

SOCIOLOGY OF SCIENCE AND TECHNOLOGY (H-235)

Warming up

Do you receive messages with pics/videos of Gods/God(wo)men, with something like the following written at the end ?

Forward this to 10 friends.

Within 7 days you'll get good fortune/news.

I tried....It really works. I got a very well-paid job

If yes, what do you do?

Not yet ?

Do you receive messages with pics/videos of Gods/God(wo)men, with something like the following written at the end?

Forward this to 10 friends.

Within 7 days you'll get fortune/news.

If you ignore the message and do not forward, something really bad will happen to you.

My friend ignored and he met with a road accident.

If yes, what do you do?

For a rational/scientific mind:

"Today is Thursday"

Forward this to 10 friends.

Within 7 days you'll get another Thursday.

It really works.

For a scientific mind:

"Today is Thursday"

Forward this to 10 friends.

Within 7 days you'll get another Thursday.

It really works.

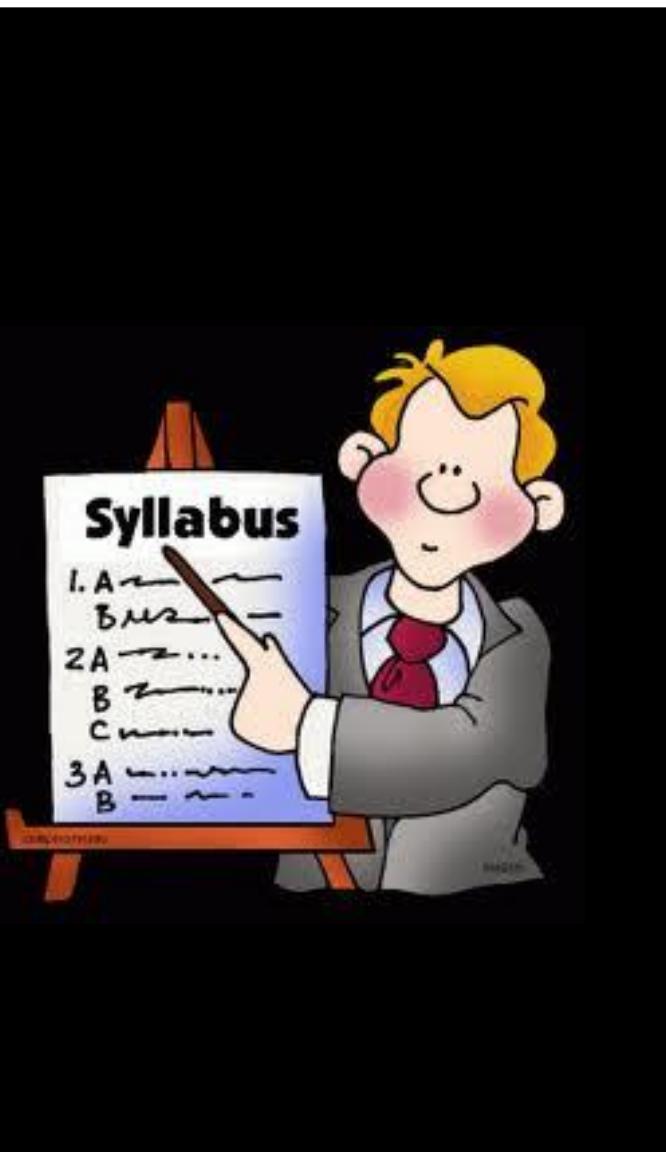
Amit ignored this message and he got a Friday within 24 hrs

Outcome/Objectives of the course



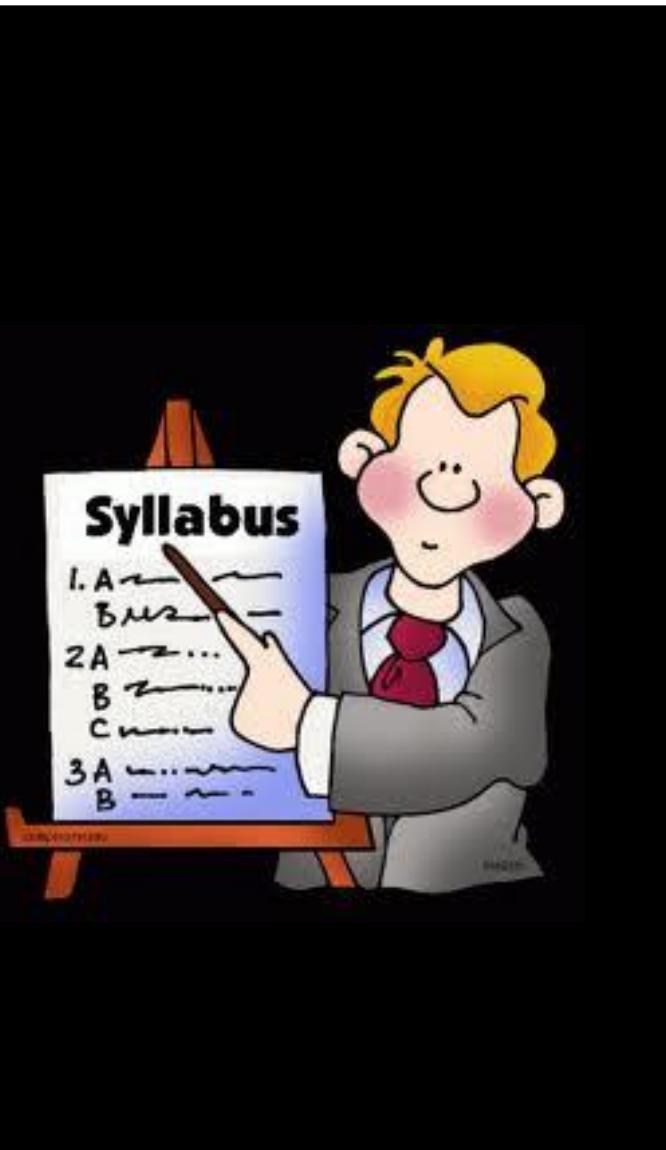
- To get familiarized with the sociological perspectives in the study of science and technology.
- To gain basic understanding and have fairly in-depth discussions of issues that fall under broader spectrum of **society-science-technology** interface

Course Outline/Session Plan



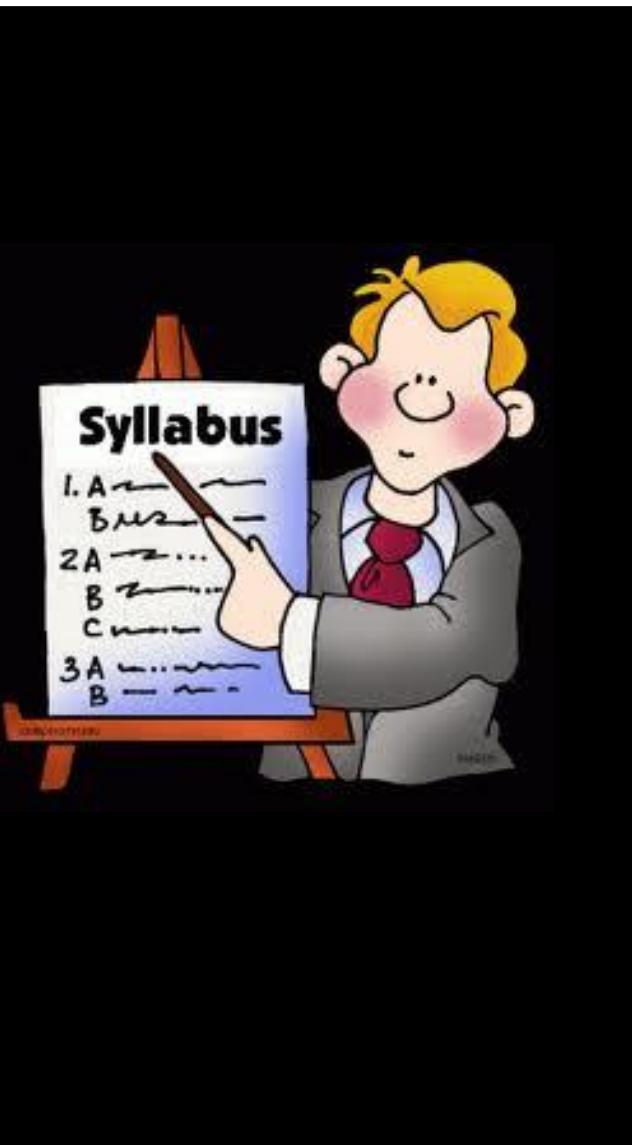
- **A Brief History and Philosophy of Science**
 - Evolution of Scientific knowledge/thinking, Legacies of Socrates, Galileo and Bacon
- **Introduction to Sociology of Science:**
 - Development of modern science
 - The Industrial and French Revolutions and their technological and scientific implications
- **Perspectives on scientific knowledge:**
 - Karl Marx, Emile Durkheim, Karl Manheim's sociology of knowledge,
 - Thomas Kuhn's structures of scientific revolutions
 - Problems with Inductive logic (David Hume)
 - Theories of Falsification (Karl Popper)
 - Paradigm Shift (Thomas Kuhn)

