Philosophical Foundations of Social Research
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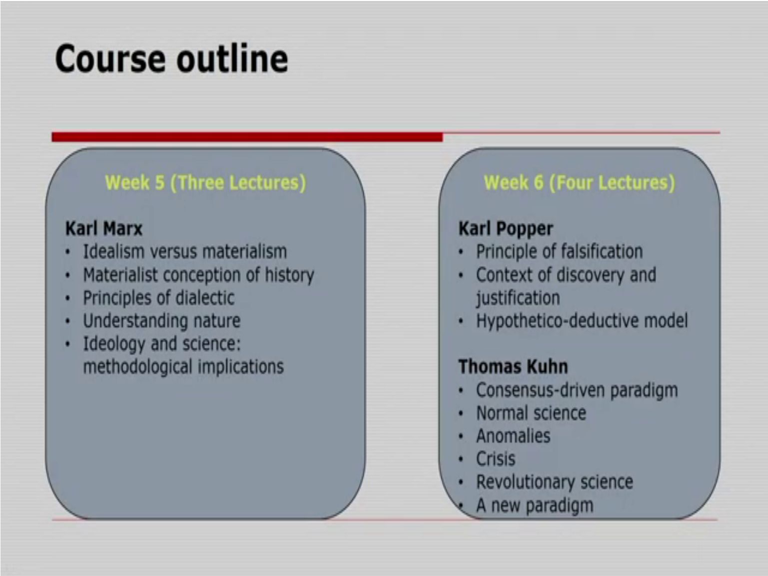
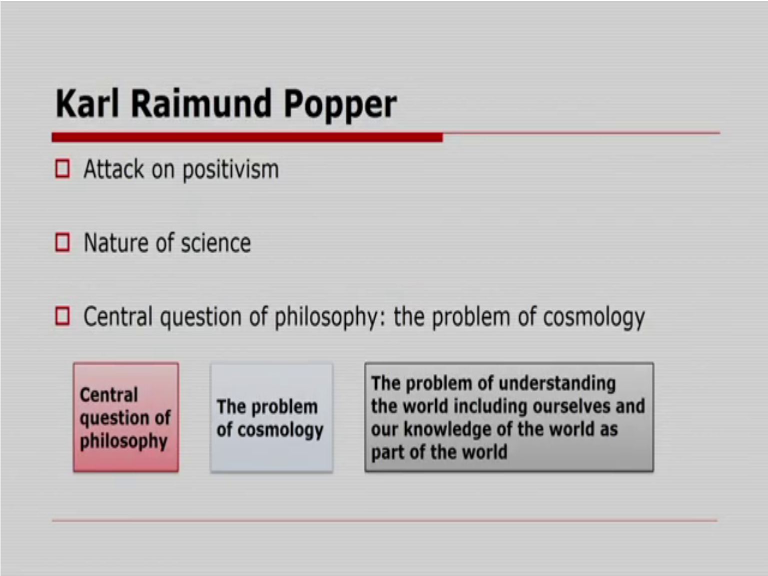
Week 6 : Lecture –15
Hypothetico-Deductive Model

Hello everyone, welcome to the 15th lecture of this Massive Open Online Course on Philosophical Foundations of Social Research.

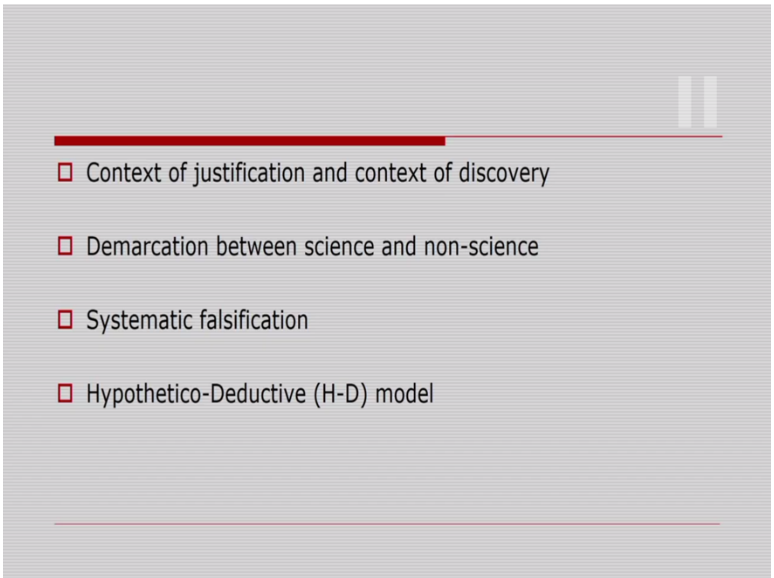


If you can recall, we are in the sixth week of this course and we are discussing Karl Popper. And then we will discuss Thomas Kuhn from the next lecture onwards in terms of two more lectures.



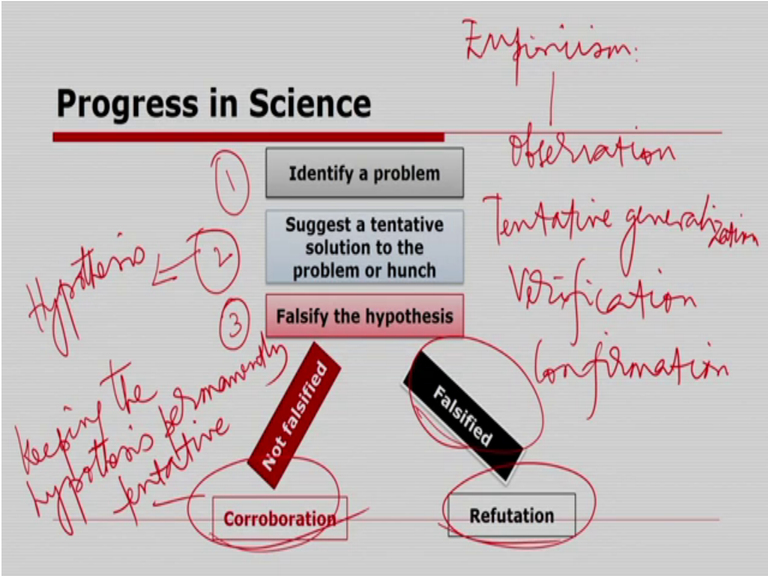
And in the 14th lecture, we have discussed how Popper made a systematic attack on the positivistic construal of science. How Popper tried to provide an alternative image of science in contradistinction with empiricism and positivism altogether? For Popper, what is the central question of philosophy? For Popper, the central question of philosophy is the problem of cosmology.

