had no answer to the question of how can a symbol mean anything, because we will see that; for us, intelligence is manipulating of symbols in a meaningful fashion. Hobbes could never say how can a symbol, mean anything. In fact, as Haugeland says he could not distinguish, he could not tell us; how minds are different from books. In the sense that books are also collections of symbols, and mind are also collections of symbols, which we are manipulating; how can the two be different, because the idea of

meaning is very elusive. So, if I were to ask you; how do you know the meaning of a word? How would you, what would your answer be? You just take any word. Let us say

Student: in terms (( ))

Prof: You could use examples.

In particular, I am talking about our standard source of meaning, which is a dictionary. So, if you want to look up a meaning of a word, you go, and look up a dictionary. How does a dictionary give us meanings, essentially, because dictionary is only describing words in terms of other words, essentially. When you give examples; also, you are giving examples in terms of other words. Where does the meaning originate from? I mean is there a fundamental source of meanings, essentially? This is a kind of difficulty, which Hobbes faces. Where does meaning come from, essentially? We are also not able to see where, the meaning comes from. See, for people before him that the notion of an apple is, because you see an apple, and that is what it means. But when you talk about language and thought and symbols; we have this difficulty of saying where, does this meaning come from, essentially; as a question that we do not, we are not yet, answered.

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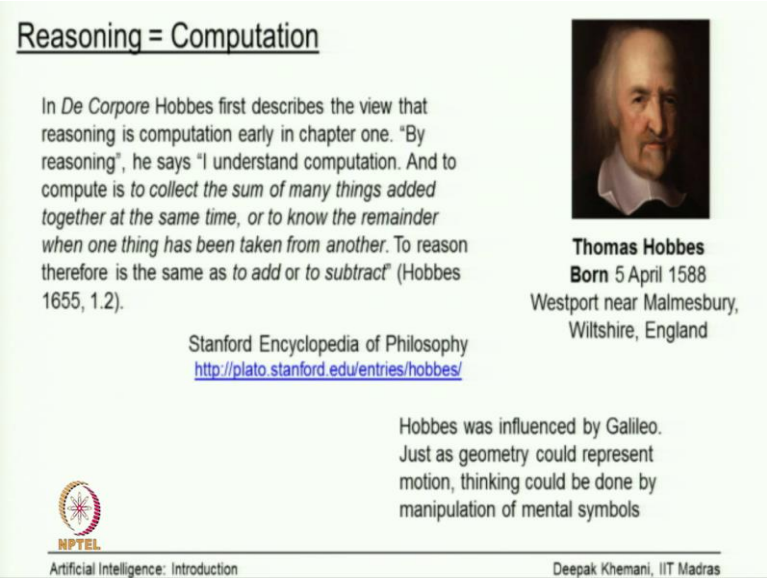

Here, is the picture of Thomas Hobbes in the 16th century. In his book called De Corpore, Hobbes first describes the view that reasoning is computation. So, he is saying reasoning is computation. By reasoning, he says I understand computation, and to compute is to collect the sum of many things, added together at the same time, or; these are very arcade languages; or to know the reminder, when one thing has been taken from another to reason, therefore, is the same as to add or to subtract. Again, like I said and adding, subtracting, arithmetic is similar to other kind, reasoning is similar to this kind of process, essentially. So, this quote, I have taken from this source, which is the Stanford encyclopedia of philosophy, and as we have just mentioned, Hobbes was influenced by Galileo; just as geometry could represent motion, thinking could be done by manipulation of mental symbols, essentially. Does not name Hobbes ring a bell? Kelvin and Hobbes; in fact, Hobbes was named after Thomas Hobbes. Kelvin and Hobbes, named after Thomas Hobbes; that is why he is such a philosophical character.