Course Outline/Session Plan



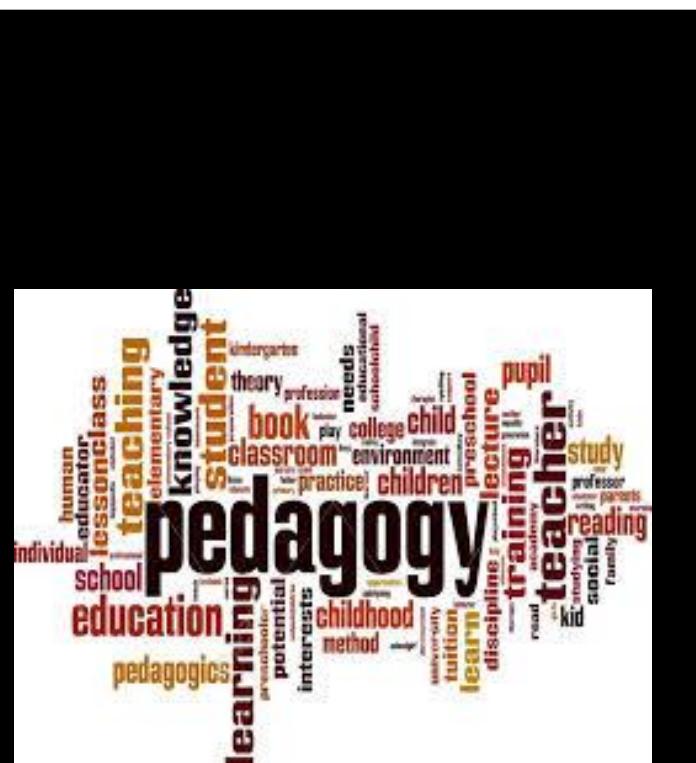
- **Society-Science-Technology Interface**
- **Social significance of science and technology:** Contextual nature of science; Scientist as Indexical and Analogical reasoner
- **Social Context of production of Scientific Knowledge**
Organization of Production of Scientific Knowledge
- **Ethics and/in Scientific Pursuits**
- **Robert Merton and sociology of science:** Ethos of science and Matthew Effect
- **Stigler's Law of Eponymy**

Course Outline/Session Plan



- **Recent trends in Sociology of Science:** Science and technology in developing and developed countries, Indian context, information technology and globalization and social inequality (**relevant case studies**)

Pedagogy and Method of Evaluation



Pedagogy

- Class discussions and case analysis with illustrations drawn from day-to-day life.
 - Not just ‘chalk and talk’: enough room for participation in the classroom by the students.

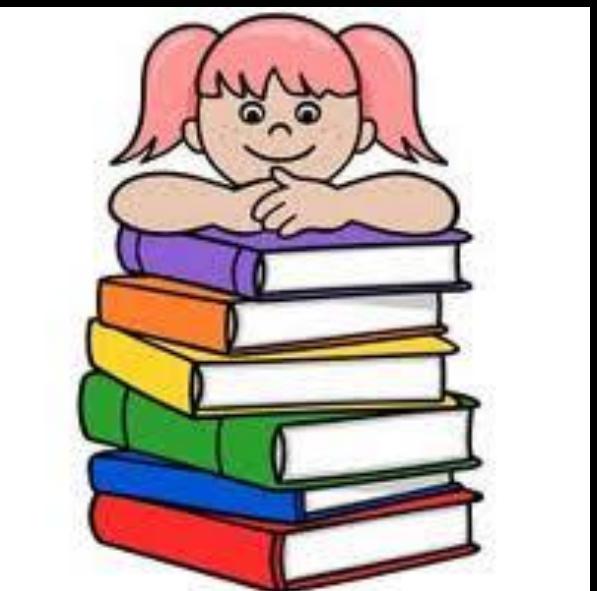
Relevant course materials and case studies (whenever required) would be made available in advance to students to facilitate group discussions.

Method of Evaluation



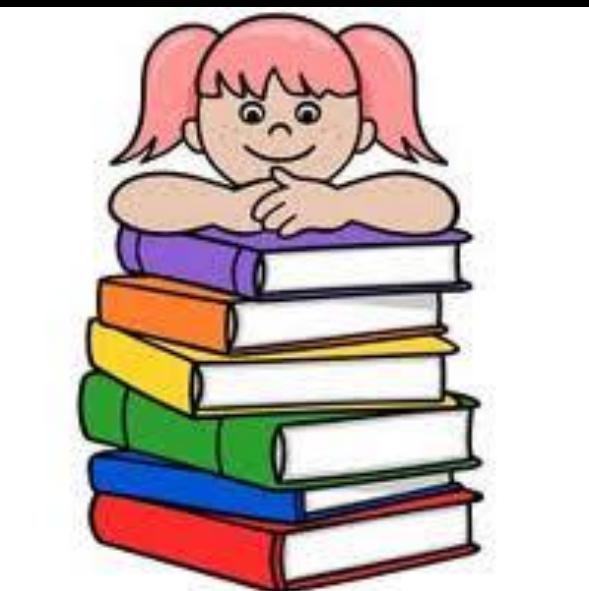
- Continuous and Comprehensive Evaluation -**60%** (quiz + assignment + mid-sem)
- Group/take home project **40%**
- Grading is **RELATIVE**
- Grading Scheme (negotiable):
 - Median - BB
 - Median - median + 1 sd = AB
 - Median - median + 2 sd = AA
 - Median - median - 1 sd = BC
 - Median - median - 2 sd = CC
 - Median - median - 3 sd = CD
 - Median - median - 4 sd = DD

Recommended Reading



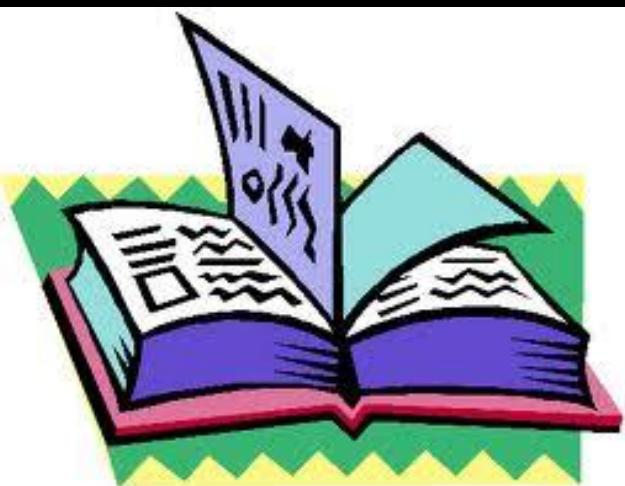
- “The Historian and the History of Science” – Harry Elmer Barnes, *The Scientific Monthly*, Vol 11, No. 2(August 1920!!!), pp. 112-126.
- “What is the History of Science?”- *History Today*, pp. 32-53. April 1985. (This article is an interview of six scientists/practitioners of science)
- *The Structure of Scientific Revolutions*, Thomas Kuhn, Chicago: Chicago University Press, 1970. (First Edition 1962). Preface, Chapter, 12,3.
- *The Sociology of Science* – Robert Merton, Chapters, 13,14,20, 21.

Recommended Reading

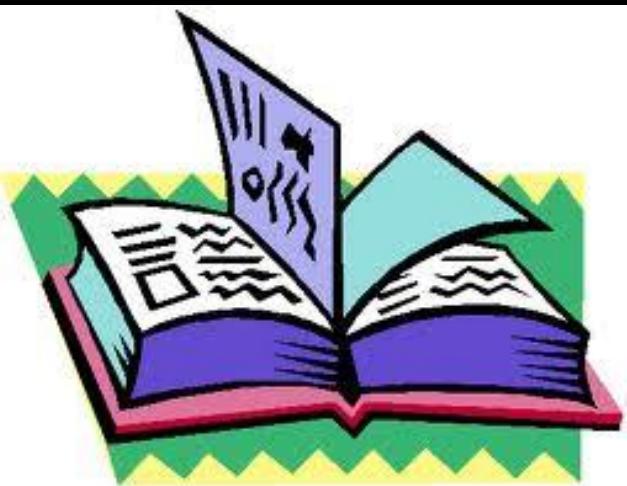


- “The Scientist as a Practical Reasoner: Introduction to a Constructivist and Contextual Theory of knowledge” - K.D .Knorr Cetina *The Manufacture of Knowledge: An Essay on the Constructivist and Contextual Nature of Science*. Oxford: Pergamon Press, 1981. (Chapter I) **A must read, highly recommended.**
- “The Scientist as an Indexical Reasoner: The Contextuality and the Opportunism of Research” – K.D .Knorr Cetina *The Manufacture of Knowledge: An Essay on the Constructivist and Contextual Nature of Science*. Oxford: Pergamon Press, 1981. (Chapter II) **A must read, highly recommended.**
- “Is Science Losing its Objectivity?” – John Ziman, *Nature*, Vol.382, pp. 751-756, 1996

Reference Books



- “Scientific Knowledge in India: from Public Resource to Intellectual Property” – E. Haribabu, Sociological Bulletin, Vol. 48, No1-2, pp. 217-233.
- Bucchi, Massimiano, “Science in Society: An Introduction to Social Studies of Science”, Routledge. 2004
- Knorr-Cetina, Karin D., “The Manufacture of Knowledge: An Essay on the Constructivist and Contextual Nature of Science”, Pergamon Press. 1981
- Krishna, V.V., “A Portrait of the Scientific Community in India: Historical Growth and Contemporary Problems”, Gaillard et al. (eds). Scientific Communities in the Developing World, Sage. 1997



- Kuhn, Thomas, “Structure of Scientific Revolutions”, Chicago University Press. 1996
- Merton, Robert K., Social Theory and Social Structure, Amerind. 1981
- Wenda K. Bauchspies, Jennifer Croissantn and Sal Restivo, “Science, Technology, and Society: A Sociological Approach”, Willey-Blackwell. 2005

KYI



| | |
|---------------------------|--|
| Instructor | : Pranay Swain |
| Office | : SHSS Building |
| Office Hours | : 9.30 am to 5.30 pm |
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| Phone | : +91 674 2494371 |
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| Email | : pranay@niser.ac.in |

