

**INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI**

**NPTEL**

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**Science, Technology and Society**

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Then what we see the way joins to at mill try to provide these 5 rules 5 methods the method of agreement the method of difference the method of the joint method of agreement and difference the method of residue as well as the method commitment variations okay the use of any mills methods presupposes and anti schedule of assumption about which circumstances a relive vent for the explanation of the phenomena under investigation.

Once these circumstances are chosen as possible causes the method a single method and in among those 5 methods which we have discussed of joins to at mill or a combination of all methods or a compilation of 2, 3 methods they help us correlate some of them with the phenomena under consideration, but this choice of possible causes might be if it is so the conclusion inferred by mills methods first cannot remain unaffected.

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The use of any Mill's methods presupposes an antecedent, assumption about which circumstances are relevant for the explanation of the phenomena under investigation. Once these circumstances are chosen as possible causes, the method(s) help to correlate some of them with the phenomena under consideration. But this choice of possible causes might be erroneous. If it is so, the conclusion inferred by Mill's methods first cannot remain unaffected by the original mistake. Secondly, even if a correlation is established, there is no proof that correlation is not fortuitous but necessary (or lawful).

By the original Investec second even if a correlation is established there is no proof that correlation is not fortuitous with us but necessary.

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Though it is true that greater the number of observed instances of correlation, higher the chances of the correlation being lawful and not fortuitous; we can never assert with certainty, no matter how many the observed instances, that the correlation is not fortuitous. Thus, the logical cleavage between induction and deduction which Mill tried to get rid of remained intact. The cruel fact that induction is induction, and deduction is deduction and the twin shall never meet remained unaltered to the discomfort of the inductivists.

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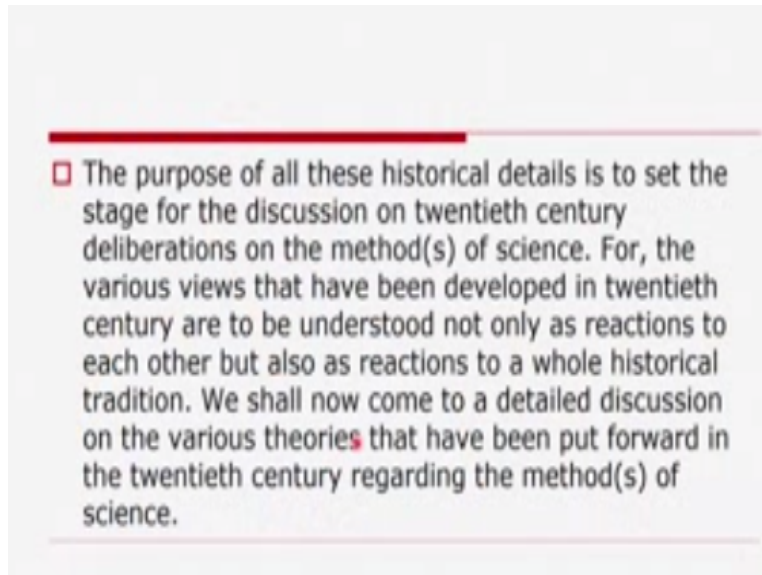
Though it is true that greater the number of observed instances of correlation higher the chances of the correlation being lawful and not fortuitous we can never assert with certainty no matter how many the observer insistences that the correlation is not fortuitous thus the logical cleavage between induction and deduction which Mill try to get rid of remained intact the cruel fact that induction is induction and deduction is deduction and the twins shall never meet remained unaltered to the discomfort of the inductivities.

Purpose of all these I mean till now what we have discussed quickly let us recapitulate we have discussed the auto logical as well as the normative structure of science okay and from there on we will move to the methods of science the in the methods of science we are discussing inductive and hypothesizes which were very much prominent since the 17 century I mean with the birth of the modern philosophy of science.