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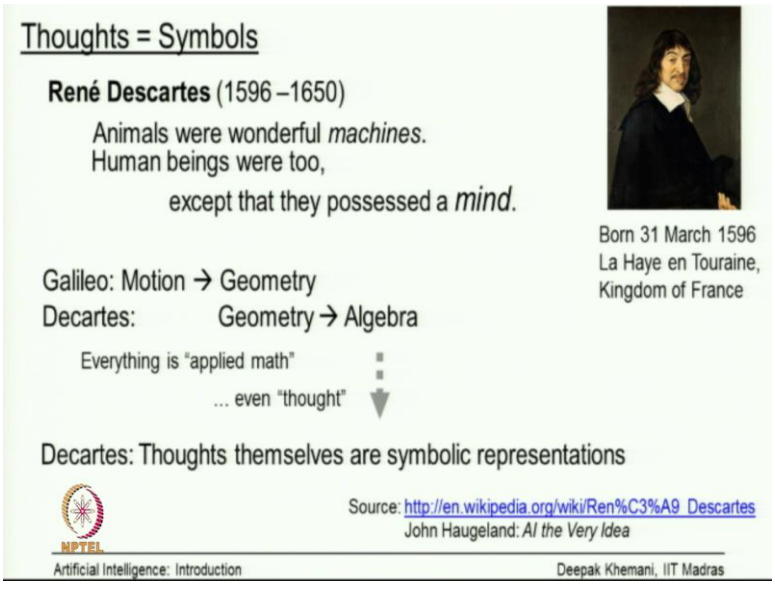

When we come to Rene Descartes, again, another great thinker from the middle times. We know for many things, including in Cartesian coordinates is named after Decartes. He had come; remember, that all these things was going on, these talking statues, moving things, and so on and so forth, and it had become surf acceptable in Europe to talk about; these machines has being liked, in some sense, essentially.

So, Descartes, in fact, goes on to saying that animals are wonderful machines; he just makes the next step that they are not like machines; they are machines, essentially. Then, he says human being were to, except for that they process something, called a mind, essentially. We will come to this Decartes problem in a moment. So, just as Galileo said that motion can be expressed in geometry; Decartes said geometry could be expressed in algebra. Decartes is the one, who invented this; we called coordinate geometry and, but he went further; he says that even thought can be expressed in the language of mathematics and thoughts themselves, are symbolic representations. So, you can see, he is building upon what, Hobbes says. Hobbes says that thoughts are symbols, and now, he says that thoughts are symbolic representation that we operate up on, essentially.

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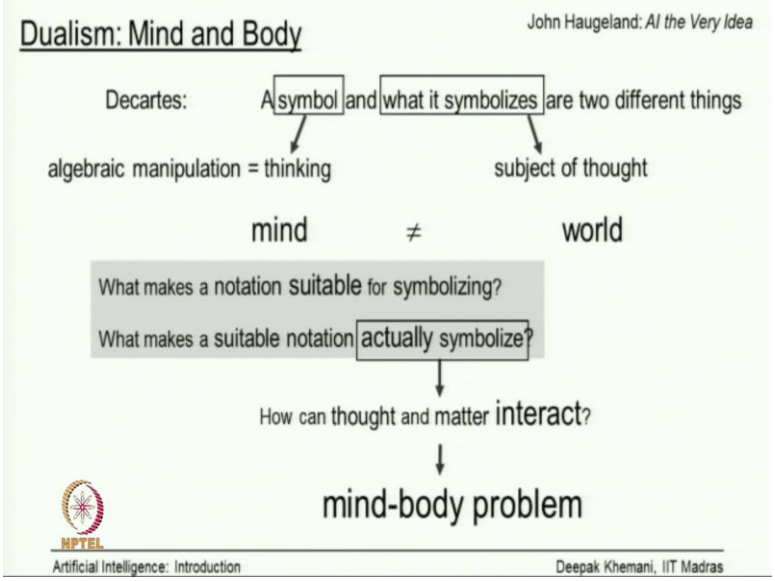

But this is something, which is new which Decartes brings in; the notion of the mind and the body. So, Decartes is what we call as the dualist, or belongs to this thinker, which says that you know mind and body are two separate things. So, we also, often called the mind body dualism. So, as opposed to dualism, there are schools of thought, which are monoist in nature, which believe that there is only one kind of thing. For the first time, Decarte is saying that two different kinds of things in this world; one is this material world, which he calls a body, and the other is the mental world, which he calls as the mind. He says that they are two different kinds of things. The material world, of course,

would obey the laws of physics and things like that. We will see later that you know philosopher said that mental world also, should obey such laws and so on, but they are different world. The world of mind is separate, and the world of body is separate.

