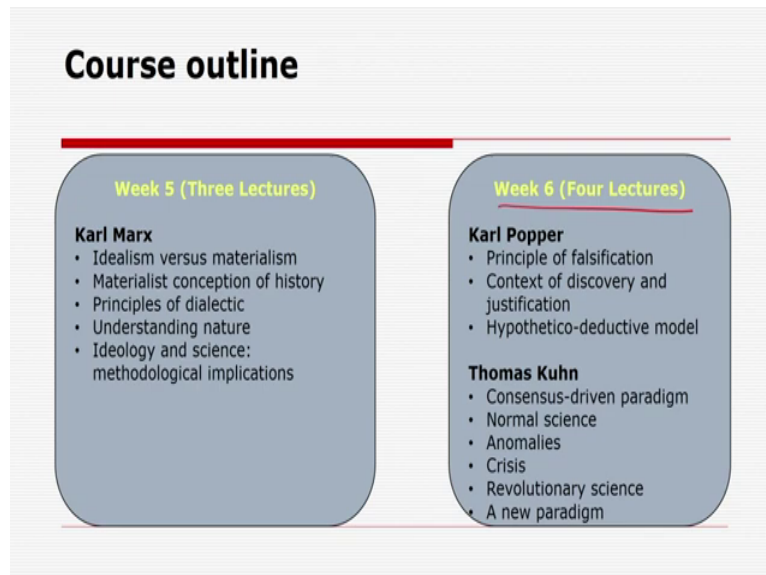


Philosophical Foundations of Social Research
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Week 6 : Lecture –14
Systematic Falsification



Hello, everyone. Welcome to the 14th lecture of this Massive Open Online Course on Philosophical Foundations of Social Research. We have already completed the lectures of five weeks, now we are on the sixth week of the course. We have completed 13 lectures and this is the 14th lecture that we are going to have.

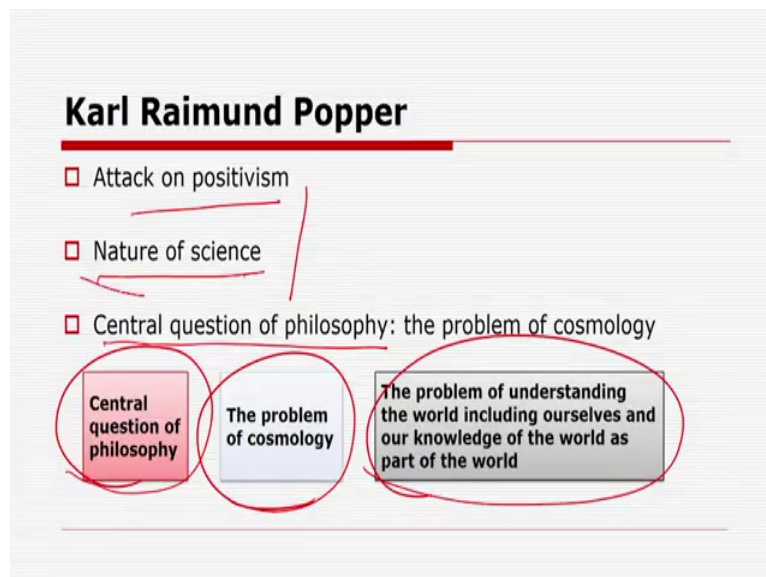
The sixth week has been classified into four lectures, two lectures each for Karl Popper and Thomas Kuhn. And in today's lecture, we are going to discuss Popper's method, Popper's philosophical foundations of social research in the context of principle of falsification, systematic falsifiability, context of discovery and context of justification, hypothetico-deductive model, how does science makes progress and so on.

If you slightly recall, we have already discussed empiricism and rationalism: how empiricism and rationalism they became rival methodologies or rival methods of science from the 17th to 19th century. And how positivists, who became very dominant in the first half of the 20th century and so on. Even today positivism is very dominant, no doubt about it, but positivism doesnot remain without any challenge, unlike in the first quarter of the 20th century.