CAVEATS



- Attendance once recorded **CANNOT** be altered
- Feel free to STOP me whenever you have a question or need a clarification
- Taking notes is optional
- Participate and discuss whenever it merits

**GOOD
LUCK**

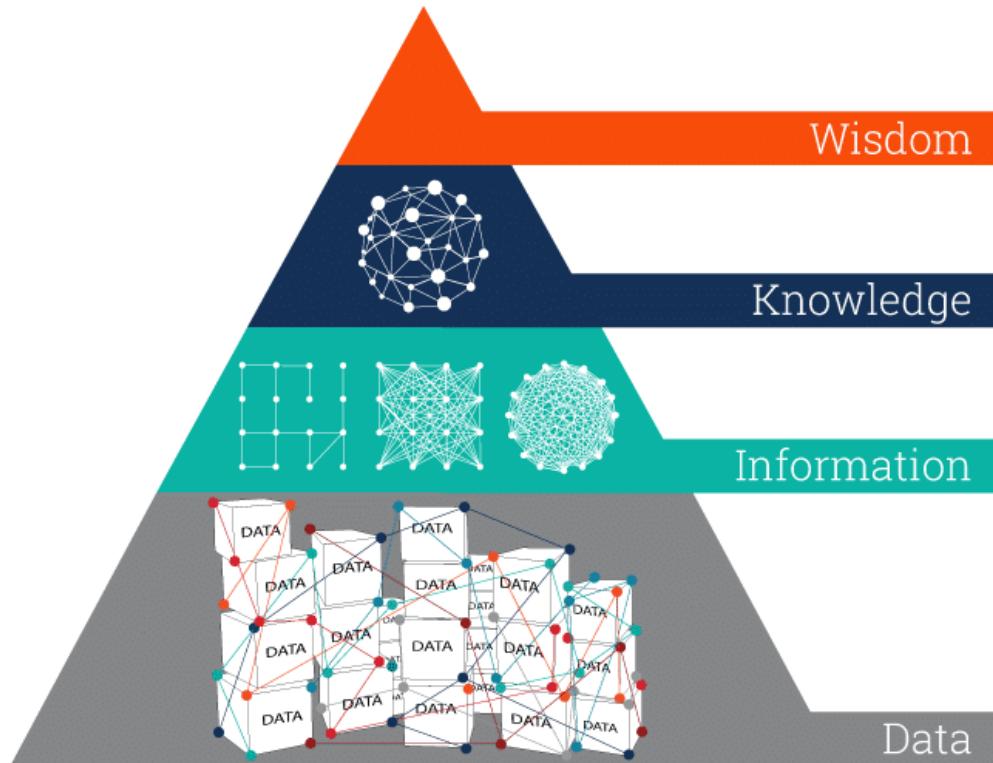
A BRIEF History of Science

08 Aug 2024

Before hitting on Science...

DIKW pyramid

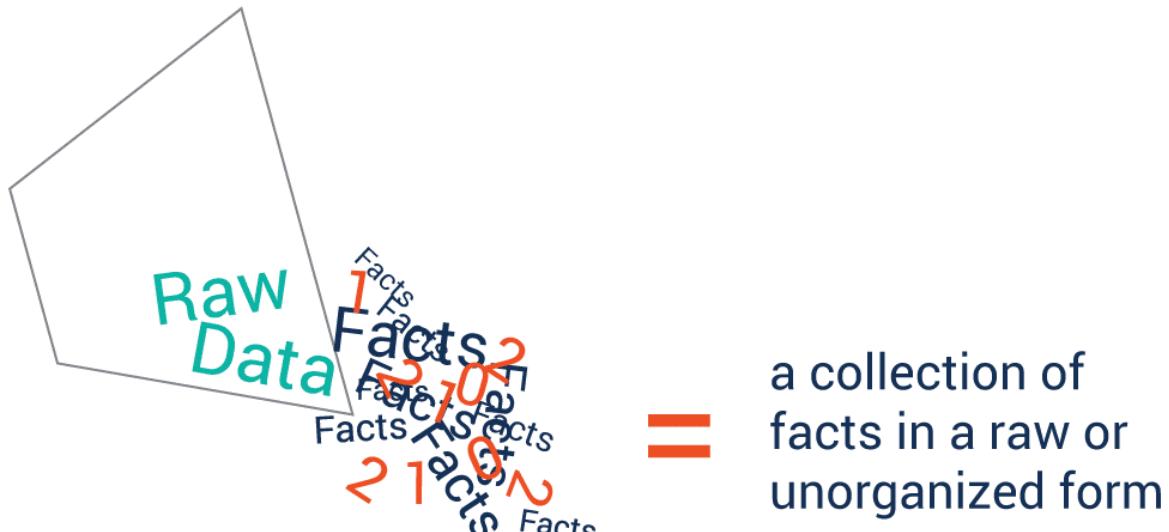
DIKW pyramid



Each step up
the pyramid
answers
questions
about and
adds value
to the initial data.

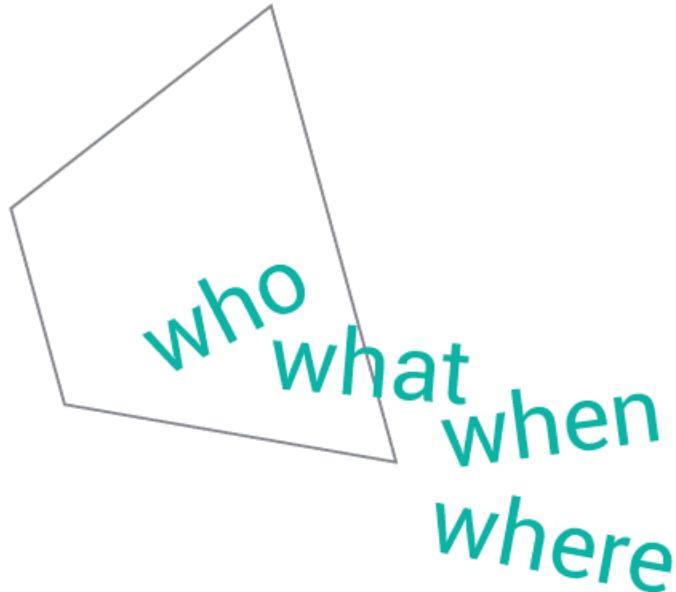
Source: <https://www.ontotext.com/wp-content/uploads/2018/03/DIKW-Pyramid.png>

Data



Base building block - Raw **Data**

Information



Second building block - Derived **Information**

Knowledge



Third building block - Relevant **Knowledge**

Wisdom



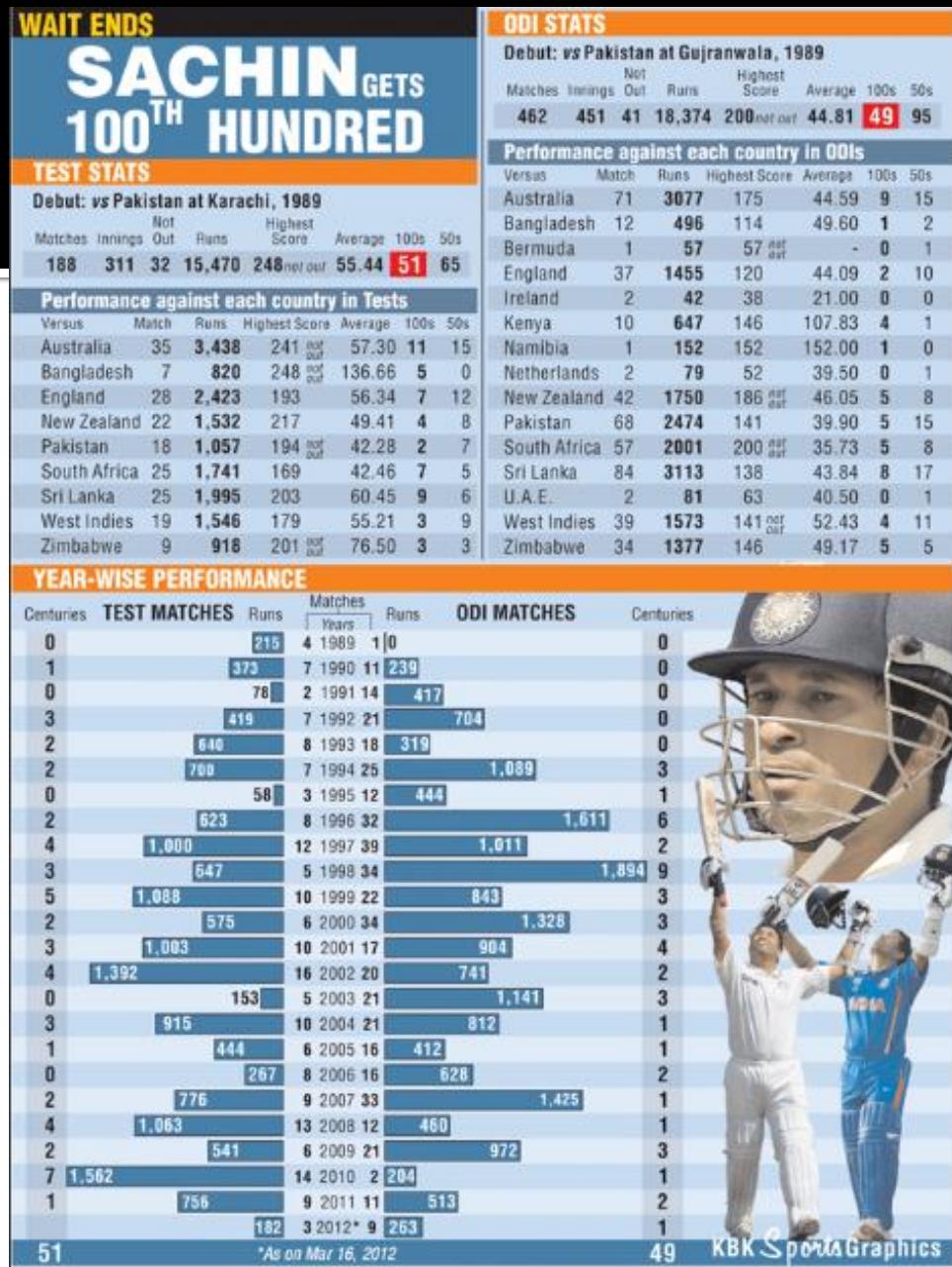
The top of the DIKW hierarchy - Guiding **Wisdom**

49 !! Does this ring any bell ?