And this is opposed to other kinds of philosophies, other kinds of views in philosophy that there is only one kind of thing. So, there is the world of idealism, which says that there is only the world of ideas. So, for example, in India we say that everything is Maya; everything is the world of ideas and matter is basically, a construct that comes out of our ideas, essentially. Very complicated to think about, but may be you can reflect upon that, a little bit. As opposed to idealism, the other world is materialism, which says that everything is matter, and the whole world is matter, and the matter interacts in the certain way. Ideas and minds and all these, kind of stuffs; they emerge out of this somehow, essentially. So, they are different viewpoints about what the world is like there, and Decartes is a dualist. He said that mind and body are two separate things. He says that a symbol and what it symbolizes are two different things.

So, if I say chalk is a symbol, it is a compound symbol made up of these letters, but it is nevertheless, a symbol. So, chalk is a symbol and this thing that I am holding in the hand, is what it symbolizes. So, this notion that chalk; symbol chock is separate. Then, we have this problem that a symbol is amenable to algebraic manipulation. So, you can do thinking, what we call as thinking is basically, symbol manipulation, which you can manipulate symbols. The subject of thought is a world; the real world out there what, it symbolizes. They are different things; the mind is different and the body is different. Of course, he had to answer questions like, you know, because see, the body or the material world obeys laws of physics. The mind, of course, was not clear how to operate it, but it was separate. He had to answer questions like this; when, what makes a notation or a symbol notation, suitable for symbolizing, and secondly, what makes a suitable notation actually symbolize?

See this problem has occurred, because he has separated the world of the mind and the body. He says the mind is one thing, and the body is another thing. A symbol is one thing and what it symbolizes, is another thing. So, the question is what makes a notation suitable for symbolizing? Now, that is a question that we are addressing now. When we

write algorithms or when we talk about knowledge representation, then we are addressing this issue as to you know, what is this? How do you represent? How do you create a domain model, for example; how do you represent the world so that, you can compute up on that, essentially. That is an easier part. A more difficult part is what makes a suitable notion actually, symbolizes; which means that if it is to be meaningful in nature, then the world of symbols or the world of thought, should be connected in some ways to the material world or the world of matter. Because they cannot be independent of each other they are not different worlds that are, you know, operating independently. Our world of thoughts is, sort of, close synchrony to the world of matters. If we raise our hands, if we think about raising our hands; we actually, raise our hands. So, that kind of, how does the interaction take place between the world of thought and the world of matter. So, the question is how can thought and matter interact; because the world of thought is different. Matter, of course, behave, sort of, obeys the laws of physics. What about the world? The world of thought is not made of matter; it is a different world. How can it interact with matter; that is a question that he could never answer; the mind body problem, essentially, or the mind body dualism, essentially.

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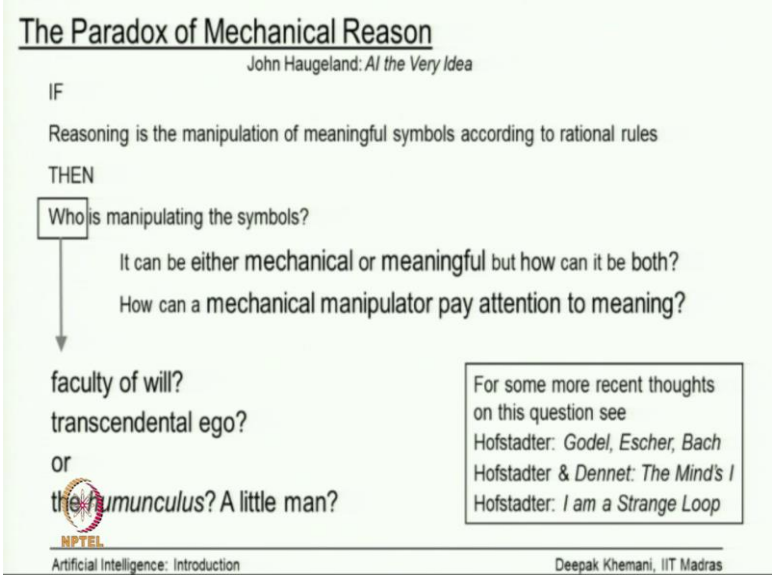