What is the problem of cosmology then? According to Popper, the problem of cosmology is the problem of understanding the world, including ourselves and our knowledge of the world as part of the world.



We have already discussed this, and then how Popper tried to provide a rational account to the context of justification, and he refuses to say anything about the context of discovery. Like positivists, Popper also sought to make a demarcation between science and non science. Nevertheless, when positivists suggested that the hallmark of science lies in the fact that all scientific statements are systematically verifiable, Popper replaces verifiability with falsifiability. According to Popper, the hallmark of science lies in the fact that all scientific statements are not systematically verifiable, rather the hallmark of science lies in the fact that all scientific statements are systematically falsifiable.

And that is how he provided the hypothetico-deductive model. For empiricists, what is the method of science?The method of science is the method of induction. For rationalists the method of science is the method of hypothesis. And for Popper, the method of science is a method of hypothetico-deduction, we have discussed this, okay.



And in today's lecture we will try to complete Popper's reflections on methods of science which have significant implications for social science research today. We have discussed empiricists always suggest that science always starts with observation, then tentative generalization, then verification and then confirmation. Confirmation so that these observations can turn out to be laws or theories. In the empiricist schema, observation, tentative generalization, verification and confirmation constitute the steps of scientific procedure.

On the contrary, in the Popperian schema, we begin with a problem. We must try to identify a problem. Research always starts with a problem. If there is no problem then there is no point in doing research. Research always starts with a question. That is why, for Popper ,science always tries to identify a problem. That is why I said, in the Popperian schema we begin with a problem, we tend to suggest a tentative solution to the problem or hunch. That the tentative solution to a problem or hunch is nothing but hypothesis. That is why from the very beginning, I have maintained that what is a hypothesis? A hypothesis is a tentative solution to a problem or hunch.

Then we try to falsify our solution by deducing the test implications of our solution, this is the third step. We tend to falsify our tentative solution to the problem or hunch, we tend to falsify our hypothesis. And then we try to show that the implications are not borne out and consider our solution to be corroborated if repeated attempts to falsify it fails. Thus, problem, tentative solution, falsification, and then we will see whether corroboration or refutation, they constitute the steps of scientific procedure. Then problem, problem identification, then tentative solution to the problem or hunch, and then we tend to falsify the hypothesis.

And if our hypothesis is falsified, then it must be refuted. In the empiricist schema, we must accept our hypothesis, we must accept if it is verified to be true, then we must confirm our tentative generalization, as laws, as theories and so on. But in the Popperian schema, if our hypothesis is not falsified, then it must be corroborated. What is this corroboration? Now, keeping the hypothesis permanently tentative. Why we should keep our hypothesis permanently tentative? Why it should be corroborated?

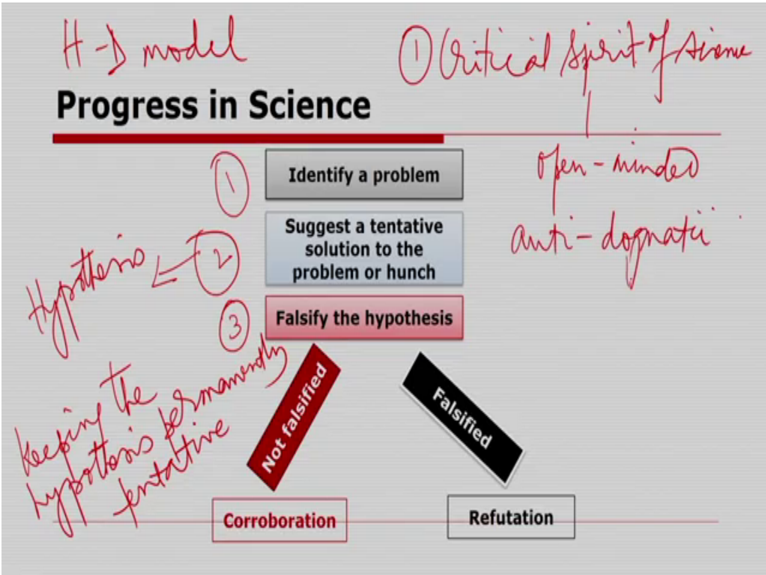
According to Popper, our hypothesis has not been falsified under certain limiting conditions. Then, when we say that we must identify a specific problem, then suggest a tentative solution to the problem or hunch, and then we tend to falsify the hypothesis. If it is falsified, our hypothesis must be refuted. In the empiricists schema, we have seen that if it is verified then we must confirm, if it is not verified, then we must reject that tentative generalization. But in the Popperian schema, if our hypothesis is falsified, then it is subject to refutation. We must refute our hypothesis, and if it is not falsified, then we must corroborate it. We must corroborate our hypothesis.

We must keep our hypothesis permanently tentative, precisely because of the fact that Science is an inquiry into the nature and limits of a particular knowledge- by limits I do not mean limitations, rather, by limits I mean under what limiting conditions science is practised or pursued. Even a set theory has limits, as I have already mentioned earlier. If you look at this, that under certain limiting conditions, under certain limiting circumstances our hypothesis has not been falsified, it does not imply that our hypothesis cannot be falsified under all conditions, that is why under certain limiting conditions our hypothesis has not been falsified, that is why we must try to keep our hypothesis permanently tentative.

One should not be diehard in proving her or his hypothesis. Once you will be diehard in proving or disproving your hypothesis, then it hinders the tradition of cumulative knowledge production. And in this sense, problem, tentative solution, falsification and corroboration or refutation, they constitute the steps of scientific procedure in the Popperian schema. Popper's scientific method is called hypothetico-deductivism or H-D model, hypothetico-deductive model.

Why? Because, according to Popper, the essence of scientific practice consists in deducing the test implications of our hypothesis and attempt to falsify the latter by showing that the former do not obtain, whereas according to empiricism, the essence of scientific practice consists in searching for instances supporting the generalisation arrived at on the basis of some observations and with the principle of induction. You keep on accumulating your observations, particular instances to arrive at concrete generalization.