And they have become I mean they became relieve methodologies and each of these methods had followers among natural philosophers as well as moral philosophers I means scientist as well as philosophers okay and then what we said that the way inductivities suggested that to know science must began with observations must remain at the level of observations and also must end with observations hypothesis claim that science begins only with we go beyond objects that is why it must be trans observation or in nature okay why do we do this exercise in HTS studies philosophy of science I mean why do we study philosophy of science methods of science in histories okay.

The purpose the intention of all these historical details is to set the stage for the discussion of 20<sup>th</sup> century dilapidations on the methods also okay for the various views that have been developed in 20<sup>th</sup> century or to be understood not only as reactions to each other but also as reactions to hole historical tradition we shall now come to a detailed discussion on the various theories that have been put forward in the 20<sup>th</sup> century regarding.

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The methods of science, now let us see how we can look at these particular phenomena okay.

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## Positivism

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- The twentieth century begins with the emergence of a school of thought called positivism. Positivism is an extremely well-known and till recently very influential theory of science and its method. It is a closely knit set of tenets formulated with an admirable amount of clarity and consistency.

The most important and the first method of science that we witness in the 20<sup>th</sup> century okay begins with the emergence of a very dominant school of thought called positivism. Positivism is an extremely well known and till recently very influential theory of science and its method it is a closely knit set of tenets formulated with an admirable amount of clarity and consistency. If you look at the law of stages by August Comte you will find that how is to come to follow three stages in the development of society in the development of our economical culture.

In politics okay those three stages are theological stage metaphysical stage and the positive or scientific stage. What is this theological stage? Theological stage believed in the fact that changes occur because of super natural interventions. Changes can and should be whatever social economic political changes cultural changes there must be attributed to the super natural movements.

Super natural interventions on the other hand metaphysical stages suggest that no it is not mediated by super changes or not mediated by super natural forces, rather the arrow by predict of natural movements, movements by nature everything is mediated through which where edge positively stick stage or scientific stage suggests that no it is not positive is rejected the idea that changes do not occur because of super natural forces, at the same time changes do not occur because of the movements of nature.

Changes occur because of the interventions made by human action human labor if you look at this transition, then it can take us to a different label you will find that tell this the 17<sup>th</sup> 18<sup>th</sup>

century in a specifically inglet okay, you on the whole that you will find that in 18<sup>th</sup> century we witness industrial revolution, and enlightenment, modernity, critical thinking reasoning capacity the capacity to interrogate the dominance of church west question, okay I mean science became super critical thinking.

Became so prime okay perhaps that kind of enlightenment we have not witness till now in Indian context okay in partially we have witness but we have not it witnessed that kind of an enlightenment okay it does not imply that we have to follow that only that kind of enlightenment we can have our own enlightenment also so that is a different matter, but why did positive is in deviate from metaphysical stage or why metaphysical stage deviated from a why did metaphysical stage deviate from theological stage.

Because super natural forces which theological stage propagated for okay, do not have any place in the metaphysical schema okay I mean super natural forces where termed unscientific absolute okay they where guided by Dogma they where guided by Dogma is propagated by a religion propagated by the powers that the propagated by the state propagated by the kings emperors and shown, in that case in such circumstances metaphysical stage obviously where is a much improved stage as compared to the theological stage metaphysical stage suggest no there is no place for super natural force in our schema.

Of knowledge production rather changes occur only when nature intervention then there is a concept called natures digged up that nature controls human action, human beings started contemplating on nature that is called faculty of contemplate okay, then what scientific stage or positivistic stage or that no human beings do not simply contemplate on nature but also control nature then we witnessed are transition from faculty of contemplate and to faculty of control that is once mark said.

That by action up and nature human beings not only change nature but also change the source and relationships I mean human beings not only change nature but also change themselves that is very important but this control over nature and prior to control over nature we discussed that faculty of contempt place and okay these transition from facility of contem pleasant to facility of control in the context of the transition from metaphysical stage to the positivistic or scientific stage must be understood okay, that is why in the metaphysical stage nature was placed on a

higher pedestals these are the human beings, whereas in the positivistic or scientific stage human beings were placed on a higher pedestals these are the nature that is important, okay.