So, this brings us to what we can call as the paradox of mechanical reason; this term is by John Haugeland in his book. The paradox says that if reasoning is the manipulation of

meaningful symbols, according to rational rules; remember, that we are talking about manipulating symbols says there are well defined ways of manipulating these ideas. It is not like you are doing it, randomly so, according to well defined rules. So, if reasoning is a manipulation of symbols, according to these rational rules; who is manipulating these symbols? Because this question of meaningful manipulation is coming; our thoughts are not independent of the real world, essentially; they have to be connected to that, essentially. If a fast bowler is running up and bowling, thinking of bowling and in swing around something, he better be able to produce the real in swing if he is worth, he solved. How is his thoughts related to the real world, essentially? Who is manipulating the symbols, essentially? It is a difficult question to answer, because what says is that it can be either be mechanical, according to some fix set of rules, or it can be meaningful. How can it be both? You cannot have a mechanical system, being meaningful at the same time, and by meaningful, we mean paying attention to the mean of what is happening.

How can a mechanical manipulator pay attention to meaning? Remember, that they are not talking about AI or any such thing; they are talking about human cognation; they are talking about human minds; how human minds operate, essentially? So, they are trying to analyze that, essentially. Decartes said that there is a world of the mind, which is the symbol processing. Then, there is a world of the body, which is the real world, made up of physical matter, but they are closely tied together. So, when I am thinking about some real world in a meaningful fashion; if I have got two pieces on a table, let us say, a cake and a sandwich, and thinking about them. I have to decide, should I pick up one of them; I am thinking about some real things in the world, in a meaningful fashion. My thoughts about the cake and the sandwich are about real things, and I making some decisions; should I eat this, or should I not eat this or something like that. So, this meaningfulness; where does that come from, essentially? How can a mechanical manipulator pay attention to meaning; it is a question I would ask you to ponder over a little bit, and see, whether you know, may be like Pen Rose said, human beings are special. There is something special happening in our brains, which allows us to do this, or like Grafus said that there are some instincts that we have, which we cannot automate, but of course, I will take the opposite group.

So, this led to a lot of debate in his time. This is, we are talking about Decartes still, Rene

Decartes, and his mind body dualism. Some people attribute the fact that you know, it is said that Decartes, who also gave us a phrase Cogito Igo, some I think, therefore, I am. Apparently, he is claimed to have a proof of the God exists, essentially, and the proof is tied to the fact that there is this difficulty about how do symbols get manipulated in the meaningful fashion, but his contemporary is, of course, did not accept any such thing. They would, in fact, mock him about you know, this idea. So, we can imagine a little bit like the Chinese room, which you have not discussed in detail. Just imagine that your brain is a Chinese room, full of symbols. There is somebody, manipulating those symbols according to some rules. Who is that somebody; that is the question that we asking. So, people would mock at Decartes and say that there is a little man sitting in your head, who is doing manipulating these symbols, but the problem is as you can imagine; this explanation does not work, because the next question that you would ask is; how does the little man operate? Little man has his little brain in his little body, which has little symbols inside his head, and who is manipulating those symbols. So, there comes an infinite review, essentially, and people say that this is what, led to Decartes claim that he can prove that God exists, essentially.

But in the real world, what was happening as to this question to who people, philosophers have tried various kinds of explanations; something called the faculty of will, which we cannot quite define, or transcended ago, or as I said, the people who used to mock him and say, there is a homunculus. Remember, the homunculus of nearby parcel; a little man sitting inside. So, that is a fundamental question one has to answer. We say that if you are in modern day world, going to write programs, which will operate according to the algorithms that you are putting into those programs; how can they be doing meaningful things? It is roughly equaling to that, essentially, or I might say that if I want to implement a neural network, which is; I know that the structure of a neuron, and how it operates, and so on and so forth, and I am just connecting together hundreds of thousands of neurons. How can that evolve; do meaningful things like character recognition? Of course, we know that it can be done; character recognition can be done, but the fundamental question is that; is that intelligent, or is it doing something that we have asked it to do.