49 !! Does this ring any bell ?

How about 51?

The 49 and 51



Year

1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013

Vs. Country

Australia | Bangladesh | England | New Zealand | Pakistan | South Africa | Sri Lanka | West Indies | Zimbabwe

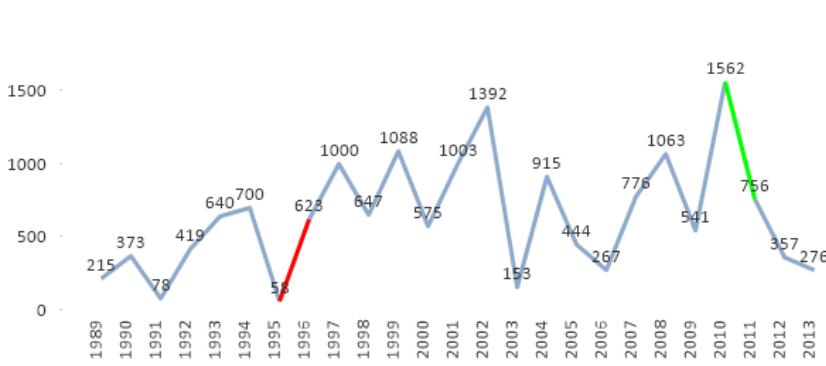
Matches
200Runs
15921200s
6100s
5150s
68Average
53.79

Sachin Ramesh Tendulkar
 Date of Birth: April 24, 1973
 Batting: Right handed

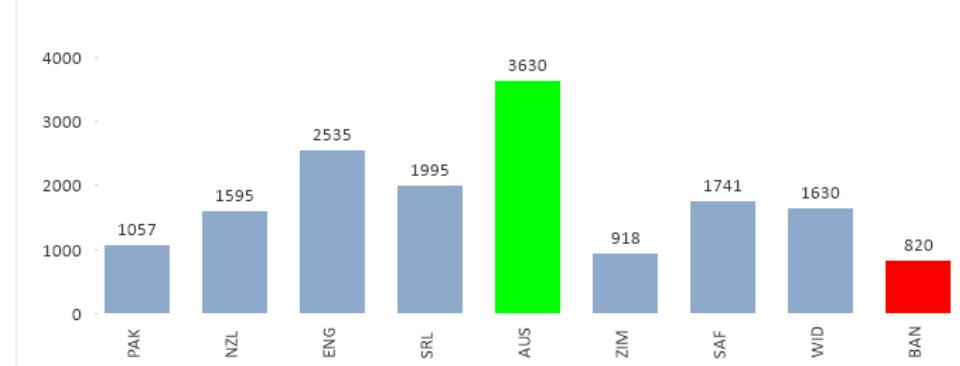


Sachin! Sachin! Sachin

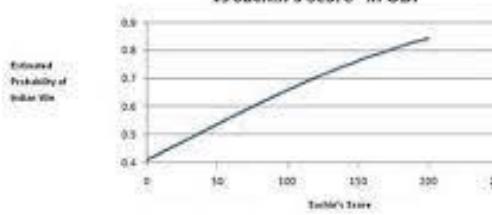
Runs Scored Year on Year



Runs scored Vs. Country



Estimated Probabilities of India's Win vs Sachin's Score - In ODI



Based on Sachin's 442 innings in One Day Internationals - Computed using MinTab

TENDULKAR'S HUNDREDS WIN MORE GAMES

| | WON | LOST | DRAW / TIE/ NR |
|------|-----|------|----------------|
| ODI | 33 | 13 | 2 |
| TEST | 20 | 11 | 20 |
| ALL | 53 | 24 | 22 |

* Figures are number of games in which Sachin Tendulkar has scored centuries



Reuters

<https://www.kreedon.com/sachin-tendulkar-century-and-indias-winning-ratio-a-case-study/>
https://www.analyticsvidhya.com/blog/wp-content/uploads/2014/11/Sachin_Overview_Qlikview.png

- In the ODI format, India registered 33 wins out of 49 ODI matches when Sachin scored a century.
- The winning percentage of India was 67% whenever Tendulkar made winning contribution.

| Batsman | M | Runs | Ave | SR | 100s | 50s |
|-------------------------|-----|-------|-------|-------|------|-----|
| SR Tendulkar (India) | 234 | 11157 | 56.63 | 90.31 | 33 | 59 |
| RT Ponting (Aus/ICC) | 262 | 10726 | 49.20 | 82.45 | 25 | 69 |
| ST Jayasuriya (Asia/SL) | 233 | 8873 | 41.26 | 96.58 | 24 | 43 |
| JH Kallis (Afr/SA) | 206 | 8012 | 52.36 | 75.71 | 13 | 58 |
| AC Gilchrist (Aus/ICC) | 202 | 7657 | 41.16 | 99.33 | 16 | 43 |

Sachin Tendulkar played 463 One Day Internationals in his career.

Out of those matches India have won 234. In those 234 innings Sachin has 33 Hundreds and 59 Fifties.

And most importantly he scored 53 scores over fifty in the remaining 229 matches.

What is Science

- Origin: Latin word: *Scientia- meaning knowledge*
- is a systematic enterprise that builds and organizes knowledge in the form of testable explanations and predictions about the universe (natural phenomena)
 - *Systematic Knowledge*

Is Science what the scientists do ?

Answer is very simple

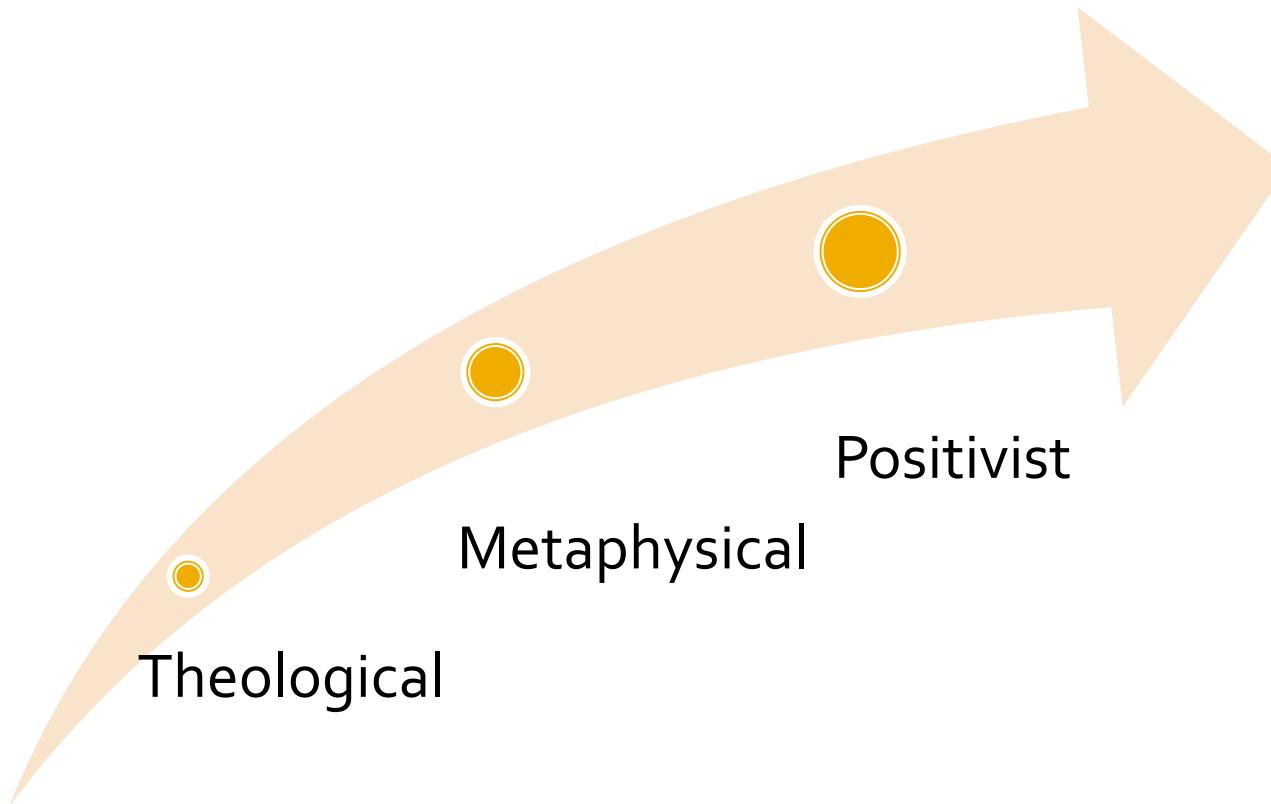
- And, It's YES

Is Science what the scientists do ?

- Answer is very simple
- And, It's YES
- Also NO !!! (confused?)