As we have already discussed positivism, let me go back a little that how we have characterized positivism. We have characterized positivism in terms of certain tenets. What

are those tenets? One is methodological for example, that science is distinct from all areas of human activity or creativity, because it possesses a method unique to it right.

Secondly, methodological monism, that there is only one method common to all sciences irrespective of their subject matter, that is methodological monism. That the method of science is the method of induction, that is inductivism; that the hallmark of science lies in the fact that all scientific statements must be systematically verifiable, it is systematic verifiability. We have also discussed how there is a dichotomy between fact and value in the positivistic construal of science. Facts do not have any value content and values do not have any factual content. Facts are value neutral, whereas values do not have any factual content. We have also discussed how there is a unilinear relationship between observation on the one hand and theory on the other. Observation leads to theory generation, but the converse is not true in the positivistic schema.



Now, that such positivistic construal of science was most systematically attacked by Karl Raimund Popper who provided an alternative image of science. Popper's theory of scientific method has won a lot of admirers not merely in science, but also in philosophy. Whereas positivists tried to work out a sophisticated version of the view called empiricism, Popper sought to resurrect to its rival, namely, rationalism.

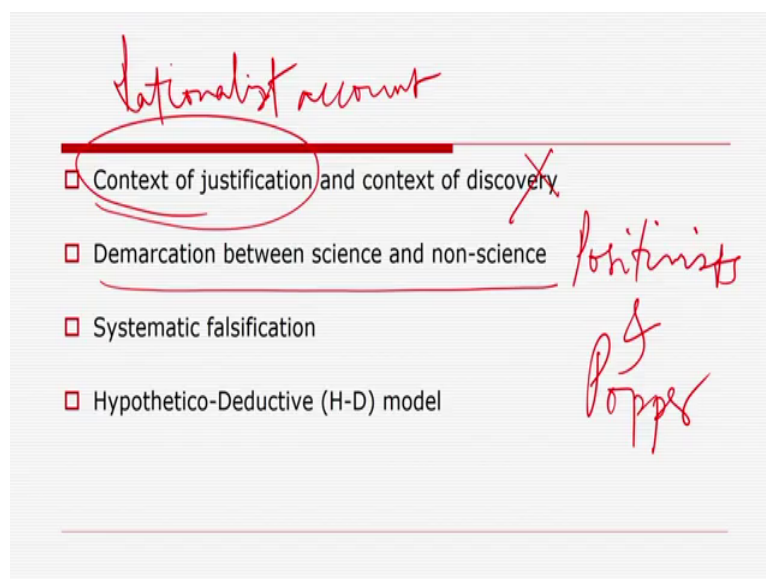
In what follows, the 14th lecture and the 15th lecture, through these two lectures we shall consider Popper's views on the nature of science along with his attack on the positivistic theory of science. It might be pointed out that for Popper, the value of the philosophical

interest in scientific knowledge lies in its ability to shed light on the central question of philosophy.

What is the central question of philosophy? For Popper, the central question of philosophy is the problem of cosmology. Now, what is then the problem of cosmology? Now, the problem of understanding the world including ourselves and our knowledge of the world as part of the world. How does Popper arrive at this point? Popper arrives at this point through the notion that we can only understand the world only if we get associated with the world that we want to examine, we want to study.

If we isolate ourselves from the world, then we are not going to examine that world, whether it is world, whether it is nature, it is human society, anything, even science. We must be able to associate ourselves with the world that we want to study as part of the world. That is why, according to Popper, what is the central question of philosophy? The central question of philosophy is the problem of cosmology. What is the problem of cosmology? The problem of understanding the world including ourselves, because we are not outside the purview of this world. Because our knowledge of the world is also not independent of the world that we live in.

In studying Popper's contribution to our understanding of science one must bear in mind Popper's general philosophical concerns which alone set in motion, guide and lend deep significance to his painstaking work on the nature of science itself.



The philosophical inquiry into the nature of scientific method, according to Popper, must confine itself into the manner in which scientific theories are evaluated.

When I say evaluated, whether these scientific theories are accepted or these scientific theories are rejected. For example, in the field of astronomy, Ptolemy's almagest has been rejected, because Ptolemy said that, the Earth remains constant and the Sun rotates on the orbit of the Earth. Ptolemy's astronomical delineation has been rejected by Copernicus and later on Galileo.