In fact, he said that the computer can only, do what is instructed to do; nothing more than

that, which is of course, true at a very fundamental level. Some recent thoughts on who is doing this manipulation, thinking, there are some very interesting books, and for those of you are interested; I would recommend them. All of three have a common author called Douglas Hofstadter, who is in the Indiana University. His famous book was Godel, Escher, Bach. He and Dennet, wrote a series, collected a series of articles called The Mind's Eye. More recently, he has written a book called I am a Strange Loop. So, he is trying to; Hofstadter is also trying to answer this question; I mean, instead of saying who, he is saying what is this notion of I that I have, as a as a human being that I have, essentially, or I or you, essentially. If I talk of you as a person; what do I really mean, essentially? What is that you, essentially? I say that my body, my mind, my hands, my eyes, my feet, my whatever; what is this I, which is saying my, essentially? That is the question, which Hofstadter is trying to answer, and he, sort of, uses a combination of emergent behavior and self-essential loops, which we do not have time to get into here, but I would recommend one of these books; they are quite easy to read and quite interesting. So, let us move on from Decartes to John Locke, known as the father of classical liberalism.

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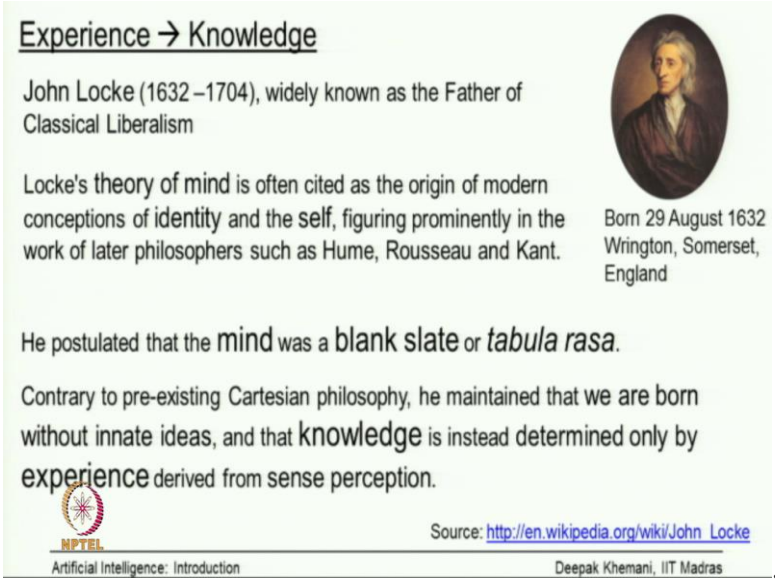

His theory of mind is often cited as the origin of modern concept of identity and the self, essentially. It influence other philosophers like Hume, that we will see and Kant that we

will see, in a moment. He postulated that mind was a blank slate, as opposed to what Thompskey says that we are born with an inbuilt grammar or the universal grammar in our heads. Locke said that the mind was a blank slate or tabula rasa as he called it, and that we are born without innate ideas, and as you can see in the last two lines; knowledge is determined by experience derived from sense perception. Whatever, we know in our heads is the result of whatever we have experienced in the world, and experience leads to knowledge, essentially.

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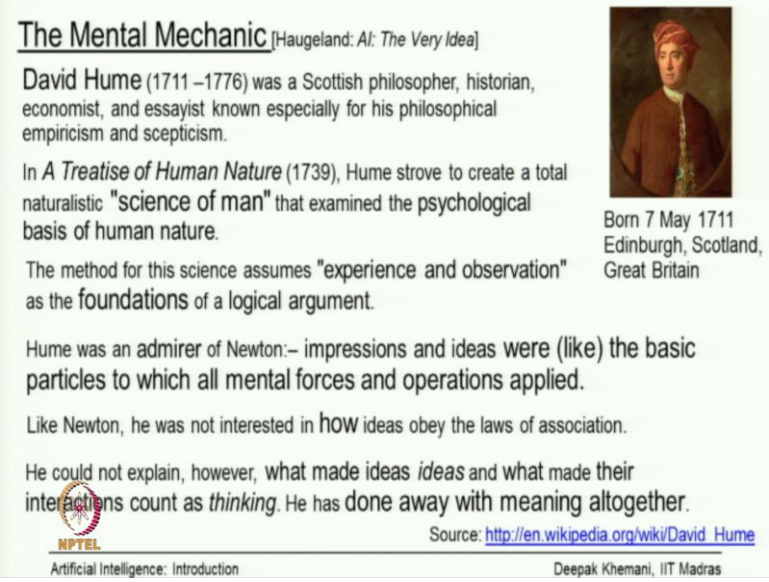

One of his elaborators or followers, David Hume, Scottish philosopher, whom Haugeland calls as a mental mechanic. By this, we mean a mechanic, who is operating in the mental domain. It was empiricism and in his book called Treatise of Human Nature, he strove to create what he called as the science of man that examined the psychological basis of human nature. He said that everything is tied up to human nature. If you can understand human nature, you can understand how human beings behave and what else is there, essentially. Science and everything, derives from there. He follows this idea of experience and observation as a foundation of logical argument. He was an admirer of Newton, and he says in a manner in which, Newton express the movement of heavenly bodies over planets and so on.