- Many (serious guys, huh !!!) would not have bothered to ask- '**what is this thing called science' !!!**
- They would have simply gone ahead and **DONE that.**

Evolution of human thinking



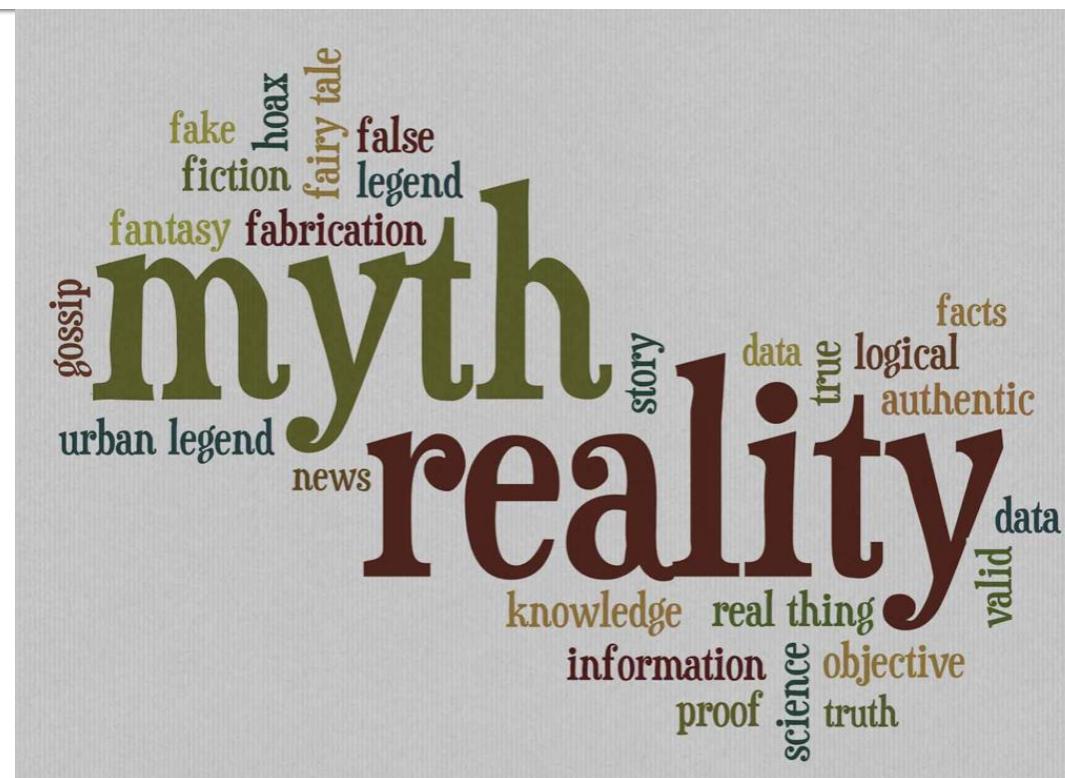
■ Dogmatic beliefs and Myths

- Tend to close the mind and produce credulity, intolerance and superstition

vs

■ Scientific temper

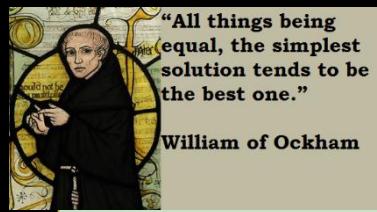
- Goes beyond objectivity and fosters creativity and progress (develops new knowledge)



The term “Scientist” is of very recent origin
(19th century)

Earlier, they used to be called “NATURAL
PHILOSOPHERS”

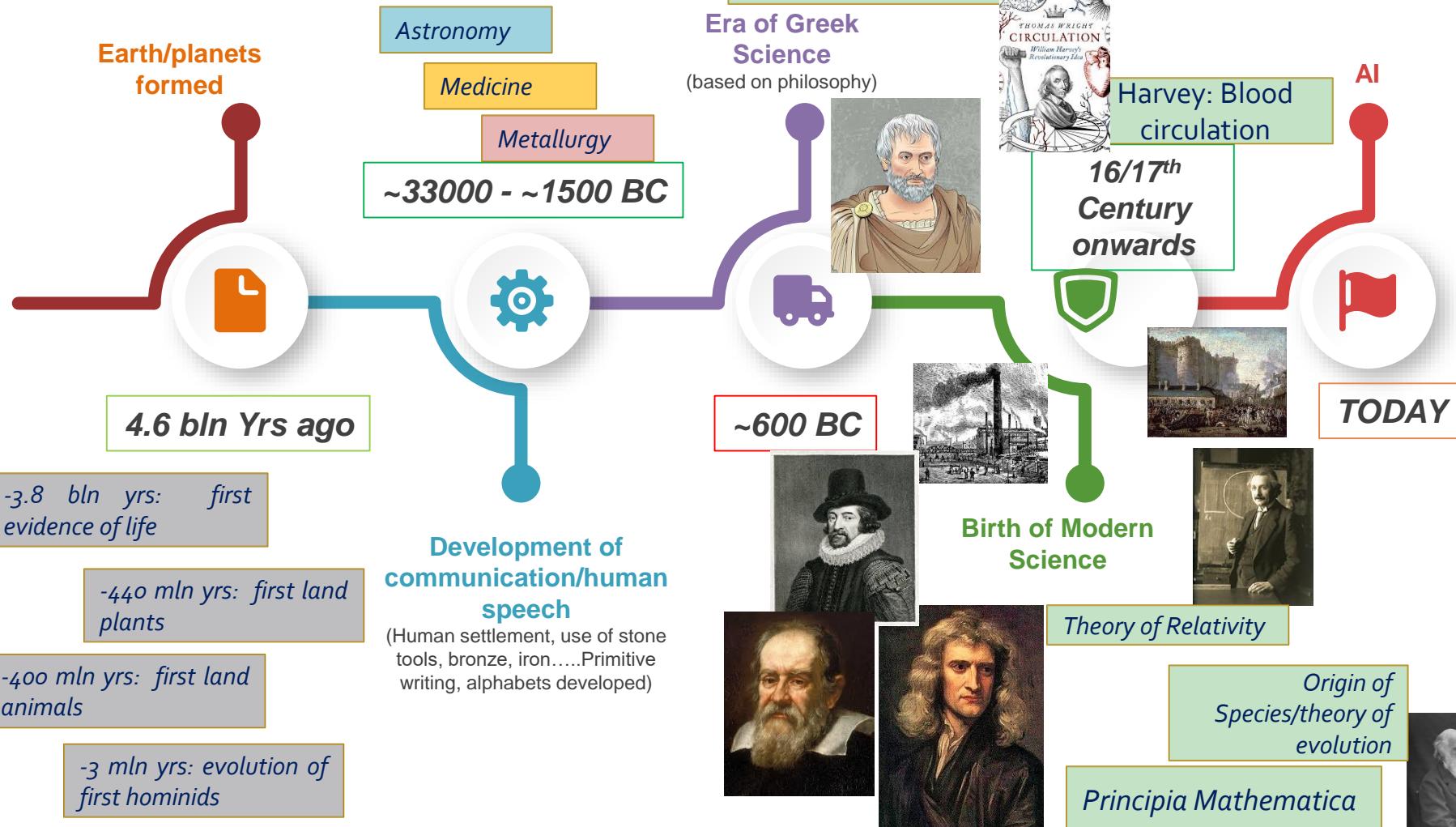
Brief history of Science



Occam's Razor
(experimental science,
problem solving
principle)

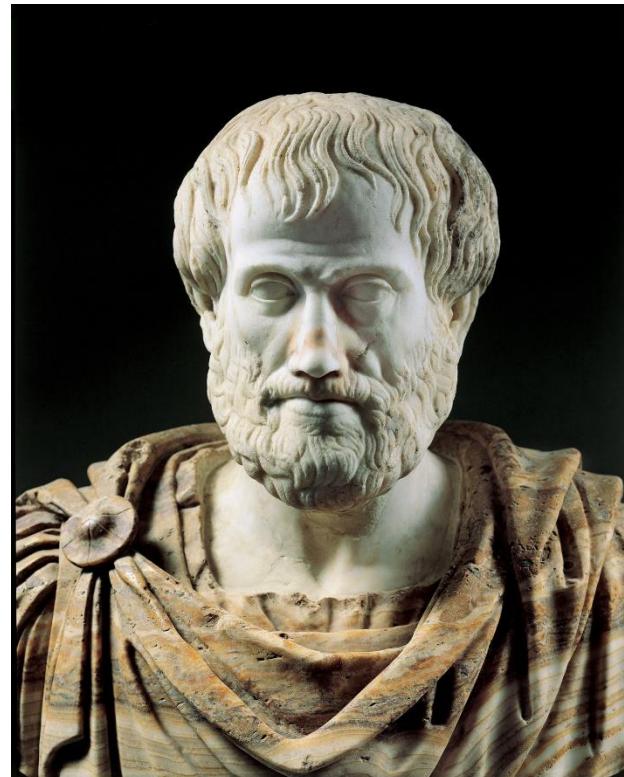


Copernican Revolution



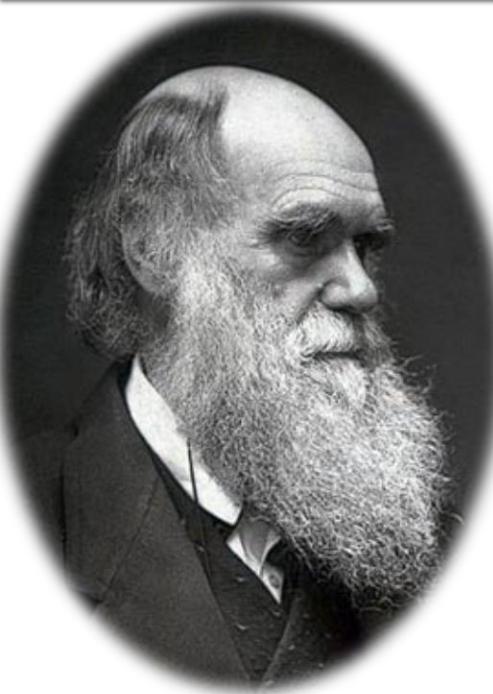
The First Scientist

- 4th Century BC
Greece
 - Western Philosophical and scientific culture
 - Aristotle
 - Logic
 - Observation
 - Inquiry
 - Demonstration