Now we do not say the Earth remains constant. Earth also rotates not only on its own orbit but also in the orbit of the Sun. That is why these scientific theories are constantly evaluated . When I say the philosophical inquiry into the nature of scientific method, according to Popper, must confine itself into the manner in which scientific theories are evaluated and whether they are accepted or not, whether they are rejected or not, how they have been evaluated.

Popper refuses to consider as legitimate the inquiry into the way in which these scientific theories are arrived at, whether it is by Ptolemy or Copernicus or Newton or Einstein. Therefore, according to Popper, philosophy of science must confine itself to the context of justification and refuse to say anything about the context of discovery.

As I said, he wanted to resurrect the rival of empiricism, namely, rationalism, that is why Popper only found out a rationalist account in the context of justification, not in the context of discovery. We will discuss this maybe in the next lecture that what are the methodological implications of how philosophy of science must confine itself to the context of justification, and how Popper refuses to say anything about the context of discovery.

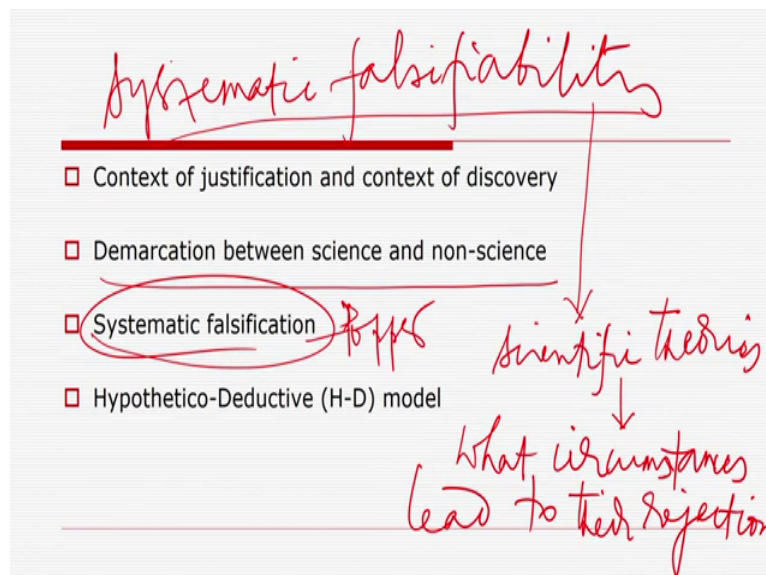
Popper considers the creative process in and through which scientific ideas are generated, to be unamendable to any rational explanation. Secondary, an adequate philosophy of science, according to Popper, must provide a criterion between science and non-science, that demarcation between science and non science.

If you say this, positivists also mentioned that there must be a demarcation between science and non-science, inductivists also suggested this, rationalists also suggested this and Popper did not deviate from this. That is, there must be a distinction between demarcation between science and non-science, not on the basis of their objectives but on the basis of the methods that they deploy.

That is why, for Popper, an adequate philosophy of science must provide a criterion of demarcation between science and non-science. Like positivists, Popper is convinced of the

uniqueness and supremacy of science in the overall scheme of our activities aimed at knowledge acquisition. If you slightly recall, we said in the context of positivism, that positivists argued that science is distinct from all areas of human activity or creativity because it possesses a method unique to it, that is methodological, there must be a demarcation between science and non-science.

Popper equally is convinced of the uniqueness and supremacy of science in the overall scheme of our activities aimed at knowledge acquisition. Hence, both positivists as well as Popper felt the need to demarcate science from the rest of our knowledge acquisition activities. That is why, positivists who were empiricists maintained that the hallmark of scientific theory lies in their systematic verifiability.



If you slightly recall, we have already discussed positivists suggested that what is the hallmark of science, that the hallmark of science lies in the fact that all scientific statements must be systematically verifiable, that is systematic verifiability. But in contradistinction with what positivist said that the hallmark of science lies in the fact that all scientific statements must be systematically verifiable, Popper maintains that what distinguishes science from the rest of our knowledge acquisition activities is not that scientific statements are verifiable, but they are falsifiable.