He says that impressions and ideas are like basic particles to which, mental forces and operations are applied. Just as Newton is giving the laws of physics, Hume is saying that there is a law of mental activity; law of associations, as he called it. They were; mental ideas were like particles. He is not saying that they were particles; they were like particles to which, mental force and operations are applied. Further, like Newton, he does not care as to how that is happening. So, Newton had never explained how gravity happens, or you know why gravity happens; there was no explanation behind there. He just gives the laws of gravity, and says that this is how planets are moving around the earth, and it is explained by gravity. So, Hume does the same thing. He does not try to explain how it is happening; he says that this is what is happening, and it can be explained by these laws; do not ask me, why it is happening, like that, essentially. But he could not explain, however, what made ideas, ideas, now. It is like that once, you say these are particles, which are obeying these laws, and then why are these ideas, essentially. What makes their interaction between different ideas count as thinking, essentially? So, he is done away with meaning, all together.

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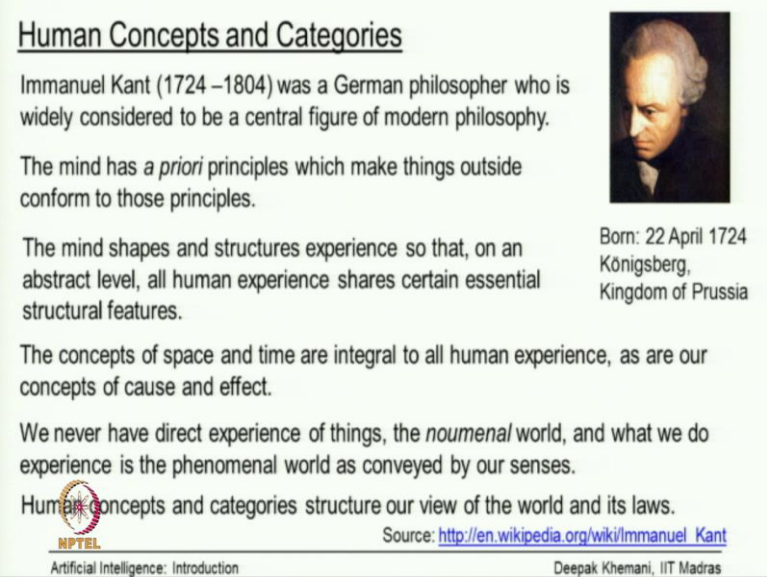

So, the last person, we will visit today, is Immanuel Kant, German philosopher, widely considered to be central to modern philosophy. In fact, when I was in undergraduate, we had a whole course, which data comparative analysis of Kant and Mills philosophy. He

says, and this is very interesting; they have come a long way in this short period of time. From this notion that the world is out there, and we are simply saying the world; the correspondence theory of knowledge and then, mind body dualism and then so; Kant has come to the other theory. He says the mind has a priori principles, which make things outside conform to those principles. These are some very consistent, with some very modern ideas. For example, some very recent research in computer vision; the simple view of computer vision would be like the correspondence theory of knowledge that you get the image of things, and you do image processing, pattern recognition, feature extraction, and all these kind of stuff, and then, you understand what is happening. It is a forward process from the world to the mind.

Modern theory says that we have preconceived notions of what we are trying to see, and what we see is already there, in our mind to some extent; this is what Kant has said. The mind has a priori principles, which makes things outside conform to those principles. Then, he says that mind shapes and structures experience; it is a mind which shapes structures and experience, so that, on an abstract level, all human experience shares essential structural features. All our mind operates in the same way. That is why we are able to communicate; that is the question that one could have asked. How one human being can communicate ideas to another human being? He says fundamentally, the mind has a similar structure. Then, he of course, goes on to explain that the concept of space and time are integral to human experience that you cannot operate without them, as are the notions of cause and effect, essentially.