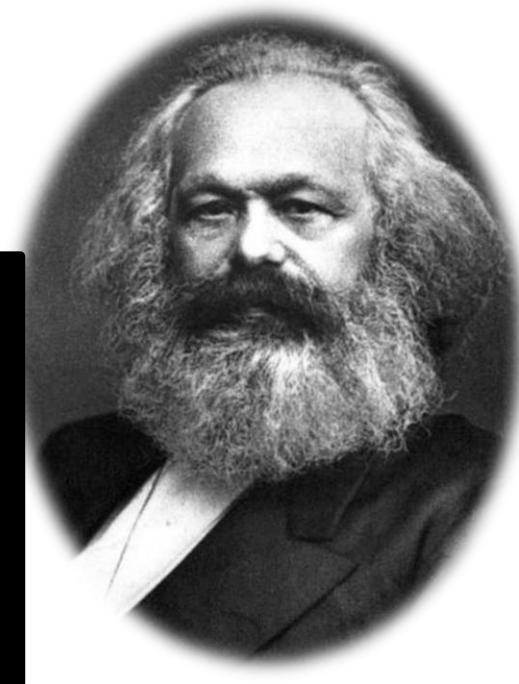


Legacy of Socrates, Plato, and Aristotle

- <https://www.youtube.com/watch?v=nkeggeV7g98>
- <https://www.youtube.com/watch?v=pJQr77Vzwyk>



"Freedom of thought is best promoted by the gradual illumination of men's minds, which follows from the advance of science"



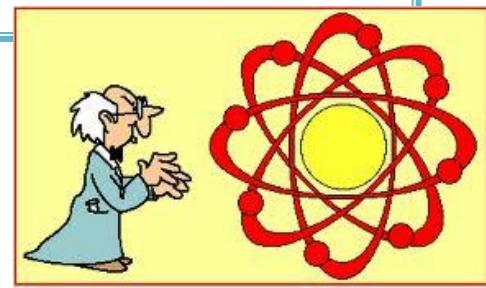
"Religion is the sigh of the oppressed creature, the heart of a heartless world, and the soul of soulless conditions. It is the opium of the people. The abolition of religion as the illusory happiness of the people is the demand for their real happiness. To call on them to give up their illusions about their condition is to call on them to give up a condition that requires illusions."

The Goals of Science



- To *explain* why something happens.
- To make *generalizations* that go beyond the individual case.
- To *predict* what will/may happen in the future.

Scientists rely on systematic studies to move beyond common sense- those ideas that prevail.



The Legacy of Galileo & Bacon

- Modern science
- Philosophy of Science



Can we actually date science back to any point in history?

What it takes?

Dialectical methods

Discourse on different points of view to establish the truth through reasoned arguments

Eliminating all possible doubts/errors

Classical philosophy

arguments and counter arguments

Propositions and counter propositions

Socratic method

Series of questions seeking clarifications

Discovery of contradictions

- Logical testing of Ideas.....and many more...

Dialectical method



Classical Philosophy



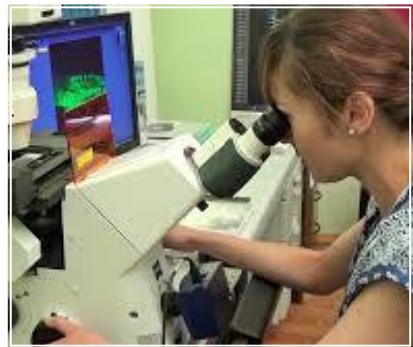
Socratic Method



Logical testing of Ideas



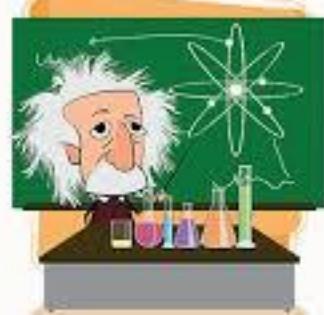
Science thrives on:



Empiricism



Observation



All cats have four legs.
I have four legs.
Therefore, I am a cat.



Logical Deduction

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Science thrives on:



Empiricism



Observation



All cats have four legs.
I have four legs.
Therefore, I am a cat.

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Logical Deduction

'If I have seen further than other men, it is because I have stood on the shoulders of giants.'



Social Sciences vis-à-vis Physical Sciences

Physical Sciences

- Comprehend, explain, and predict the events in our natural environment.
- Use of ***scientific methods*** to acquire knowledge and conduct experiments to unfold/verify the facts
- Theories and laws of **universal validity** are established more easily and accurately

Social Sciences

- Examine human relationships in an attempt to objectively understand the social dynamics in the natural environment.
- Less exact and less precise due to complexity of social data, interdependence of cause and effect, problems of objectivity and prediction

Production of scientific knowledge:

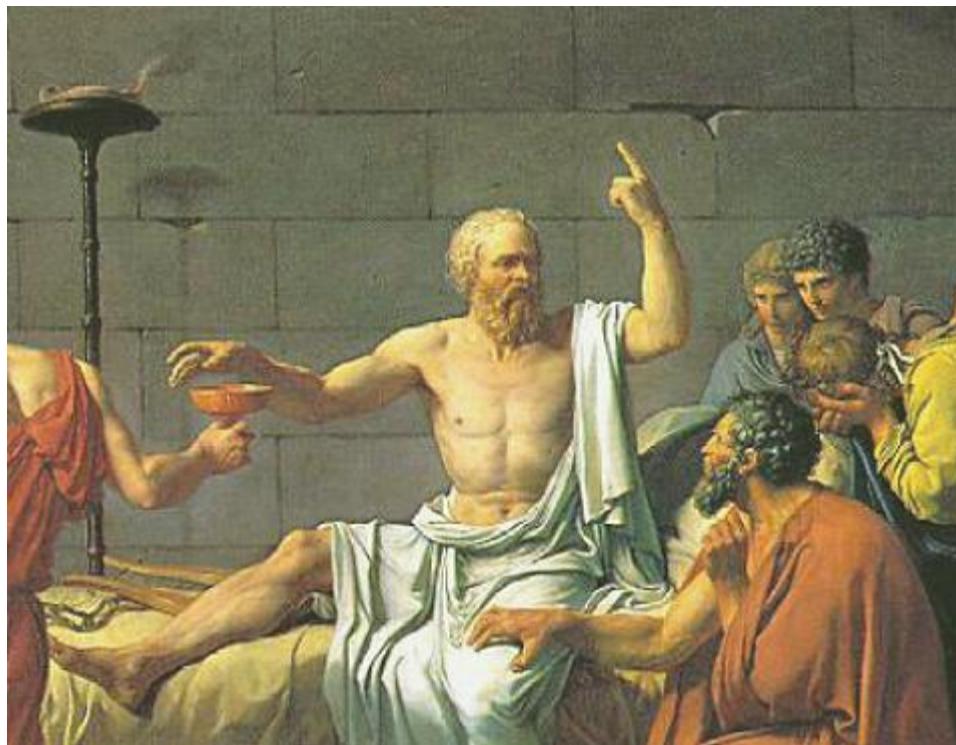
- Science consists of
 - a body of knowledge and
 - the process by which that knowledge is developed.
- The core of the process of science is:
 - generating testable explanations, and
 - the methods and approaches to generating knowledge are shared publicly so that they can be evaluated by the community of scientists.
- Scientists build on the work of others
- Scientific knowledge is subject to revision and refinement as new data, or new ways to interpret existing data, are found.

(Ref: Carpi, A & Egger, A. 2011. The Nature of Scientific Knowledge, Visionlearning: NY)

In other words...

- production of new knowledge by means of laboratory research
- publication of knowledge in the form of papers and abstracts of papers
- consumption of the new knowledge and its absorption into the general mass by critical comparison with other experiments on the same or similar subjects

Socrates (469-399 BC): Logical Deduction



- Socrates is considered to be the wisest man of the ancient world as he relentlessly pursued truth in all spheres of life and lived and died for it.
- The Greek philosophy emerged with the philosophy of Socrates.
- He taught people not to follow anything blindly

Bacon (1561-1626)

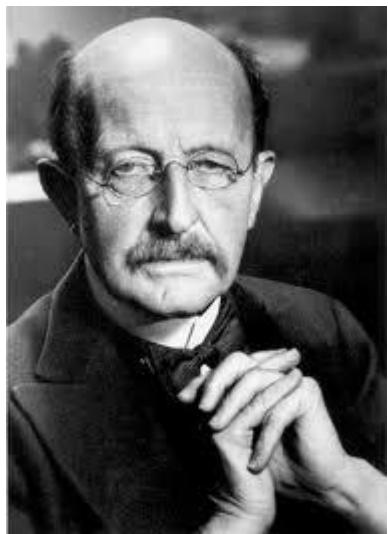


- Onslaught on the medieval scholars

HOW CAN WE BE SURE THAT OUR
KNOWLEDGE IS COMPLETELY RELIABLE ?