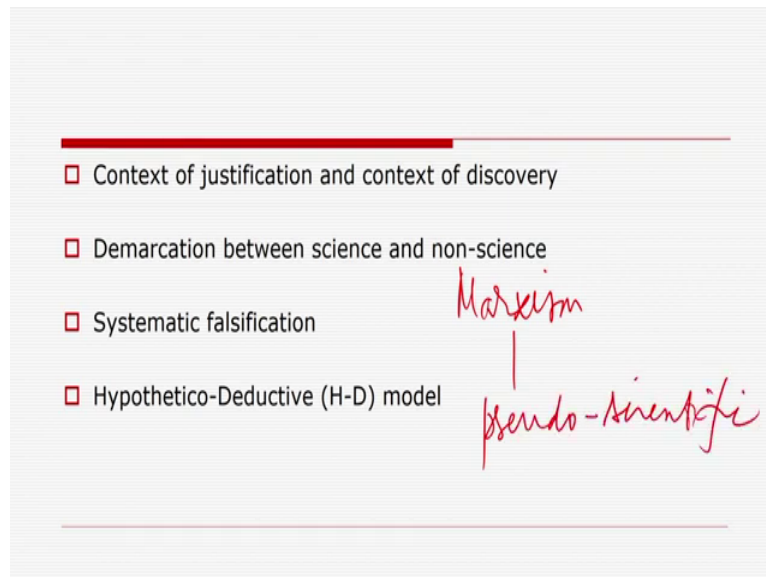
And for positivists, the hallmark of science lies in the fact that all scientific statements are systematically verifiable, then for Popper hallmark of science lies in the fact that all scientific statements must be systematically falsifiable.

That is why positivists who were empiricists maintained that the hallmark of scientific theories lies in the fact that all scientific statements are systematically verifiable. Popper replaces verifiability by falsifiability. According to Popper, the hallmark of scientific theories lies in their systematic falsifiability. Popper always maintained that what distinguishes science from the rest of our knowledge is not that scientific theories are verifiable, but they are falsifiable.

That the scientific theories are falsifiable, according to Popper, in the sense that they transparently state, what circumstances lead to their rejection. Whenever scientific theories are advanced, it is also stated under what conditions they turn out to be false, so that we try to obtain those conditions in order to falsify them.

An ideal scientific statement is constituted in such a way that its terms instead of helping to survive, enable to readily accept the risk of being falsified. In other words, a model scientific statement should readily yield test implications, which we will deduce in order to refute it. A statement, however plausible and perfectly consistent with what we observe is not scientific, unless we can easily deduce testable consequences from this. And it is in this connection, in the open society and its enemies, Popper attacks Marxism as being pseudo scientific.

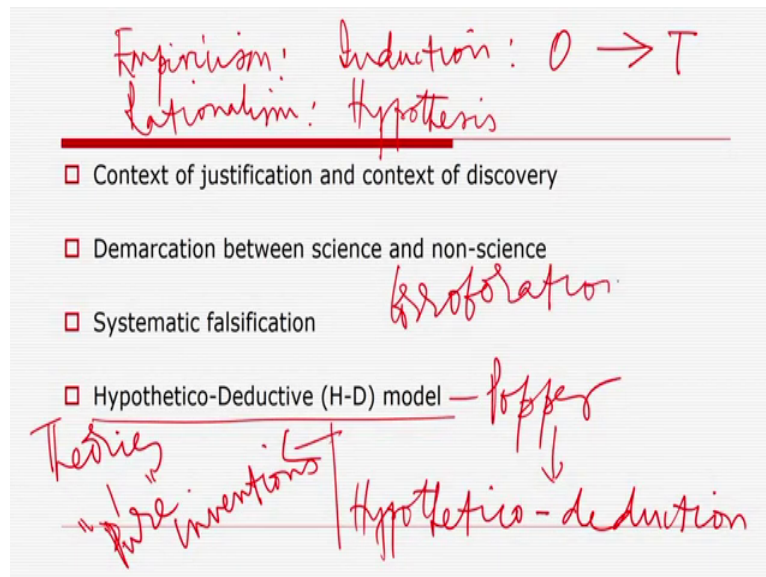
In fact Popper said there are at least three enemies of the open society, where one is Marx, secondly Darwin, and thirdly Sigmund Freud. Whichever way you try to criticize them, whichever way you try to bring about a critique of Marx, Darwin and Freud, there will be walls to protect them. That is why perhaps they cannot be falsified, and if this cannot be falsified, then they are pseudo scientific in nature. Even for Popper even Marxism or Darwinism or Freudian psychology, they all are pseudo-scientific.