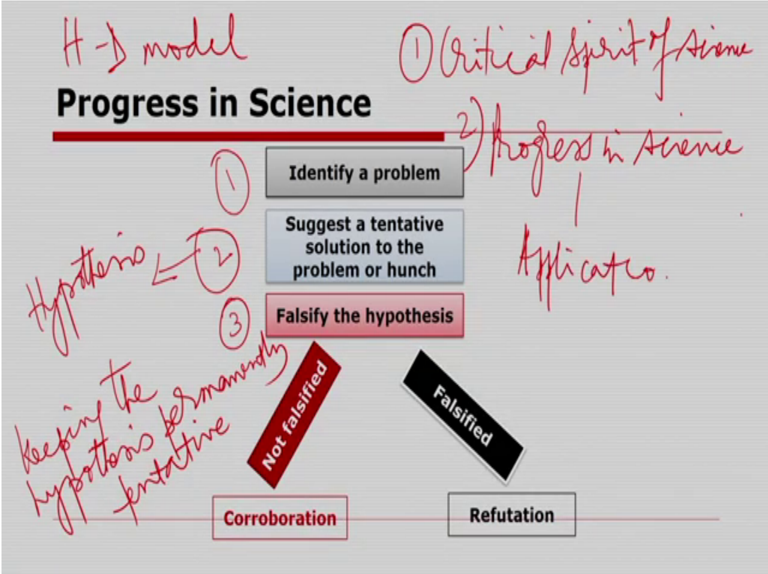
But H-D model, hypothetico-deductive model doesn't follow that.Because the essence of scientific practice according to Karl Popper, consists in deducing the test implications of our hypothesis and attempt to falsify the latter by showing that the former do not obtain. Popper claims that the hypothetico-deductive model of scientific method is superior to that of empiricists, for certain reasons. Why Popper thinks that the hypothetico-deductive model is superior to the empiricist model?



First, hypothetico-deductive model, does justice to the critical spirit of science by maintaining that the aim of scientific testing is to falsify our theories. And by maintaining that our scientific theories, however corroborated, permanently remain tentative.

In other words, the hypothetico-deductivist view presents scientific theories as permanently vulnerable with the sword of possible falsification always hanging on their head. The empiricist view of scientific method makes science a safe and defensive activity by portraying scientific testing as a search for confirming instances and by characterizing scientific theories as established truths.

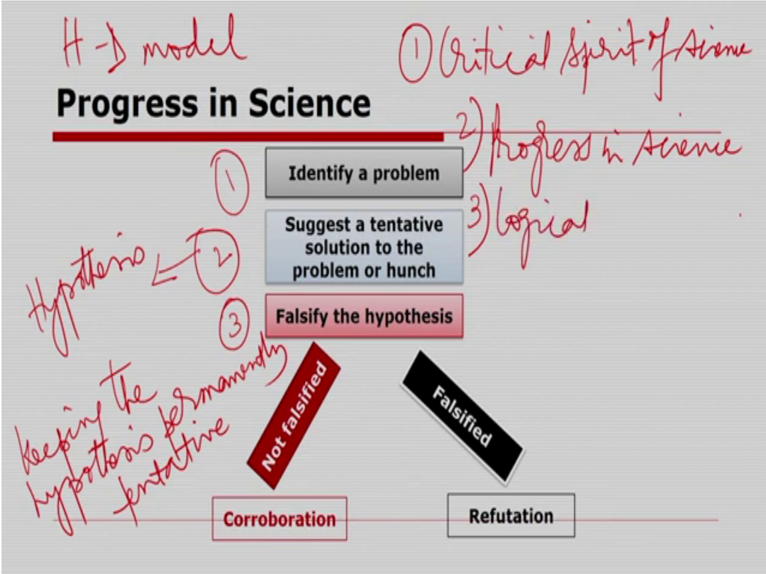
On the contrary, according to Popper, the special status accorded to sciences due to the fact that science embodies an attitude which is essentially open minded. What is this critical spirit of science? Science must be open minded and anti dogmatic. Science does not believe in dogmas. Hypothetico-deductivism, hence according to Popper, is an adequate model of scientific practice because it gives central place to such an attitude. What kind of attitude? An attitude of being open minded, attitude of being anti dogmatic.



Secondly, Popper thinks that if science had followed an inductivist or empiricist spath, it would not have made the progress it has. Suppose a scientist has arrived at a generalization. If that particular scientist follows the empiricist path, then she or he will go on in search of instances which is establish it as truth. If she or he finds an instance with conflicts with her or his generalization, what she or he does is to qualify the generalization mentioning that the generalization is true, except in the cases where it has been held to be unsupported.

Such qualifications impose heavy restrictions on the scope of the generalization, and this results in scientific theories becoming extremely narrow in their range of applicability. But if a scientist follows the hypothetico-deductive view, then that particular scientist will throw away his or her theory once she or he comes across a negative instance, instead of pruning it and fitting it with known positive facts. Instead of being satisfied with the theory tailored to suit the supporting observations, the scientist will look for an alternative which will encompass not only the observations which supported the old theory, the existing theory, but also the observation which went against the old theory, or the existing theory.

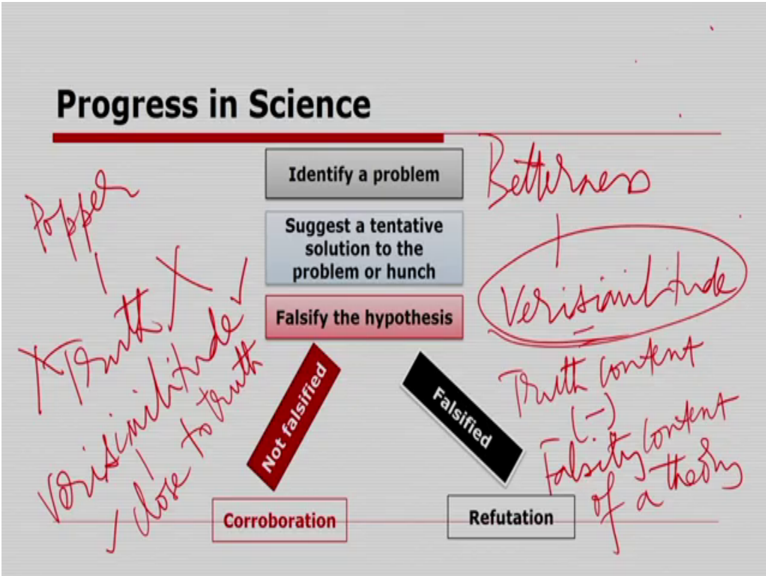
And more importantly, which will yield fresh test implications. The theoretical progress that science has made can be explained by the fact that science seeks to come out with bolder and bolder explanations, rather than taking recourse to the defensive method of reducing the scope of the theories to make them consistent with facts. And therefore, Popper claims that the hypothetico-deductive model gives an adequate account of scientific progress. According to Popper, if one accepts the empiricist or inductivists account of science, then one fails to give any explanation of scientific progress.