What causes? Causal theory is basically, a mental theory. In the real world, I mean, we have these cause and effect kind of a motion that if I turn a switch on, the light will come out. But the physics does not recognize any cause or causal theory. Physics only recognizes the equations; it goes from one equilibrium state to another equilibrium state; there is no causal thing, but these are fundamental to our thinking, essentially. So, the second last paragraph is very interesting. He says that we do not have direct experience of things, and we will visit this in the next class, which we have on Wednesday. We will come back to this question. After, as he called is the nominal world or the real world outside, we do not have direct experience access to the real world, but what we do experience is the phenomenal world, as conveyed by our senses. So, we cannot; you

know, this is the very philosophical question. If you look at some Indian philosophies, like Buddhism, they ask this same question, again that what is there in the mind, is what we think, essentially. That is what Kant is saying, essentially. He says that human concepts and categories, structure the view of the world, as we see it, essentially.

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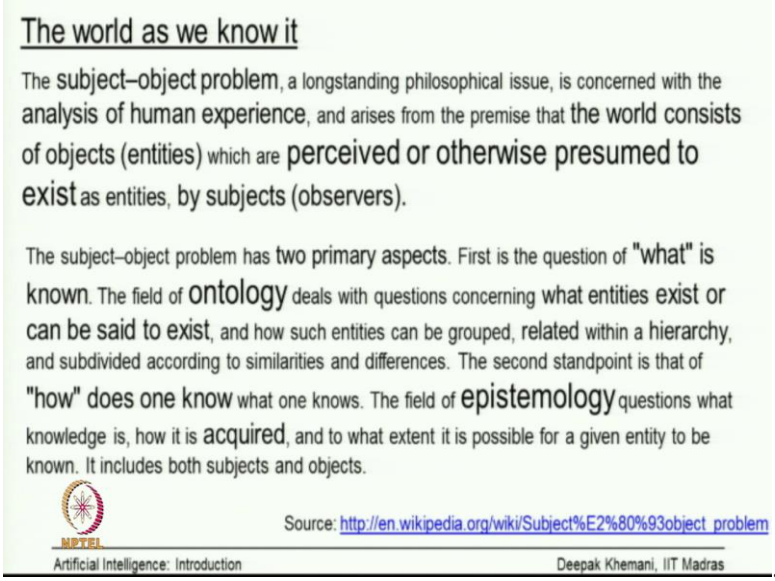

So, the world is not as it is out there, but as we see it, essentially; the world as we know it. So, this is known as the subject-object problems. A longstanding philosophical issue is concerned with analysis of human experience. So, the question is that the world consists of objects and entities, which are perceived, or otherwise, presumed to exist as entities by subjects; there is the subject. So, we think that the world has this object out there, and how does that happen, essentially. There are some technical terms, which we should be familiar with. The subject-object problem has two primary aspects; first is what is known; what can exist out there, and this is something that we call as ontology, which became very popular in current day computer science. So, the field of ontology deals with questions concerning what exist, or what can said to be exist, actually, and how such entities are grouped together, essentially, related within a hierarchy and that kind of a theory.

Nowadays, computer scientists talk a lot about ontology, and in the concept of the

semantic webs. So, we have one computer, talks to another. One computer sitting here to meaningfully, talk to another computer, and we have the social of ontology and taxonomies, which we may not have time to go through in this course. The second standpoint is how does one know what we know; and this concerns epistemology; questions as to how knowledge is acquired. So, ontology says what can exist, and epistemology is concerned with how do we get the real facts of, for example, why was Durga suspended; epistemic question. How do we say that this is what is really, happened out there, essentially; is the question of knowledge acquisition or epistemology.