- Importance of empirical observation
- Formal experiment , the only way of adequately testing hypotheses

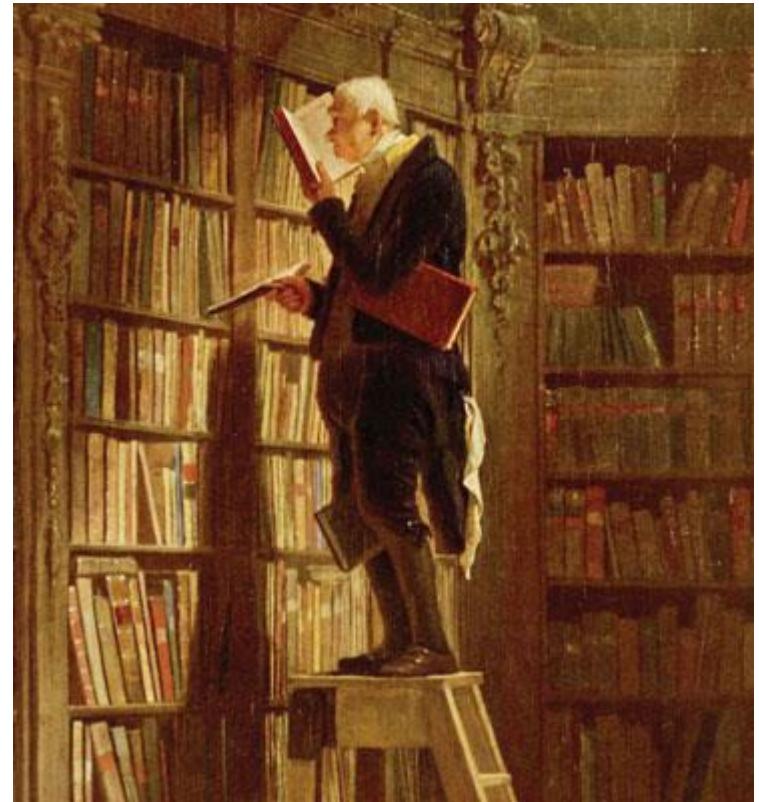
Experiments are the only means of knowledge at our disposal. The rest is poetry, imagination.



Max Planck

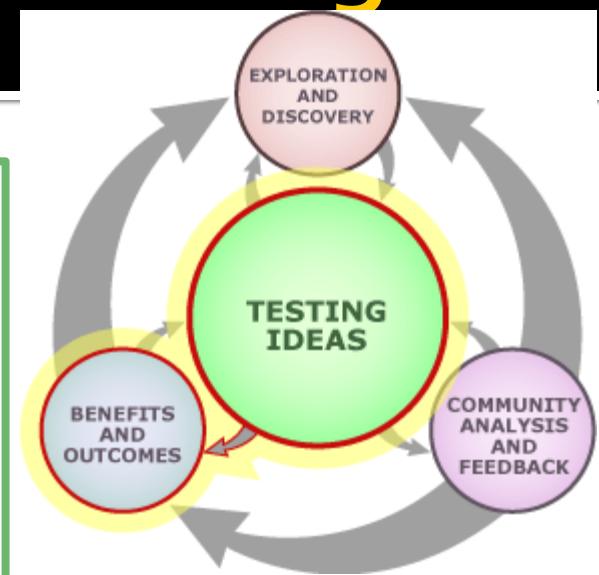
Over next two Centuries

- Rapidly growing band of professional scientists
- Rigorous application of logic to arguments
- Championing of empirical testing of hypotheses



Evolution of Scientific Knowledge

- Theories of science are simply generalizations derived from a series of observations
- 3 stages:
 - Description
 - Induction (observation based generalization)
 - 'Tested'
- Exp: 'Every time lightning strikes, thunder always follows'



Evolution of Scientific Knowledge

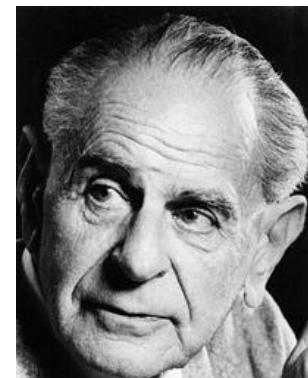
■ David Hume's (1711-76) problem with induction (generalization)

- questioned common notions of personal identity, and argued that there is no permanent "self" that continues over time.
- A single counter-example is enough to disprove a generalization



■ Karl Popper's (1902-94) theory of Falsification

- Primitive myths vs genuine science
- Experiments designed to *falsify* the hypothesis under test
- Scientific inquiry should aim NOT to verify hypothesis but to rigorously test and identify its limitations



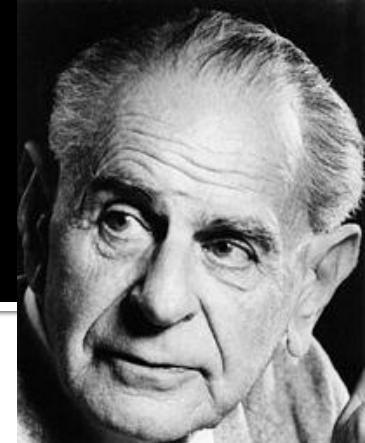
Your way vs. My way

Amusing and hostile rivalry between Edison and Nikola Tesla to dominate the electrical power industry, in what is now often referred to as the “War of the Currents”.

Tesla, bashing Edison’s style of research, commented, “If Edison had a needle to find in a haystack, he would proceed at once with the diligence of the bee to examine straw after straw until he found the object of his search. I was a sorry witness of such doings, knowing that a little theory and calculation would have saved him ninety per cent of his labour.”

This is both an illustration of how strong personalities can shape the nature of scientific discourse. It is also a good illustration of how different styles of research can produce equally effective results (despite Tesla’s gripes, it is clear that Edison and Tesla were both very successful scientist/engineers).

Karl Popper



- Counter-example: the hallmark of sciences
- Science as a process of falsification
- Inherent problem was – it was too stringent and would actually lead to abandonment of science in a short time
- Knowledge is limited hence scientists may run out of hypotheses to test

Taleb's Black Swan Theory

- it is an *outlier*, as it lies outside the realm of regular expectations, because nothing in the past can convincingly point to its possibility.
- it carries an extreme 'impact'.
- in spite of its outlier status, human nature makes us concoct explanations for its occurrence *after the fact*, making it explainable and predictable.

rarity, extreme 'impact', and retrospective (though not prospective) predictability.

Those who dealt with the notion of the improbable (Hume, Mill, and Popper) focused more on the problem of induction in logic, specifically, that of drawing general conclusions from specific observations.

Predictions of events depend more and more on theories when their probability is small

Something that is not visible in past occurrences needs a strong '*apriori*' theory



ABN

7:30 PM ET

NUCLEAR THREAT IN WADIYA

Science is what Scientists do
?

Or

Science is what is done
scientifically/systematically ?

THE CLICHE



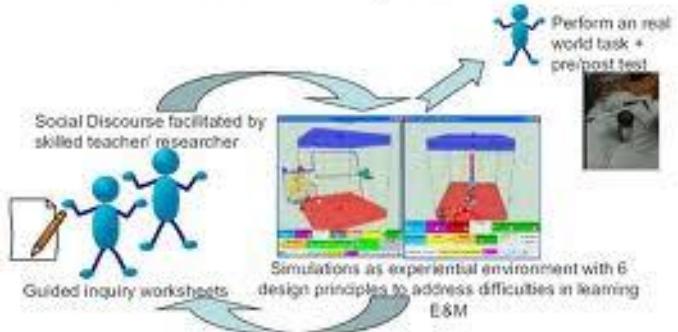
18th and 19th Century



Scientific Method

THEORY

Theoretical/conceptual framework



This proposed framework for the context of this study on physics learning with simulation