And thirdly, for Popper, the hypothetico-deductive model of scientific method avoids the predicament encountered by empiricist theory in the face of Hume's challenge. As we have seen Hume conclusively showed that the principle of induction or the principle of empiricism cannot be justified on logical grounds. If Hume is right, then science is based upon an irrational faith if you keep on believing in empiricism according to Popper.

According to the hypothetico-deductive view, science does not use the principle of induction at all. Hence, even though Hume is right, it doesnot matter to science if science follows the hypothetico-deductivist lines of procedure. Also, Popper seeks to establish that inductivism and hypothetico-deductivism are so radically different that hypothetico-deductive model of scientific method in no way faces any threat, akin to the one faced by positivism or inductivism and empiricism. In this connection, Popper draws our attention to the logical asymmetry between verification, the central component of the empiricist and positivistic schemas, and falsification, that is the central component of the hypothetico-deductivist H-D schema.

They are logically asymmetrical- hypothetico-deductive model on the one hand and positivistic and empirical empiricist models on the other, they are asymmetrical in the sense that one negative instance is sufficient for conclusively falsifying a theory, whereas no amount of positive instances are sufficient to conclusively verify a theory. It may be recalled that Hume was able to come out with the problem of induction or problem of empiricism, precisely because a generalization cannot be conclusively verified. , all theories according to inactivity, more empiricism or positivism are generalizations. In this sense, Hume was able to come out with the problem of induction, precisely because a generalization cannot be conclusively verified.



Then how does Popper characterize science or characterize scientific progress? According to Popper, one finds in the history of science invariable transitions, from theories to better theories. What does the word better stands for? What does it mean? What does it imply? What do we mean by better theories?

It may be recalled that according to Popper, no scientific theory however corroborated can be said to be true. Hence, Popper drops the very concept of truth. In the Popperian schema, there is nothing called truth. He drops the very concept of truth and replaces the concept of truth by the concept of verisimilitude.

What is this verisimilitude for Popper? Truth likeness or truth nearness. You cannot just say that no this scientific theory is absolutely true, it is close to truth, it is verisimilitude. When Popper tried to replace the concept of truth with the concept of verisimilitude in his characterization of goal of science, in other words, those science cannot attend truth that is, though our theories can never said to be true, science can set for itself the goal of achieving higher and higher degrees of verisimilitude That is to say, they can progressively approximate to truth. So, in science, we go from theory to better theory and the criterion of betterness is verisimilitude.

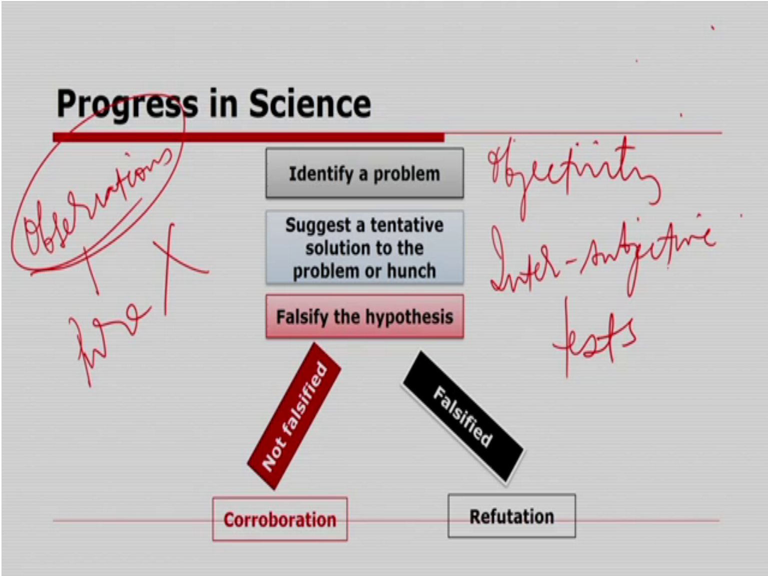
But what is the criterion of verisimilitude? The totality of the best implications of hypothesis constitutes what Popper calls the empirical content of the hypothesis. The totality of the test implications, which is borne out constitutes the truth content of the hypothesis and the totality of the test implications which is not borne out is called the false content of the hypothesis.

And the criterion of verisimilitude of a theory is nothing but truth content minus false content of a theory. Truth content minus false content of a theory is equal to verisimilitude. What is then verisimilitude? Verisimilitude is equal to truth content truth content minus falsity content of a theory.

In the actual history of science, we always find that the theory is being replaced by better theories, that is theories with higher verisimilitude. In other words, of the two successive theories, at any point in the history of science, we find the successor theory possesses greater verisimilitude and is therefore, better than its predecessor. Indeed, according to Popper, theory is rejected as false only if we have an alternative, which is better than the one at hand, better than the existing one, in the sense that it has more test implications and a greater number of its test implications are already borne out.

The growth of science is convergent in the sense that the successful part of the old theory or the existing theory is retained in the successor theory with the result, the old theory becomes a limiting case of the new one. For Popper, the growth of science thus shows a continuity. In other words, it is the convergence of the old theory into the new one that provides continuity in the growth of science. It must also be mentioned here, that in this connection that unlike empiricists or positivists, Popper is a realist.