I mean in the metaphysical stage nature was the subject and human beings were objects, whereas in the positivistic stage human beings become subjects whereas nature became object okay, then in this kind of transition of and this transition has not occurred overnight this transition has occurred due to changes in the modes of production due to changes in our intellectual and political consciousness over time and across space, that is why many, many perspective thinkers they also have suggested that you know the distinction between facility of contemplation.

And facility of control is not rigid but for us because human beings are always a part of nature and human beings also know how to control nature at the same time nature also knows how to exhibit its anger towards human intervenes undo human intervenes, okay.

And why I said undo in human intervenes precisely because the way human beings today dominate nature in fact this a power over nature or domination over nature has in reality been translated into power over people and that is why we see in the construction of big technology projects construction of large dams, deforestation how this power over nature controlling the particular technology has affected millions of lives and their livelihoods.

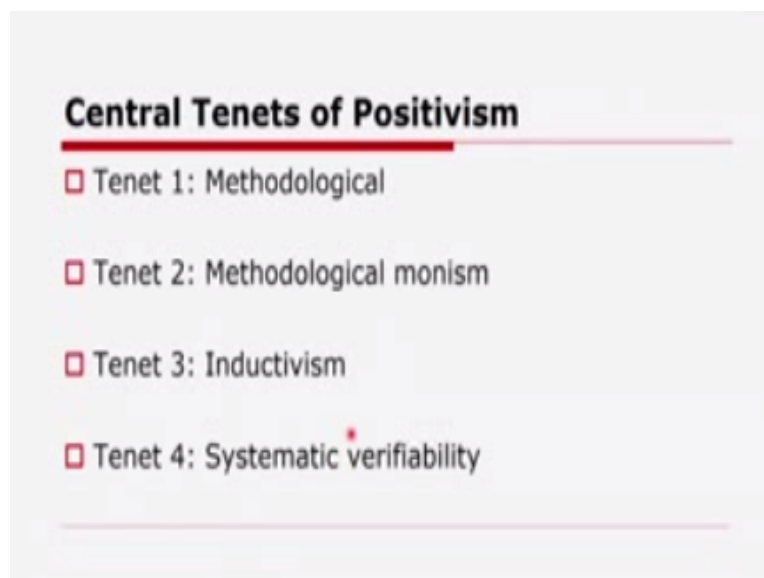
And it is this domination over nature I mean domination over nature and then subsequently domination over people power over nature subsequently power over people okay, has made a murky of liberty in any substantial scene and any how got freedom to you have got liberty, the idea of liberty which was envisaged at during the French revolution of 1770 and 1848 but if you look at this liberty also fades always with the passage of time because of this undo human intervenes, okay.

But this is just say for separate story all together how we can bring about a critic to this a power over nature, but or power over people but for the time being let us concentrate more on the aspect of scientific stage or positivistic stage, positivistic stage emerged I mean positivistic should squarely against metaphysics the scientific stage a positivistic stage they coated the dominance of charge, they propounded for industrial revolution, they propounded for changes in the modes of production, okay.

They propounded for more and more reasoning capacity among the people I mean positivism always was in favor of scientific temper okay, in these context we are going to discuss positivism as a, I just as a method we have only discussed a positivism as a stage of society, as a stage in the development of society from ethological stage to metaphysical stage to positivistic or scientific stage, but now we will see positivism as a method of science, as a method to generate knowledge as a method to produce knowledge this is very important, okay.

Now what are the, then if positivism is even today is a very important method to produce scientific knowledge okay, till what are the central characteristics.