For example, when Marx propounded his theory of capitalist society, his theory was falsifiable; one because it yielded test implications such as disappearances of middle class, emergence of revolution in advanced industrial societies and so on. However, these test implications were not borne out, and hence the theory was falsified. But the followers of Marx tried to explain the fact that the Marxist predictions did not come about by taking recourse to ad-hoc explanations, and thus insisted that there was nothing wrong with the theory.

In the process, the followers of Marx went on building safety valves for the theory with the result that the theory becomes unfalsifiable. A religious theory about the world is of course also unfalsifiable. But the propounders of religious theories about the world never claim scientificity for their views, whereas Marxists do so vehemently. Hence, Marxist theory is not merely unfalsifiable and therefore unscientific, but also pseudo scientific. It is this pretension to be scientific, while being unfalsifiable makes the theory pseudo scientific according to Karl Popper.

In accordance with what Popper considers to be the hallmark of scientific theory, Popper put forward an adequate model of scientific method. What is that model? Popper characterises his model of scientific method as hypothetico-deductive model, H-D model, short. According to Popper, the method of science is not the method of induction as empiricists and positivists argued or method of hypothesis as hypothesisists argued.



Now for the method for empiricists in the world of empiricism, what is the method of science? Now the method of science is the method of induction. In the context of rationalism or hypothesisism, what is the method of science? The method of science is the method of hypothesis. If you slightly recall that empiricists always maintained that science must start with observations, must remain at the level of observations and must end with observations.

On the contrary, the rationalist suggested that, science begins only when we go beyond observations. Hence, science must start with a hypothesis, that is a tentative solution to a problem or hunch. On the contrary, Popper characterizes his model of scientific method as hypothetico-deductive model, according to Popper, the method of science is not the method of induction or the method of hypothesis, but the method of hypothetico-deduction. Then, what is the method of science? Now the method of science is the method of hypothetico-deduction.

What are the fundamental differences between these models? One suggests that method of science is the method of induction, somebody says that the method of science is a method of hypothesis and now Popper says that no, no the method of science is not the method of induction or hypothesis, rather the method of sciences the method of hypothetico-deduction. What are the fundamental differences between these three?

First, the inductivist model maintains that our observations are theory-independent, and therefore cannot be doubted. What positivists argued or empiricists argued? They said that there is always uni-linear relationship between observation and theory. Observations lead to

theory generation, but the converse is not true, theories are dependent on observations, but observations are theory independent.

And for this reason, observations cannot be doubted, observations are indubitable in nature. That is to say that since observations are theory independent, they have probability value of 1. It also suggests that both positivists as well as empiricists they also suggest that our theories are only winnowed from observations. If you slightly recall, observation leads to theory. The converse is not true that our theories are only winnowed from observations, borrowed from observations and therefore, our scientific theories have the initial probability value 1 in principle.

Of course, empiricists and positivists admitted that in actual practice, theories may contain something more than what observation statements indicate. Our actual theories may not have been winnowed from observations and therefore the need for verification arises. Popper rejects the empiricist view or the positivistic view that our observations are theory-free, and hence rejects the idea that our observation statements have probability value equal to 1. More importantly, Popper maintains that our theories are not winnowed from observations or facts, but are free creations of human mind.