In the sense, according to Popper, scientific theories are about unobservable world. This implies that the real world of unobservable though can never be captured by our theories entirely, is becoming more and more available to us. Popper contends that the greater and greater verisimilitude attained by our theories, evidence that the gap between the truth and our theories can never be completely filled, it can be progressively reduced with the result, the real world of unobservables will be more and more like what our theories say, though not completely shown.



How does Popper establish objectivity of scientific knowledge? For example, empiricists sought to establish the objectivity of science by showing that scientific theories are based upon pure observations. Science is objective, science is neutral, science is value free, science is not value laden, non-sciences are value laden, but science is value free.

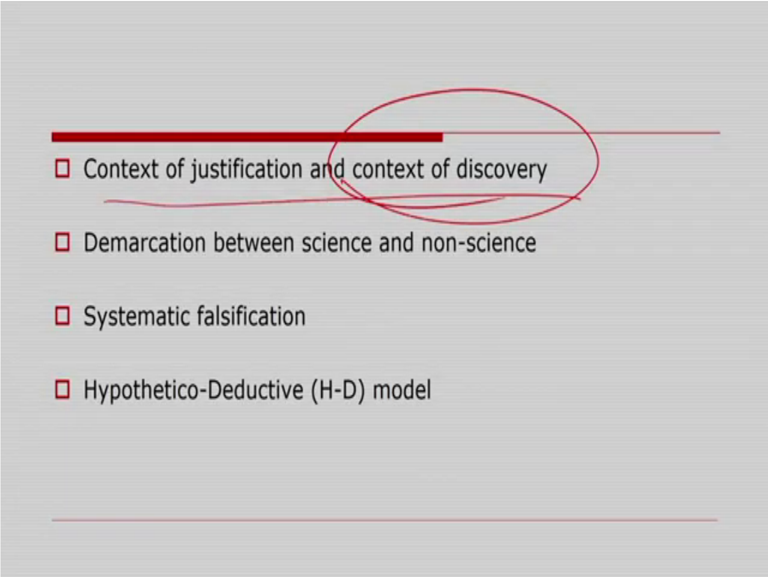
The so called pure observations, were supposed to be absolutely theory free. They are only given and hence free from the subjective consequences, subjective inferences, subjective dispositions. Popper, as we have seen, rightly rejects the idea of pure observations- for empiricists, for positivists, observations are pure. For Popper, they are not. They are not, there is nothing called pure observations.

Consequently, Popper cannot accept the empiricist account of objects or the objectivity of science. First, what endangers scientific objectivity, according to Popper, is not the possibility of pure observation, but the possibility of intersubjective testing. In short, science is objective because it is public and it is public because its claims are intersubjectively testable.

Secondly, Popper makes room for relative autonomy of facts or observations. That is to say, whereas the empiricists considered observations to be absolutely theory free, Popper construes them to be relatively theory free. Popper maintains that, though an observation must depend upon some theory, it can be independent of the theory which is tested in terms of it. Hence, the theory depends upon a prior observation- whether a theory has to be rejected or it has to be kept permanently tentative, whether it has to be corroborated or tentatively accepted.

A theory for Popper depends upon prior observation which in turn needs ratification in terms of theory prior to it. To the question which comes first, observation or theory, empiricists immediately suggested, observations come first. Popper answers earlier observation or earlier theory. To Popper, the question is as illegitimate as the question which comes first egg or hen, that can be only answered by saying earlier egg or earlier hen.

In what follows, let us make a few critical comments on Popperian methodology which has as many detractors as admirers. Before moving on to Thomas Kuhn's paradigm shift, we will try to make a few critical comments on Popperian methodology, the way Popper draws an invidious distinction between the context of discovery and context of justification.



If you slightly recall, we said that Popper tried to associate a rationalist account of science with the context of justification and Popper refuses to say anything about the context of discovery, such distinction he tried to make. Why? Precisely because Popper maintains that philosophy of science as methodology of science must confine itself to the context of justification, since according to him, discovery or the other process of discovery involves irrational factors of which defy rational explanations.

Why? Now, precisely because his rejection of the possibility of a rational account of discovery has been called into question. Popper seems to confine his attention to the examples like Kekuele's discovery of Benzene structure wherein the central idea occur to Kekeule in a dream. But not all such cases are standard, typical discoveries are provided by an elaborate reasoning process. Even in the case of Kekeule, one must explain why only that dream was taken as providing a clue to the benzene structure. It appears more plausible to say that Kekeule had undertaken enough reasoning to get the hint from that dream.

That is to say, though, clicks, hunches, intuition and other imponderables do play a role in the formation of hypothesis, they are preceded and succeeded by a long and guided chain of reasoning. Perhaps the main reason for Popper's rejection of the possibility of a rational account of discovery is his identification of the possibility of a rational account of discovery with the possibility of an empiricist account of discovery.

The empiricist account of discovery maintains the use of the principle of induction, coupled with repeated observations leading to discovery. Later, empiricists like Mill even tried to work out thumb rules of discovery. Popper is right in saying that empiricists came nowhere near providing an account of discovery, no amount of observations can suggest to us a theoretical idea.

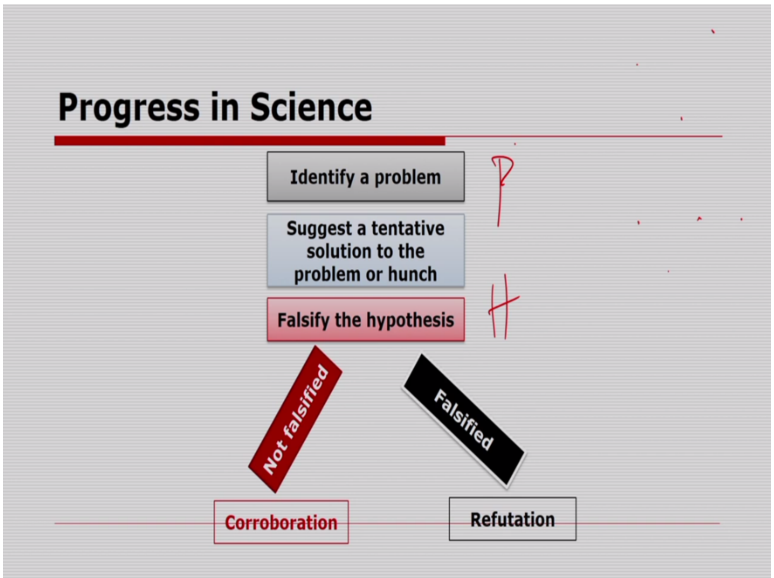
But Popper is wrong in thinking that from this it follows that a rational account of discovery is an impossibility. NR Hanson, for example, in his Patterns of Discovery comes heavily on Popper and advances a theory concerning discovery on the basis of the work by Charles Pierce. If according to Popper, the essence of science consists in the way in which theories are tested, according to Hanson, real science is over with the conception of the hypothesis.