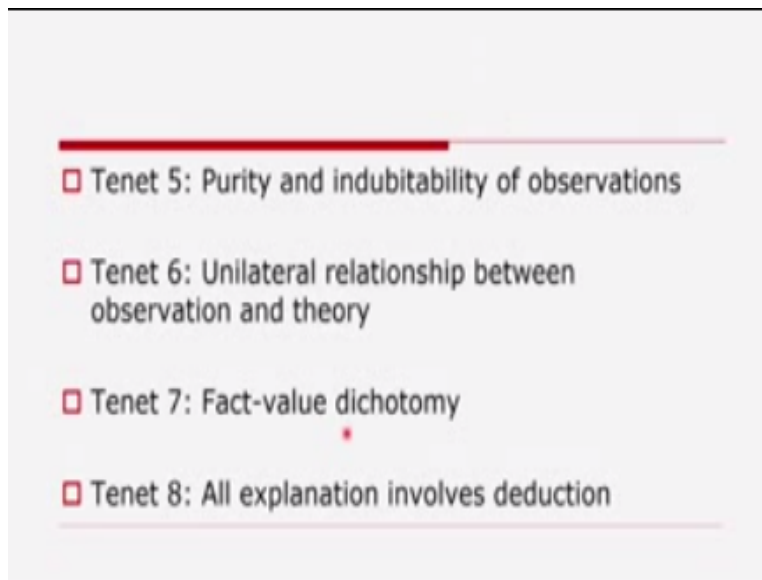
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What are the central tenets of positivism okay, first tenet 1 that is methodological what is this methodological we will say methodological, methodological monism, inductivism.



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- Tenet 5: Purity and indubitability of observations
  - Tenet 6: Unilateral relationship between observation and theory
  - Tenet 7: Fact-value dichotomy
  - Tenet 8: All explanation involves deduction

Systematic verifiability, observations are pure and indubitable, observation unilateral relationship between observation and theory there must be a dichotomy between fact and value.

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## **Central Tenets of Positivism**

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- Tenet 1: Methodological
  - Tenet 2: Methodological monism
  - Tenet 3: Inductivism
  - Tenet 4: Systematic verifiability
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All explanation in must involved detection and so on we will see what kind of thing okay, when I say methodological I mean that science is for positive it's for the proponents of projective is that science is distingue from all areas of human activity or creativity because it progress a method unique to it, that is the first and perhaps one of the first and for most important characteristics of positivism. What is that?

The science is distinct from all areas of human activity or creativity because it progress a method unique to it. I mean other areas of human activity or creativity because of the context positivism also emerged as a re-accent to both theological as well as metaphysical stages. Okay then if a proponent of theology okay suggest that no knowledge is produced through believes it does not imply that science does not have any believe kind of the believes in certain believes and follows certain believes but those but theology does not allow those believes to be translated in to the forms of knowledge.

Theology does not allow those believes to be verified theories I mean theology is do not allow I mean the theological frame work does not allow those believes to be cross checked examined explained. Whereas positivism provides that space for it is believes to be examined explained

verified cross checked and so on, how? In terms of empirically conformed and logically consistent statements of regular it is.

It must be based on experience as well as region okay. That is what positivism believes in this it is very important that science is distinct from all areas of human activity or creativity because progresses a method unit to it, that is methodological. Then what is this methodological monism? If you look at this then the, that there is only one method common to all sciences irrespective of the subject matter that is methodological monism.

Let whether it is physics or chemistry or biology or astronomy okay the follows a method common to they follow the common method okay it does not reply that this is the end we can also have a predict to positivism later on okay, if you look at these I mean let you will not find the kind of methods that science is follow the same methods theology or metaphysics never followed okay that is why these methods I mean though then what kind of methods you know in the basis of experience and region.

Thirdly third tenet leis in intuitivism that the method of science is the method of induction positivism is are giped let you come from you make principle of induction I mean the method of induction which suggest that you start with the particular instance then provide an in evidence in terms of two premises you require at least two premises to arrive at a concrete generalization or you drive a conclusion okay suppose sacristies is motel x sacristies is motel sacristies is a man that why all manner motel okay that is the method of induction that from particular instances to arrive at a concrete generalize okay.

Then the forth one is systematic verifiability positivism argued that the hallmark of science consist in the fact that it statements are systematically verifying, that is why I gave you the example that I have seen a ghost if I have seen a ghost the others also should be able to see that I can say that you know I have seen a ghost I talk to my grandfather at nights but that is not science that is something else okay.