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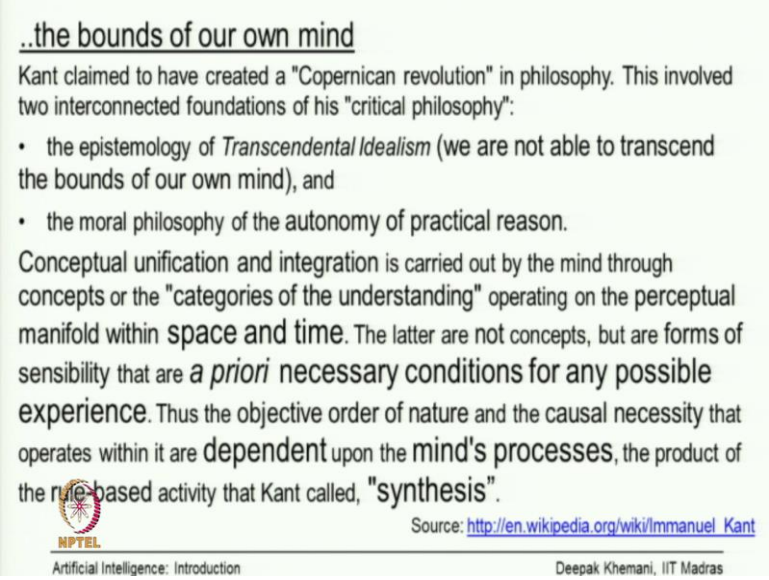

The bounds of our own mind; he creates. Kant says that he has done something, like a Copernican revolution in philosophy; what he calls as a critical philosophy. So, he says that two things; one is the epistemology of transcendental idealism, which says that we are not able to transcend the bounds of our own mind. We can only perceive the world through the prism of our mind, in some sense; through the spectacles of glasses as mind, and we cannot exceed that. So, we cannot access the real world out there; only, what our mind allows us to see. Already, the notion of mind has become prominent, essentially. The moral philosophy in those days was not quite what we talk about it as right now, but something, to do with the mental world. The moral philosophy of the autonomy of

practical reason; he says that practical reason can be automated.

May be, this is the last thing I will leave you with. Conceptual unification and integration is carried out by the mind through concepts or the categories of understandings. So, this is again, those terms, some ontologies are coming up. We have concepts about things. We know, we have categories of birds, and flowers, and apple, and fruits; all these kind of categories or things, operational on the perceptional manifold, which is build within space and time. Space and time is something, fundamental to our minds. Our minds think in terms of space and time, and everything that we think about is located within our notions of space and time. They are not concepts, but are forms that are a priori necessary conditions for any possible experience. He says that without the notion of space and time, you would not have been able to imagine the world, and think about the world. Thus, the objective order of nature and the causal necessity that operates within it are dependent upon the mind's processes, which he called by a product of rule based activity, which he called as a synthesis. So, the emphasis is totally, shifted to the human mind. It is a human mind, which shapes the way we see the world, and we reason about the world, and everything is dependent upon that. So, from a notion when we did not even have a notion of a mind, and then, gradually we said thought and reality is different, and then, mind body is different. Kant has come, taken us to a point, which says that our interaction with the world is controlled by our minds, essentially.

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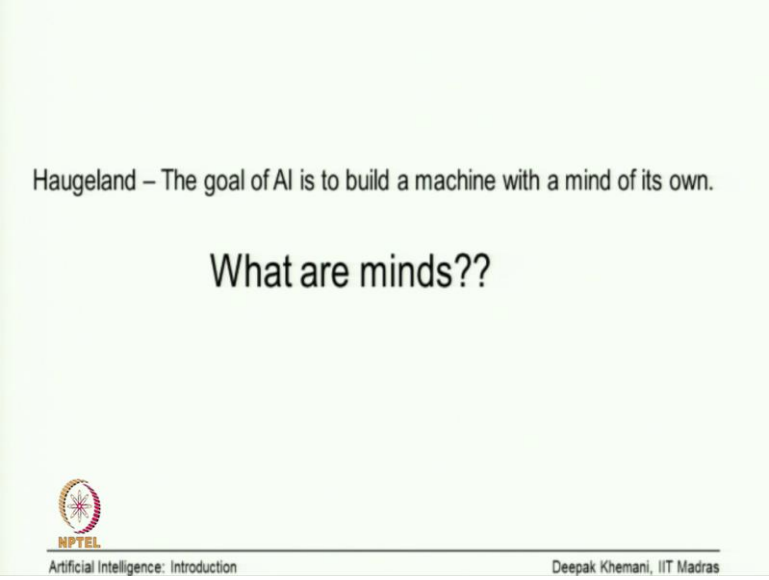

So, this is what we will do in the next class. Just to remind you of the goal that Haugeland that we had said. The goal of AI is to build the machine with a mind of its own. So, in the next class, we will come back to this the cantian view of the mind, and discuss a little bit more, and may be, wind up with the introduction in that on next Wednesday.