To quote Hanson, "there is something wrong with the hypothetico-deductive account. If it were construed as an account of physical practice, it would be misleading. Physicists do not start from hypothesis, they start from data, though not in the empiricist fashion. By the time a law has been fixed into the into a hypothetico-deductive system, a really original and physical thinking is over."

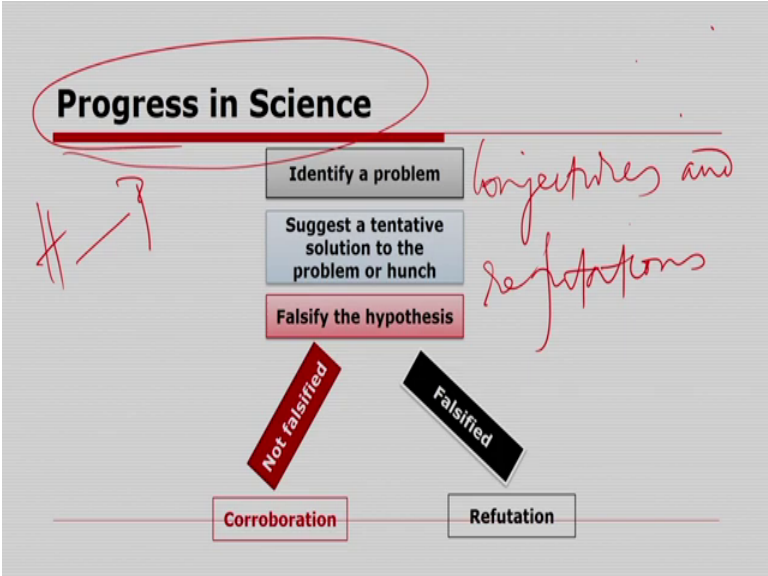
The pedestrian process of deducing observation statements from hypothesis comes only after the physicist sees that the hypothesis will at least explain the initial data requiring explanation. And reacting to Popper's contention that the context of discovery is irrelevant from the methodological point of view, that he always said that context of discovery is an impossibility, if we have to look at it from a methodological vantage point, Hanson suggests that Galileo struggled for 34 years before he was able to advance his constant acceleration hypothesis with confidence.

Is this conceptually irrelevant? Was it only the predictions from his hypothesis which commended to Galileo? The philosophers of science must answer no. Discussing in detail the process by which Kepler arrived at his final position, Hanson concludes, Kepler never modified a projected explanation capaciously. He always has a sound reason for every modification that he made. When exactly satisfied the observations it stood up on a totally different logical footing from what it would if it has been struck out at random, and has been found to satisfy observations.

In this sense, Kepler shows his keen logical sense in detailing the whole process by which he finally arrived at the true orbit.



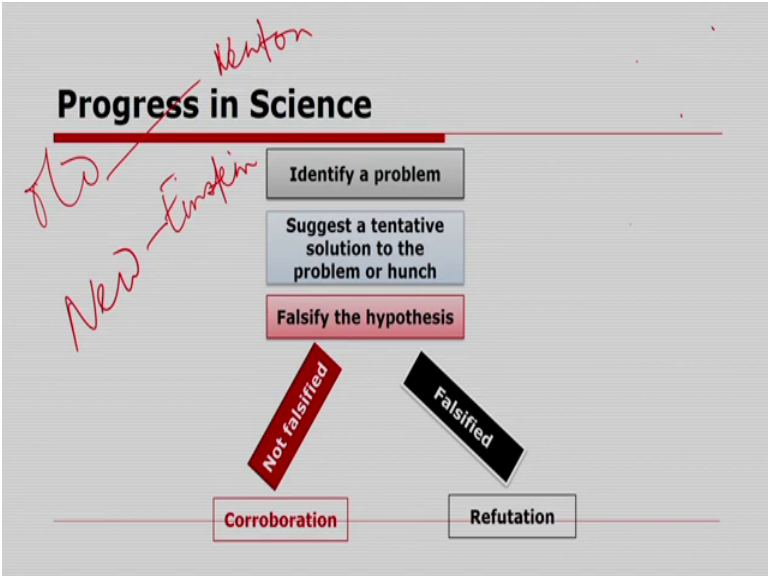
This is the greatest piece of retroductive reasoning ever performed. The type of reasoning which has gone into Kepler's thinking N R Hanson characterises as retroductive- the form of the inferences some surprising phenomenon suppose P is observed, and P would be explicable as a matter of course, if a hypothesis H is true and hence, there is a reason to think that H is true; H does not emanate from some unaccountable criterion as hypothetico-deductivist think, nor from some simple repetitions of observation as empiricists think. It emanates from a mode of thinking, which seeks to find out a plausible pattern into which, what are observed or fitted.



A hypothesis provides such a plausible pattern. Before we test a hypothesis, it must at least be plausible and not just a conjecture; this is what Popper discusses in Conjectures and Refutations, that before we test a hypothesis, it must at least be plausible and not just a conjecture. Of course, apart from its plausibility, the hypothesis must satisfy further conditions such as if a hypothesis H is meant to explain a phenomenon P then H cannot itself rest upon the features in P which required explanation. That is why the peculiar colour and odour of chlorine P, are not explained by reference to atoms in a volume of chlorine each one having the colour and odour in question H. Understanding this point is essential for any understanding of the fundamental concepts of modern particle physics.

Of course, the current work on Discovery has gone much ahead of Hanson in terms of sharpness of articulation and rigor of analysis. But the credit of putting on defensive the Popperian position on discovery goes to Hanson's path breaking work.

Another serious lacuna in Popper's position concerns is idea of scientific progress. The progress in science is continuous in the sense that in two successive theories, the latter contains the former or the best part of it.