For Popper, one just cannot say that we have arrived at theories through observations or facts. But for Popper theories are observation free, theories are free creations of human mind and so on. According to Popper, our scientific ideas in other words are not extracted from observations, they are pure inventions. When positivists argued that observations are pure, in the sense that they are not dependent on theory, observations only lead to theory generation, and in this sense observations are pure. For Popper, theories are pure inventions, observations are not.

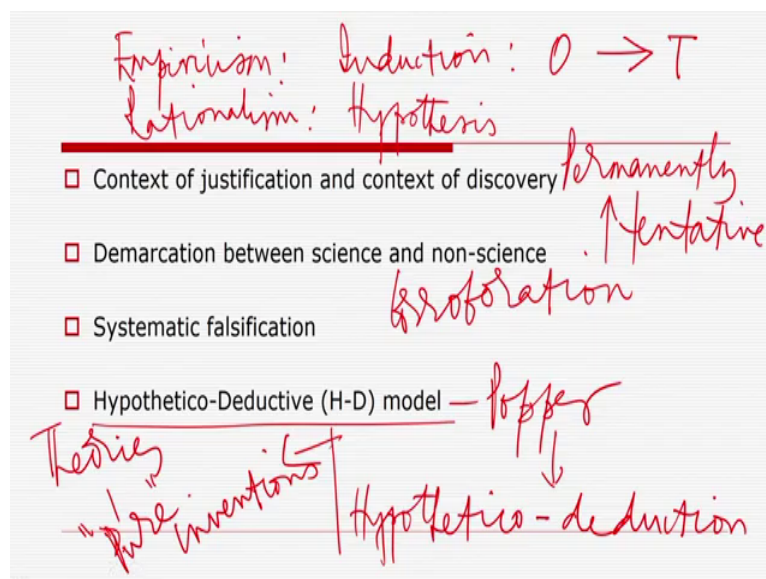
Since our theories are our own constructions, not the functions of anything like pure observations, which according to Popper are anyway myths, the initial probability of our scientific theory is always 0 for Karl Popper. From this what follows that whereas according to empiricists as well as positivists, what scientific tests do is to merely find out whether our scientific theories are true. According to Popper, scientific tests cannot establish the truth of scientific theories, even when the tests give positive results.

If a test gives a positive result, empiricists claim that the scientific theory established is true. Whereas according to Popper, all that we claim is that our theory has not yet been falsified.

The truth or falsity of any scientific claim can be easily established in the empiricist or positivistic scheme. But in Popperian methodological schema, the truth or falsity is very difficult to determine. If it is falsified then it is easy, but if it is not falsified then what will happen, are we going to accept it or not? We will see a little while later.

Popper suspects even that the Sun always rises in the east. This is a famous thing that people very often say that the sun rises in the east, whereas astronomy science always suggests that the sun doesnot rise in the east or set in the west, rather that part of the earth which faces towards the Sun becomes day and that part of the earth which does not face towards the Sun, becomes night.

These are all basic arguments in science that we make that this is a misnomer that if people think that the Sun rises in the east and sets in the west- the horizon sets in the East, correct. That is why we always glorify Copernican revolution that how the Earth is not constant, the Earth rotates, the Earth rotates not simply on its own orbit but also on the orbit of the Sun.



In Popper's schema, no amount of positive result of scientific testing can prove our theories. Whereas, whereas empiricists as well as positivists speak of confirmation of our theories in the face of positive results of the test, Popper only speaks of corroboration. In the empiricist schema we tend to confirm our scientific theories if they are tested right, if they are verified to be true. And in the rationalist schema, if the hypothesis is tested right then it is accepted, if it is tested wrong then it is rejected.

But in the Popperian schema, you will find that if a hypothesis has been falsified, then it must be refuted. But if a particular hypothesis has not been falsified, then it just cannot be

accepted, it has to be corroborated. What is the meaning of corroboration? The meaning of corroboration, you have to keep the hypothesis permanently tentative.

That is why whereas inductivists as well as positivists speak of confirmation of our theories in the face of the positive results of the test, Popper only speaks of corroboration. In other words, the empiricist schema we can speak of scientific theories as established truths. Whereas in the Popperian schema, a scientific theory however well supported by evidence remains permanently tentative, it has to be corroborated. We can bring out the fundamental difference between verificationism in the inductivist and positivistic schema and falsificationism in the hypothetico-deductivism by drawing on the analogy between two systems of criminal law.