Because it cannot be verified, okay somebody may say that no just because it cannot be verified it can it not be call it science but science always believes in not simply absorbable facts but also verifiable facts which the frames of theology and metaphysics they missed out they do not believe anything they only believe in the absorbable facts but projective claim that they

projective argue that science not only believes in absorbable facts but also believes in verifiable facts okay if those observations cannot be verified cannot be cross checked cannot be explained cannot be examined properly when that is not satisfy okay.

That is not a part of knowledge acquisition activity okay the fifth point, the fifth point the scientific observations or shown or can be shown to the pure in the sense that there that purity will come to indubitability a little while let okay that scientific observations are can be shown pure in the sense that their theory independent.

I mean observations theory are independent observations do not depend on theory as inductivism starts that is why we what did inductivism survey that observe in first we must make collect observational data without recourse to any theory in this sense if you look at that observation in the projectivism schema okay.

Their theory independent they do not depend on theory it leads us to make a point that theory denote from facts or observations, observations are not denote from facts observations or facts are not denote from theory rather theories are denote from or drawn from facts or observations such that a theory what is the theory for in projectivism schema.

A theory is nothing but nothing more than a condensed version of an therefore reducible to set of observations or set of statements and describing observations I repeat that theories are we note from facts or observations such that a theory is nothing more than a condensed version of an therefore is reducible to a set of statements describing observations okay.

It leads us to appoint where we can say that there is a unilateral relationship between observations and theory okay if I say there is a there must be a unilateral relationship between observation and theory then it implies that theories are dependent on observation where as observations are theory independent observation leads to theory formulation where as theory leads to observation rather theories are dependent theories are very much contingent of the way we make objects.

That is why there is a unilateral relationship between observation and theory observation leads to theory but the converse is not okay that is why if I say that to given set of observation statements their corresponds uniquely or theory such that we can deduce theory from objects okay then why it is so that only observation can lead to theory but not the converse is not to why it is so.

Now precisely because if you look at this that the observation that we make in the projectivism schema it is constitute that facts where as theories are not facts in the positive schema theories are we note from those facts those facts they make theory possible those observations they make a theory possible.

That is why there must be the dichotomy or distinguishes between facts and wealth what is dichotomy? A dichotomy means approached group, approached category if I say subject object image takes okay there they constitute dichotomy they essentially they constitute immensurability thesis they are not compensable with each other okay.

That is why there is dichotomy between facts and wealth okay I mean that about factual judgments or valid neutral and our values judgments have no factual contained if I say perhaps able to see this table or see this laptop okay this is a fact this table is a fact this mouse is a fact if I show okay.

But if you look at this but if I say no this laptop looks beautiful if I say this table looks ugly if I say this mouse looks beautiful then I had value to which this is not a fact okay science bring a instance of actual enquiry okay does not have any value contained or does not have value commitments science in the projectivistics schema always starts with factual content. This is the table, this is the laptop, this is water bottle, this is my watch, these are all facts, but if I say no my watch looks beautiful, science are ugly, I mean science does not believe in this, science always believes in facts, we cannot add value to it, that is why values the way we study, the HST followers are engaged in studying values okay, they become a part of interpretation.

This is how I may say that know it looks beautiful, it looks ugly, it is good, it is bad okay. This does not come under the preview of science okay, it comes under the preview of interpretation, and this is the subjective perception that I had on you, a particular objective reality. But sciences does not look at the subjective perception as such in the positivity, rather it looks at the objective reality alone. When argued that all explanation involves deduction what does it mean, if you look at this the tenant number 8.

What it means? That science must start with some kind of a pattern or scientific explanation, must start with a pattern. It can start with a set of lodge followed by a set of statements describing initial condition, when I say initial condition I mean a evidence must be provided. See

if you just provide a law and without giving an example you are not able to explain that, you are just providing the statement, you are providing the law.