If you have two successive theories, suppose if I say old one and the new one, the new one must contain the former or the best part of old one. The continuity of scientific progress is exemplified by the fact that, that between two successive theories, the former is always the limiting case of the latter; the old one must be the limiting case of the new one.

In this connection. Popper cites the example of Newtonian theory and Einsteinian theory. Suppose, if I say, the old one is represented by Newton, and the new one is represented by Einstein, but that is how Popper tried to cite this, these examples. But Popper first overlooks the fact that in the actual history of science, such comparables are rare. For example, it is assured to say that phlogiston chemistry is the limiting case of oxygen theory or polemic theory is the limiting case of Copernican theory. Secondly, Popper's idea that our successive theories exhibit increasing degrees of verisimilitude is more like what our present theory says then what our earlier theory indicated.

It implies following Popper, we must say that the ultimate constituents of matter are more like fields as contemporary physical theory indicates, than particularized classical physics indicated. But this is slightly unintelligible. In short, we are led into in unintelligibility if we literally apply Popper's characterization of two successive theories to the very cases he takes to be paradigmatic.

And finally, in characterizing the old theory as an approximation to the new one, Popper assumes that the general locations of the new theory imply the same things as in the old one. That is to say, Popper assumes that when a fundamental shift in theory takes place, the meaning of the terms remain invariant. This assumption has been called into question by some philosophers of science, who show that the terms like mass or force that have one meaning in Newtonian framework and another in the post Newtonian framework.

For example, if you at the works of Kuhn that we are going to discuss in the next lecture, you will find Kuhn, and later on if somebody is interested, he or she can look at Paul Feyerabend works, Lakatos's work, Michael Polanyi's works and so on. Especially Kuhn and Feyerabend have convincingly argued that a shift from one theory to another is accompanied by a shift in the meaning of the works that are common to both the theories. If so, then Poppers entire characterization of growth of science as continuous, collapses.

Then till now, what we have discussed? We have discussed how does science make progress, how does Popper characterize scientific progress - in terms of certain steps of scientific procedure. In the Popperian schema, science must start with a problem, then it must suggest a hypothesis as a tentative solution, then try to falsify our solution by deducing the test implications of our solution and then try to show that the implications are not borne out and consider our solution to be corroborated if repeated attempts to falsify it fails.

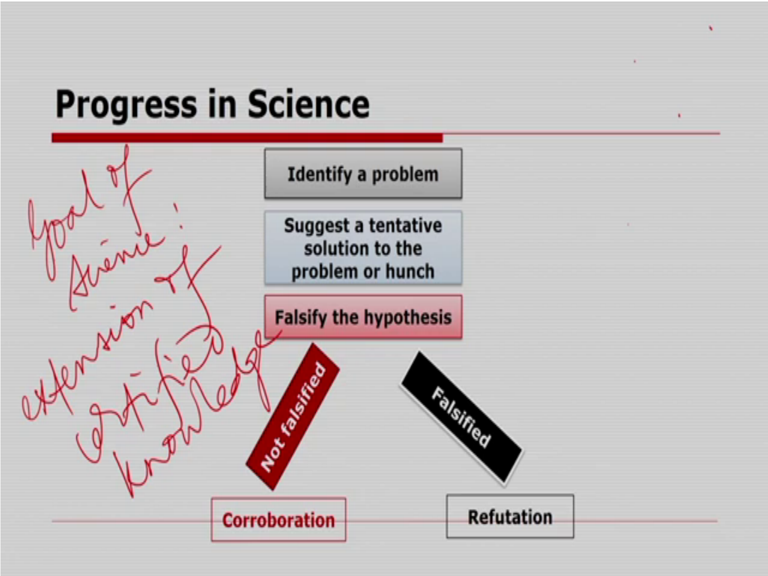
Thus problem identification, tentative solution, systematic falsification and corroboration or refutation, they constitute the steps of scientific procedure in Popperian schema. And Popper's theory of scientific method is called hypothetico-deductivist model of scientific method. Because, according to Popper, the essence of scientific practice consists in deducing the test implications of our hypothesis and attempt to falsify the latter by showing that the former do not obtain.

Popper claims that, as we have already discussed, that the hypothetico-deductive model is superior to the empiricist model or the positivist model, in the sense that the hypothetico-deductive model, H-D model does justice to the critical spirit of science by maintaining that the aim of scientific testing is to falsify our theories. And by maintaining that our scientific theories, however corroborated, permanently remain tentative.

In other words, the hypothetico-deductivist view presents scientific theories as permanently vulnerable with the sword of possible falsification always hanging on their head. According to Popper, the special status accorded to science is due to the fact that science embodies an attitude which is essentially open minded and anti dogmatic. Because science doesnot believe in dogmas according to Popper.

And hypothetico-deductivism is an adequate model of scientific practice, according to Popper, because it provides a central place to such an attitude, that attitude of being open minded, attitude of being anti dogmatic. And secondly, Popper thinks that if science had followed an empiricist path or a positivistic path, then it would not have made the kind of progress that it has made. That is I gave you this kind of example that how a scientist makes generalization and so on.

And thirdly, the hypothetico-deductive view, according to Popper, avoids the predicament encountered by empiricists theory in the face of Hume's challenge. According to Popper, one finds in the history of science invariable transitions from theories to better theories. That is how we have discussed the concept of verisimilitude. What does the word better mean? What does the word better imply? What does the word better stand for in the Popperian schema?



It may be recalled that according to Popper, no scientific theory however corroborated, can be said to be true. Hence, Popper drops the very concept of truth and replaces it by the concept of verisimilitude, truth likeness or truth nearness or closer to the truth in his characterization of the goal of science. Now, what is that goal of science? The goal of science is the extension of certified knowledge.

In other words, though science cannot attain truth. That is, though our theories can, can never set to be true, science can set it for itself the goal of achieving higher and higher degrees of verisimilitude, that truth likeness, truth nearness, closer to the truth, okay that is they can progressively approximate to truth.

So in science, we go from theory to better theory. What is the criterion of betterness- the criterion of betterness is verisimilitude. Then what is the criterion of verisimilitude? The totality of the best implications of hypothesis constitutes what Popper calls the empirical content of the hypothesis. The totality of the test implications, which is borne out constitutes the truth content of the hypothesis and the totality of the test implications which is not borne out is considered the false content of the hypothesis.