According to one system, the judge has to start with the assumption that the accused is innocent. And consequently, unless one finds evidence against her or him, she or he should be declared innocent. And according to the other, the judge has to start with the assumption that the accused is a culprit, and consequently, unless and until evidence goes in her or his favour, she or he should be declared to be a culprit.

Obviously, the system where the judge has to start with the assumption that the accused is a culprit and consequently, unless and until evidence goes in her or his favour, she or he should be declared a culprit. This system of criminal law is harsher than the one where the judge starts with the assumption that the accused is innocent, and consequently, unless and until one finds evidence against her or him, she or he should be declared innocent.

The empiricist as well as positivist schemas are analogous to the former criminal law that where the judge starts with the assumption that the accused is innocent, and hence consequently, unless evidence goes against her or him, she or he should be declared innocent.

Whereas the hypothetico-deductive scheme is analogous to the view where the judge starts with the assumption that the accused is the culprit, and unless and until evidence goes against her or him, she or he should be declared culprit. Then what have we discussed till now?

We have discussed how the positivistic construal of science was most systematically attacked by Karl Popper, who provided an alternative image of science. Popper's theory of scientific method has won a lot of admirers, both in science as well as philosophy, whereas positivists tried to work out a sophisticated version of the view called empiricism. Popper said to resurrect its rival namely rationalism.

And in what follows, we discussed Popper's views on the nature of science along with his attack on positivistic theory of science. It might be pointed out that for Popper the value of the philosophical interest and scientific knowledge lies in its ability to shed light on the central question of philosophy. What is the central question of philosophy? Now, the central question of philosophy is the problem of cosmology. What is the problem of cosmology? The problem of cosmology is the problem of understanding the world, including ourselves, and our knowledge of the world as part of the world.

And then we have discussed while studying Popper's contribution to our understanding of science, one must bear in mind Popper's general philosophical concerns, which alone set in motion guide and lend deep significance to his painstaking work on the nature of science itself.

And then we have discussed how, according to Popper, the philosophical inquiry into the nature of scientific method must confine itself to the manner in which scientific theories are evaluated, where evaluation may result in acceptance or rejection and Popper refuses to consider as legitimate the inquiry into the way in which these theories are arrived at. Therefore, according to Popper, philosophy of science must confine itself to the context of justification and Popper refuses to say anything about the context of discovery, because rationalist account is associated with the context of justification, not the context of discovery according to Popper.

Popper considers the creative process in and through which scientific ideas are generated to be unamendable to any rational explanation. Secondly, an adequate philosophy of science, according to Popper, must provide a criterion of demarcation between science and non-science, like positivists. Popper is convinced of the uniqueness and supremacy of science in the overall scheme of our activities aimed at knowledge acquisition.

Hence both positivists as well as Popper felt the need to demarcate science from the rest of our knowledge acquisition activities. That is why positivists who were empiricists maintained that the hallmark of scientific theories lies in their systematic verifiability, whereas Popper replaces verifiability by falsifiability. According to Popper, the hallmark of scientific theories lies in their systematic falsifiability.

Popper maintains that what distinguishes science from the rest of our knowledge is not that scientific theories are verifiable, but they are falsifiable. The scientific theories are falsifiable

according to Popper in the sense that they transparently state what circumstances lead to the rejection. Whenever scientific theories are advanced, it is also stated under what conditions they turn out to be false so that we try to obtain those conditions in order to falsify our claims.

An ideal scientific statement is constituted in such a way that its terms instead of helping to survive enable it to readily accept the risk of being falsified. In other words, a model scientific statement should readily yield test implications which we deduce in order to refute it. A statement however plausible and perfectly consistent with what we observe is not scientific unless we can easily deduce testable consequences from it. And in this sense, we have discussed how Popper attacks Marxism as pseudo-scientific and so on.

