

# HS 312 – Introduction to Science and Technology Studies

Lecture 4  
Mahendra Shahare

# Outline

- What makes knowledge scientific?
- Can Science be Science without Scientific Method?

# What makes knowledge scientific?

- Logical Empiricism – Scientific theory is the logical representation of data, and no more or less than a condensed summary of possible observations
- Karl Popper – Genuine scientific theories are falsifiable
- Problem of induction; Duhem-Quine thesis (theories are parts of webs of belief)
- No method for creating scientific theories but are imaginative creations
- Accordingly, for positivism and falsificationism, what makes science scientific are formal relations between theories and data

# Is this scientific?

## [Events] Centre for Sanskrit Learning: Talk on Garbhavigyan - The Science of Begetting Good Progeny by Acharya Mehul Shastri



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Dear all,

We are pleased to announce a seminar on Garbhavigyan – The Science of Begetting Good Progeny by Acharya Mehul Shastri (PhD Nyaya Shastra) from Sanskruti Arya Gurukulam on \*18th January from 5 to 7 pm\*.

You will get to learn about the following:

1. Factors influencing the internal and external qualities of the child
2. How our ancestors influence the qualities of the child
3. Health of mother and fetus during pregnancy
4. Preparations of the mind and body before pregnancy
5. Consequences of carelessness during pregnancy
6. Some rules for garbasanskar.

Who can attend :

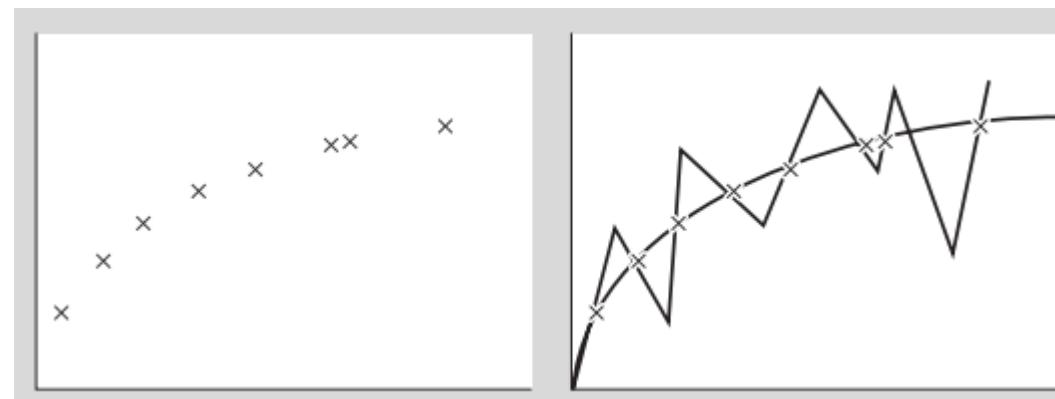
1. Researchers
2. Young adults
3. Parents of young children
4. Educators

# Realism

- Realism: Most scientific theories are approximately true, and therefore science both accumulates and progresses toward truth
- Increases in precision of scientific predictions -> denotes increase in truth -> has rational basis and not luck
- *Rene Descartes -- dubito, ergo sum, vel, quod idem est, cogito, ergo sum* ("I doubt, therefore I am — or what is the same — **I think, therefore I am**")

# Underdetermination

- Choice of the best theory is from among those that have been seriously considered
- But that does not warrant that the best theory so far considered, out of the other (potentially) infinite empirically adequate explanations, happens to be the true one
- how do we know that nature is simple and elegant, and why should we assume that our ideas of simplicity and elegance are the same as nature's?
- **Scientific theories as instruments for explaining** and predicting Vs. Realist view that evidence lead to approximately true theories



Source: Sismondo, p7

# Underdetermination

Physics

• This article is more than 4 months old

## Controversial new theory of gravity rules out need for dark matter

Exclusive: Paper by UCL professor says 'wobbly' space-time could instead explain expansion of universe and galactic rotation



A photo combining an image of a supercluster with magenta-tinted clumps of an inferred dark matter map derived from observations by Nasa's Hubble space telescope. Photograph: Alamy

Dark matter is supposed to account for 85% of the mass in the universe, according to conventional scientific wisdom. But proponents of a radical new theory of gravity, in which *space-time is “wobbly”*, say their approach could render the elusive substance obsolete.

The proposition, outlined in a new paper, raises the controversial possibility that dark matter, which has never been directly observed, is a mirage that a substantial portion of the physics community has been chasing for several decades. The theory is viewed as quite left-field and is yet to be thoroughly tested, but the latest claims are creating a stir in the world of physics.

Announcing the paper on X, Prof Jonathan Oppenheim, of University College London, said: “Folks, something seems to be happening. We show that our theory of gravity ... can explain the expansion of the universe and galactic rotation without dark matter or dark energy.”

Image Source:  
<https://www.theguardian.com/>

# Structural Functionalism

- Robert Merton – science serves a social function of providing **certified knowledge**
- Science a well regulated activity but nothing particularly ‘scientific’ about the people who practice science
- Social structure of science rewards behaviour that promotes the growth of knowledge and vice versa (Popper, Polanyi)

# What is scientific?

- “Allopathy is a stupid and bankrupt science...More people died of allopathic treatment than those who died of oxygen shortage or because of COVID-19” (Kumar, 2021)
- “You must be made aware of the fact that the cure for all the serious illnesses such as chickenpox, polio, Ebola, SARS and tuberculosis were developed in allopathy. Even the development of vaccines in the fight against pandemic is the result of allopathy,” the minister Dr Harsh Vardhan wrote (Kumar, 2021)



# Summary

- STS investigates how scientific knowledge and technological artefacts are *constructed*
- A common notion to all these views (LP, F, R, SF) is that **standards or norms** are the source of science's success and authority
- Standards are attempts to define what it is to be scientific
- Therefore, these views of science are not merely an abstraction but a **view of ideal science**

# Rethinking history of science

- Thomas Kuhn – *The Structure of Scientific Revolutions* (1962)
- Science is merely what scientist do
- Rejected philosophical/formal views of science and idea of steady progress
- Whig History – the past as a series of steps toward present views;
- Too simple progressivism – attempts to construct/see what we now believe to be the truth as more rational, more natural, teleological

# Normal Science

- Normal Science – is the science done when members of a field share a recognition of beliefs about theories, important problems, methods for solving
- In Kuhn's terminology, scientists doing normal science share a paradigm
- *Paradigm* – “universally recognized scientific achievements that for a time provide model problems and solutions to a community of practitioners”
  - Newton's mechanics, Lavoisier's chemistry, Mendel's genetics
  - Lavoisier's ideas about conservation of mass and balance shaped the work practices of chemistry
  - **Normal science** is a period when research is well structured within a conceptual and social backdrops

# Normal Science

- Classical or Newtonian physics paradigm – preference for causal explanations, precise quantitative predictions, world as composed of material particles (that collide due to forces acting in straight line), laws of motion and gravitation, standard mathematical techniques, accounts for friction/resistance
- Paradigm examples – Ptolemaic astronomy, **Phlogiston theory of combustion**, Daltonian chemistry (theory of differing atomic weight of elements), fluid flow theory of electricity (electricity is a material fluid), caloric theory of heat (heat is a material fluid), particle optics (light is a collective of fast moving particles), relativistic physics (time between events is relative to frame of reference), quantum physics (energy possessed by objects/waves comes in discrete units)



SOURCE: <https://www.youtube.com/watch?v=2gHVJA8YAbg>

Thank you