And the criterion of the verisimilitude of a theory is nothing but truth content minus falsity content of a theory. And in the actual history of science, we always find the theories being replaced by better theories, that is theories with higher and greater verisimilitude. In other words, the two successive theories at any time in the history of science, we find the successor theory possesses greater verisimilitude and is therefore better than its predecessor.

Indeed, according to Karl Popper, a theory is rejected as false only if we have an alternative which is better than the one at hand, better than the existing one, better than the old one in the sense that it has more test implications and a greater number of test implications are already borne out. The growth of science is convergent in the sense that the successful part of the old theory or the existing one is retained in the successor theory with the result that the old theory becomes a limiting case of the new one. And that is why the growth of science shows a continuity.

In other words, it is the convergence of the old theory into the new one that provides continuity in the growth of science. It must also be mentioned in this connection that unlike empiricists, or positivists, Popper is a realist in the sense according to whom scientific theories are about an unobservable world. It implies that the real world of unobservable, though can never be captured by our theories entirely is becoming more and more available to us.

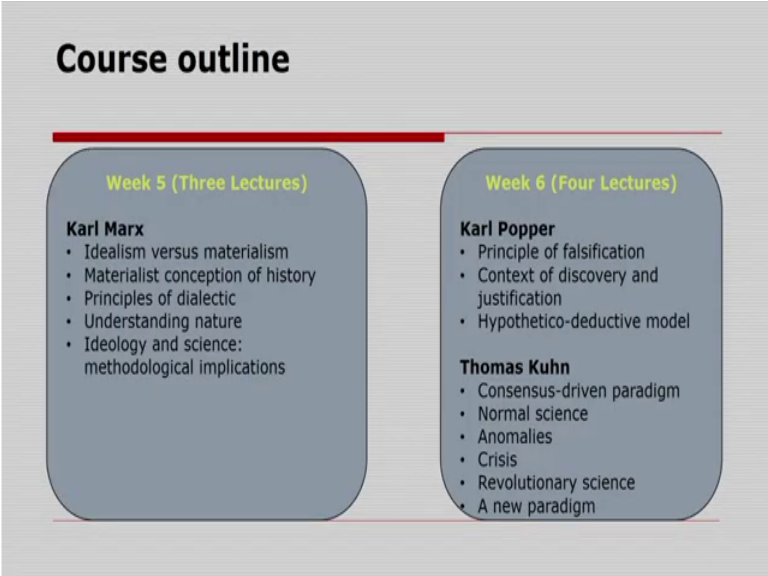
Popper contends that the greater and greater verisimilitude attained by our theories, evidence that the gap between the truth and our theories can never be completely filled. It can only be progressively reduced. With the result of the real world of unobservable will be more and more like what our theories say, though not completely so. That is how Popper tried to establish the objectivity of scientific knowledge- Not the way empiricists or positivist suggested that science is absolutely objective neutral, science is value free.

For Popper they are only given. But Popper, as we have seen, rightly rejects the idea of pure observations. Consequently, Popper cannot accept the empiricist account of the objectivity of science. First, what engendered scientific objectivity, according to Popper, is not the possibility of pure observation but the possibility of inter subjective testing. That is what we have discussed in this lecture, that is to say that science is objective because it is public. And it is public, because its claims are inter subjectively testable.

Secondly, Popper makes room for relative autonomy of facts or observations, that is to say, whereas empiricists considered observations to be absolutely theory free, Popper construes them to be relatively theory free. Popper maintains that though an observation must depend upon some theory, it can be independent of the theory which is tested in terms of it. Hence, a theory depends upon whether the theory is rejected or corroborated. It always depends upon a prior observation, which in turn needs ratification in terms of theory prior to it.

In this sense, Popper tried to grapple with the relationship between observation and theory. Unlike empiricists or positivists the way they said that observation is prior, observation comes first, observations lead to theory generation, and there is a unilinear relationship between observation and theory. For Popper, the answer to whether it is observation or theory, Popper answers, earlier observation or earlier theory. To Popper, the question is as illegitimate as the question which comes first, egg or hen - that can only be answered by saying earlier egg or earlier hen.

That is how we have discussed today Popper's reflections on the methods of science, which have significant implications for social science research today. And we have also discussed how N R Hanson, he tried to critically evaluate Popperian schema of hypothetico-deductivist model of scientific method.



In the next lecture, we are going to discuss Thomas Kuhn and his concept of paradigm shift, paradigm is nothing but a model. Then, if a model of scientific method that has been designed in such a manner, whether it follows logic, whether it follows observation statements, whether it follows hypothesis or it follows a problem. But what Kuhn suggests that perhaps that this model has been designed, the model has been approved by the kind of consensus that the scientific community has and whether science is greatly intertwined with politics or not.

For example, if I say, India going guide with nuclear tests,is it a scientific question or a political question, perhaps there is a closure alliance between science and politics today along with industry. And in this sense, that whether the kind of consensus that we want to build today while making policies, while making decisions, while framing a model, while framing paradigm that you will find that we tend to have a consensus which has become a by-product of the alliance between science, politics and industry.

What we are going to discuss in the next lecture that how Kuhn tried to look at paradigm shifts from pre paradigmatic stage to paradigmatic stage; from within the paradigmatic stage how normal science is practiced., normal science means norm-bound science, rules and regulations bound science is practiced. Normal science is a puzzle solving activity, day to day activities purported to do research. And within normal scientific tradition you will encounter some unanticipated or unexpected occurrences or happenings, these are known as anomalies. And when you tend to encounter anomalies within normal scientific tradition, then science enters the phase of crisis.

When science becomes crisis ridden, it tries to search for alternative paradigms. While looking for alternative paradigms, science always tries to go beyond normal scientific tradition, thereby science tries to look for, hunt for, search for alternative paradigms or a new paradigm by revolutionising the nature of science itself.

When science becomes crisis ridden, science looks for a new paradigm mediated by a revolutionary science. That is why if normal sciences is a tradition bound activity, then revolutionary science is a tradition shattering activity. That is what we are going to discuss in the next lecture. Thank you.