In accordance with what Popper considers to be the hallmark of scientific theories, he puts forward an adequate model scientific method, he characterises his model of scientific model as hypothetico-deductive model. According to Popper, the method of science is not the method of induction or the method of hypotheses, rather the method of hypothetico-deduction.

We have discussed the fundamental differences between these methodological models. First you will find that the empiricist model suggests or maintains that our observations are theory independent, and therefore are indubitable. That is to say, since observations are theory independent, they have probability value of 1. It also says that our theories are only winnowed from observations, and therefore our scientific theories have the initial probability value one in principle.

Of course, empiricists maintain that, that in actual practice theories may contain something more than what observation statements indicate the result, our actual theories may not have been winnowed from observations, hence the need for verification arises. On the contrary, Popper rejects the empiricist view that our observations are theory free, and hence rejects the idea that our observation statements are probability equal to 1.

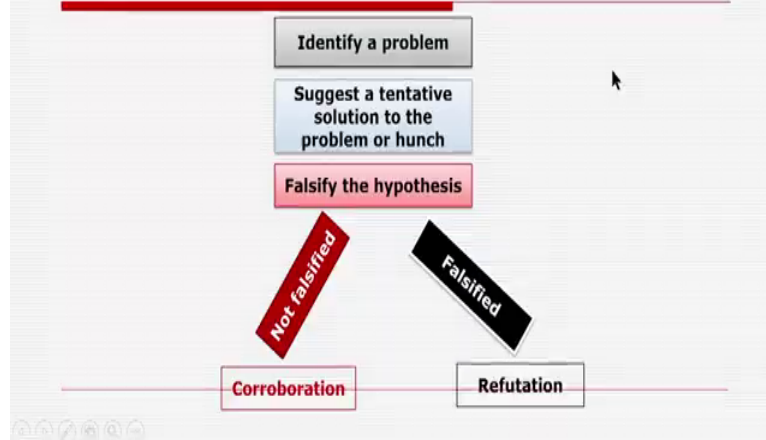
More importantly, Popper maintains that theories are not winnowed from observations or facts, but are free creations of human mind. Our scientific ideas, in other words, are not extracted from our observations, rather they are pure inventions. Since our theories are our own constructions, not the functions of anything like pure observations, which according to Popper are anyway myths, the initial probability of our scientific theories is zero.

From this, what we have discussed in this lecture, it follows that, whereas according to empiricists, what scientific tests do is to merely find out whether our scientific theories are true or not. According to Popper, scientific tests cannot establish the truth of scientific theories, even when the tests give positive results. If a test gives positive result, empiricists claim that the scientific theory established as true. Whereas according to Popper, all that we claim is that our theory has not yet been falsified. Popper suspects even that the sun rises in the east. In Popper scheme, no amount of positive result of scientific testing can prove our theories. Whereas empiricists and as well as positivists you will find, they speak of confirmation of our theories in the face of positive results of the test, and Popper only speaks of corroboration.

In other words, in the empiricists' scheme as well as positivistic scheme, we can speak of scientific theories as established truths. Whereas in the Popperian schema, a scientific theory, however well supported by evidence, remains permanently tentative. We can bring out the fundamental difference between verificationism in the context of empiricism as well as positivism on the one hand, and falsificationism in the context of hypothetico-deductivism by drawing on the analogy of two systems of criminal law that we have discussed.

According to one system, the judge has to start with the assumption that the accused is innocent, and consequently, unless one finds evidence against her or him, she or he should be declared innocent. According to the other, the judge has to start with the assumption that the accused is a culprit and consequently unless evidence goes in her or his favour, she or he should be declared to be a culprit. Obviously, that latter system of criminal law is harsher than the former, the the empiricist or the positivistic scheme is analogous to the former kind of criminal law, whereas the hypothetico-deductive scheme is akin to the latter one.

Progress in Science



What we are going to do in the next lecture: we will discuss how does science make progress in the Popperian scheme, how science must start with a problem, then we must suggest a tentative solution to the problem or hunch in the form of a hypothesis, and then how we are going to falsify the hypothesis. If our hypothesis is falsified then it must be refuted, and if our hypothesis is not falsified then it must be corroborated. We will discuss it in the next lecture. Thank you.