But you must be able to provide evidence in the form of initial condition, I mean a set of lodge when I say, it reminds number 1, when I say a set of statements describing initial conditions in the form of number 2 and then you derive a statement describing the phenomenal to explained. All scientific explanation okay must follow these patterns, what is the pattern? It must start with a set of log followed by a set of statements describing initial conditions and then you arrive at a conclusion in the form of a statement describing the phenomenal to explain.

In other words to explain a phenomenal, it has deduce it is description from the set of premises prostituted by lodge and statements describing some conditions. In some it is totality in the nut cell, all scientific explanation involves deduction and a explanation which does not have or cannot be recast into this pattern, I mean this pattern of following these set of lodge then set of statement describing initial conditions and from there you conclude that a set of statements describing the phenomenal to explained.

If any explanation which does not have or cannot be recast into this pattern in the positivity schema okay it is not the legitimate scientific express and therefore it is subjective to deduct economy digit. I mean that is null and void it does not hold true, it is not valid it is not legitimate okay. then when you come to this point that the progress of science okay, I have not completed this portion, I still have point to make in the context of the indubitably of observation, we will see how.

But let me build the context, build the background that the progress of science consist in the increase accumulation of observations and the cumulative growth of our queries based on those, accumulation of observation okay. If you look at this then the science must be objective. The objectivity of science is guaranteed by the fact that our scientific queries are based on indubitably of observation, because our observation in positivity schema cannot be doubted. Our observation can be indubitably because they are can be shown to be theory independent.

I mean this is where the point lies that as observation cannot be doubted okay, the kind of knowledge that we produce by making observations okay then they become pure, then they leads

us to formulate newer theory and the aim of philosophy of science is to discover and legitimize these universal and change less.

knobs which science follows and by following which science has become the most rational under pride in the positivity scheme fellowosers of science to understand science in terms of these knobs these central delays these positive version which determine their scientific practices that's why whenever you talk to scientist according the few that they mostly they follow these methods a positives while practice and in doing so they provide an account science which is normality these methods become the normality frame work.

Of science since these knobs constitute the very logical of scientific practices philosopher of science provide what may we call a logical science keeping these delays in mind okay positive said for themselves of program by adopting what we thought they could defined. The principle of index in the fact of the formal attack made by dum tube it was an inductive but a kind of critic that he brought about so far was consent and in that knowledge as inductive they were obliged and positives were I mean positives were obliged of one of the ghost of humans by showing that the principle of index can be rationalized positive I mean positive that scientific observations are in principle curie free.

And therefore are inductively they cannot be doughty scientific objectivities or facts are prier theory are not prier observations are prior facts are prior to the formulation of theory okay theory which are the interpretive are positively added as I said as we discussed that observations are prior observations lead to the formulations of theories that's were observations are pure observations are induvailable observations cannot be toughed that is why you will find observations are prior.

And huge are nearly inter present of those observations and hence they are positive observation okay and then these observations constitute the bed row on which the theoretical of sciences it is constituted by theory and arrived at by hugging the principle of index and now positive is thought that if they could show that the index actively arrived that scientific theories as are relative in certain specifiable wage to the bed continued by observations.

They would success in establishing the rationality of our belief in the principle of it okay critical positivity program collapsed like house of gods the way they formulated this okay and it began

the champion so far the methods of science are consent in the 20<sup>th</sup> century even today in 2017 it is very important okay we just cannot ignore the methods of positivism and not only did the critics of positivism failed to identify this specific way in which the observation are sub structure.

And theoretical super structure of science were related but they also mismanage the operant's of positivism but convince however convincingly sort that the idea of pure or independent observation was telling our women were advanced so that all observations are theory in depend it may be noted that positivism dominated during the bulk of half of the 20<sup>th</sup> century but every positivism has been successfully called into question of subsequently okay.

The first unit of positivism was to fall towards the one consenting the idea of pure objects okay it is interesting to see in this connection how the critics of positivism is exploded the mid of pure observation by showing how our observations be supposed to okay we mean let us discuss a couple of arguments next phase okay I mean how whether how observations pre supposed theory all the conserve is true okay let us will see theses argument.

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