DATA/OBSERVATION





MOVIECLIPS.COM

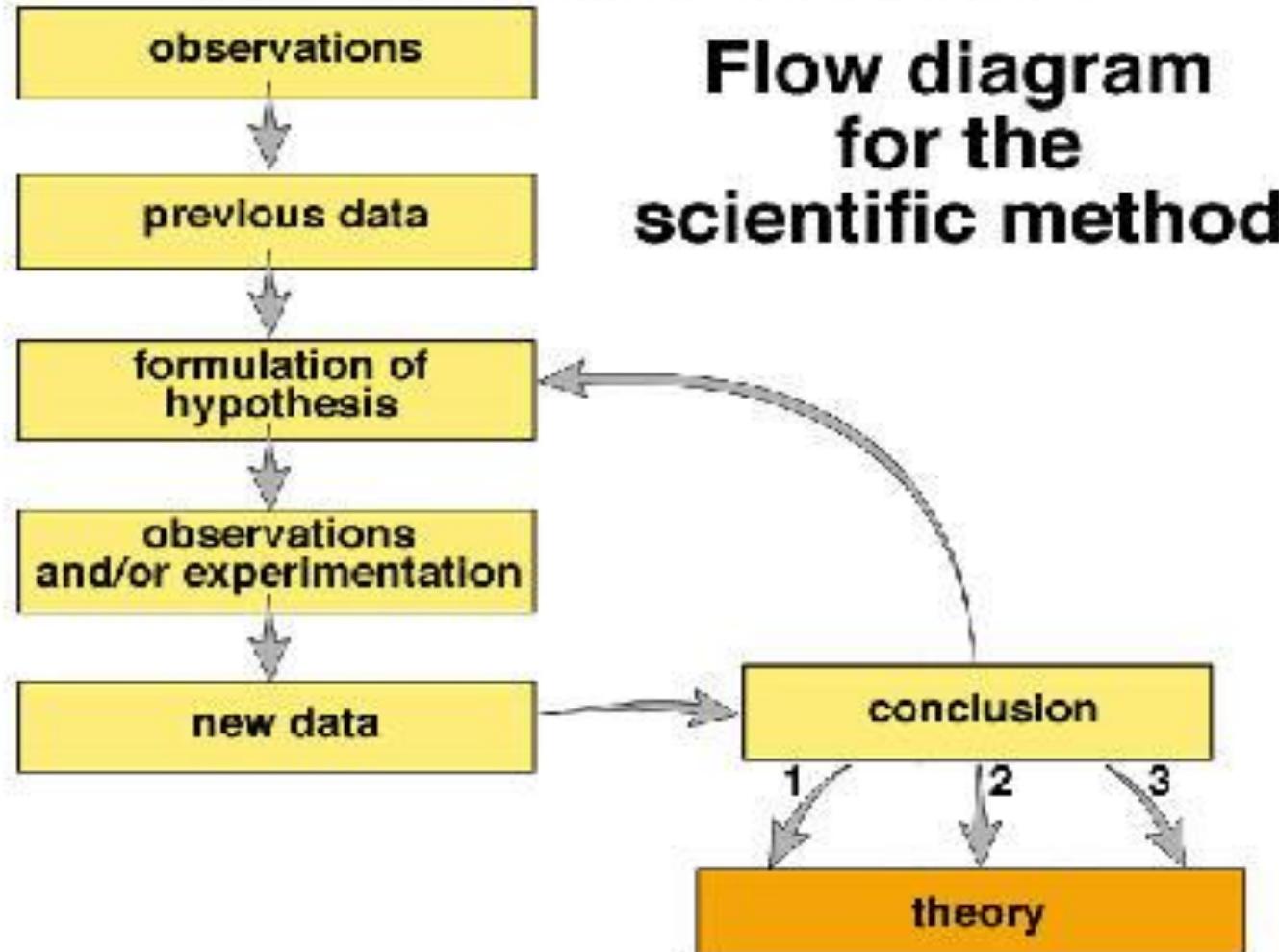
Scientific Method

- ▶ Ends
 - ▶ Knowledge
 - ▶ Predictions
 - ▶ Control
- Means
 - Methods
 - Values and justifications
 - Methodological rules are proposed to govern methods
 - To distinguish between science and pseudo science or non-science



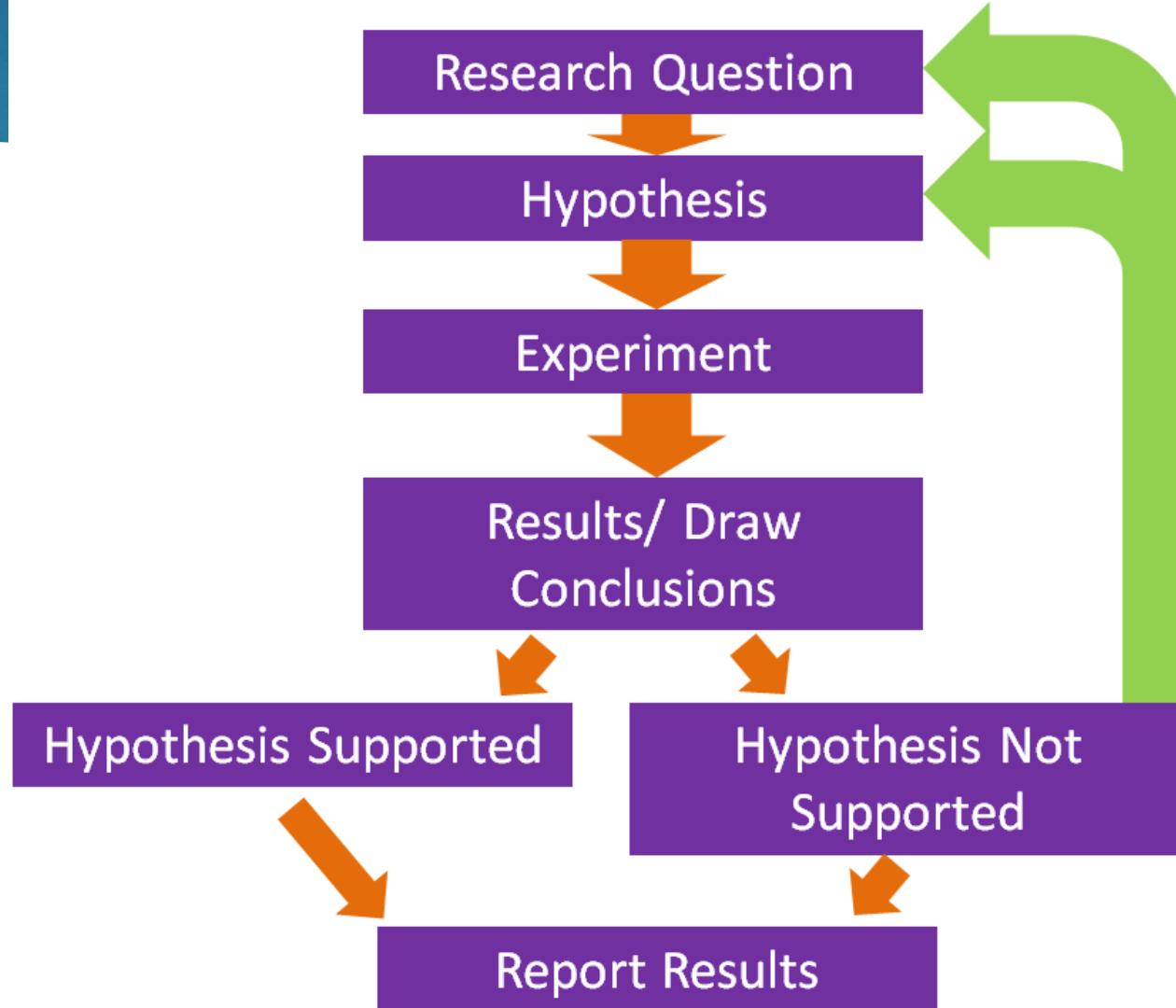
Early 20th Century

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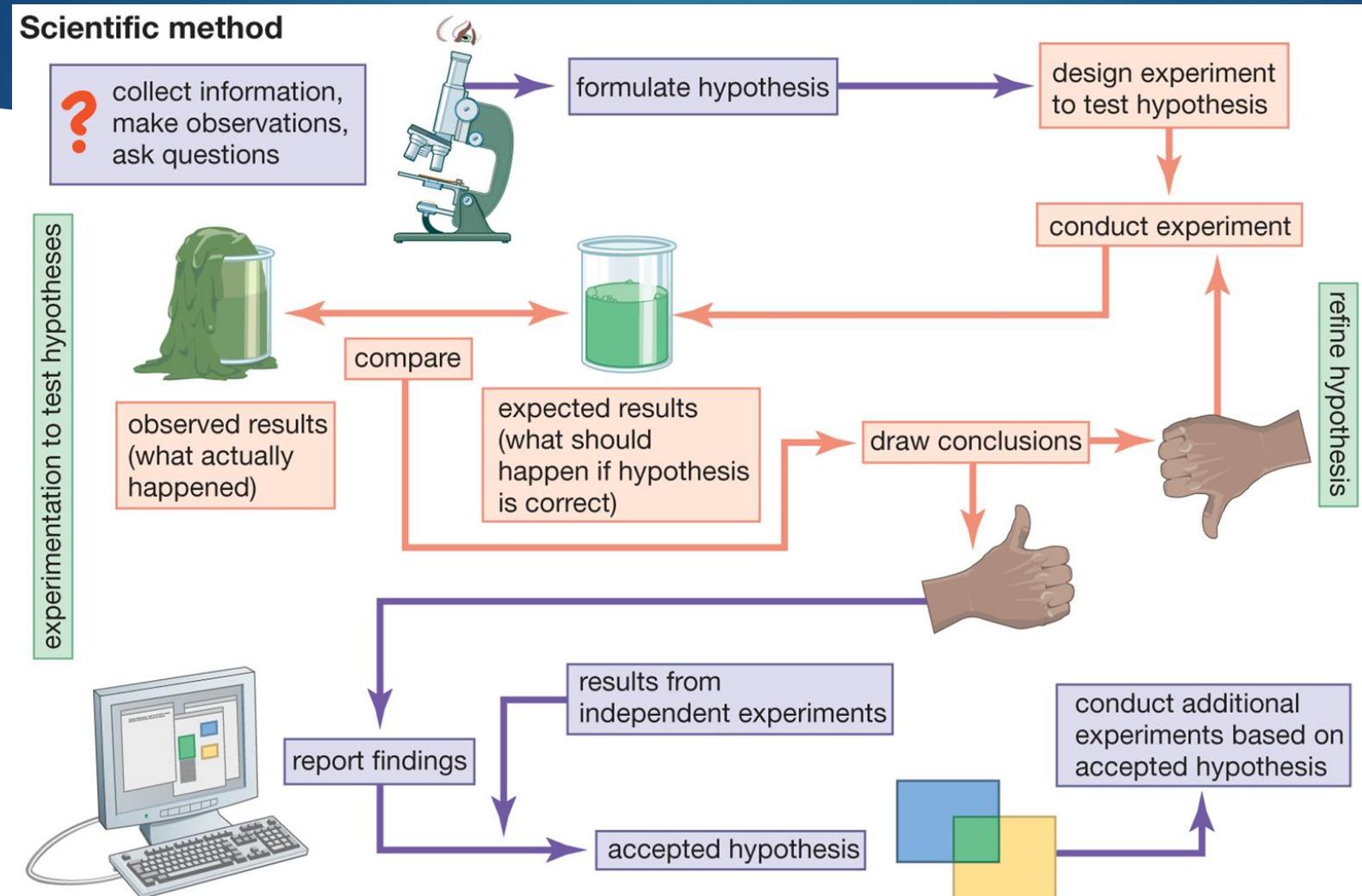




Social Character of Science



Creation of Sc Knowledge



Knowledge

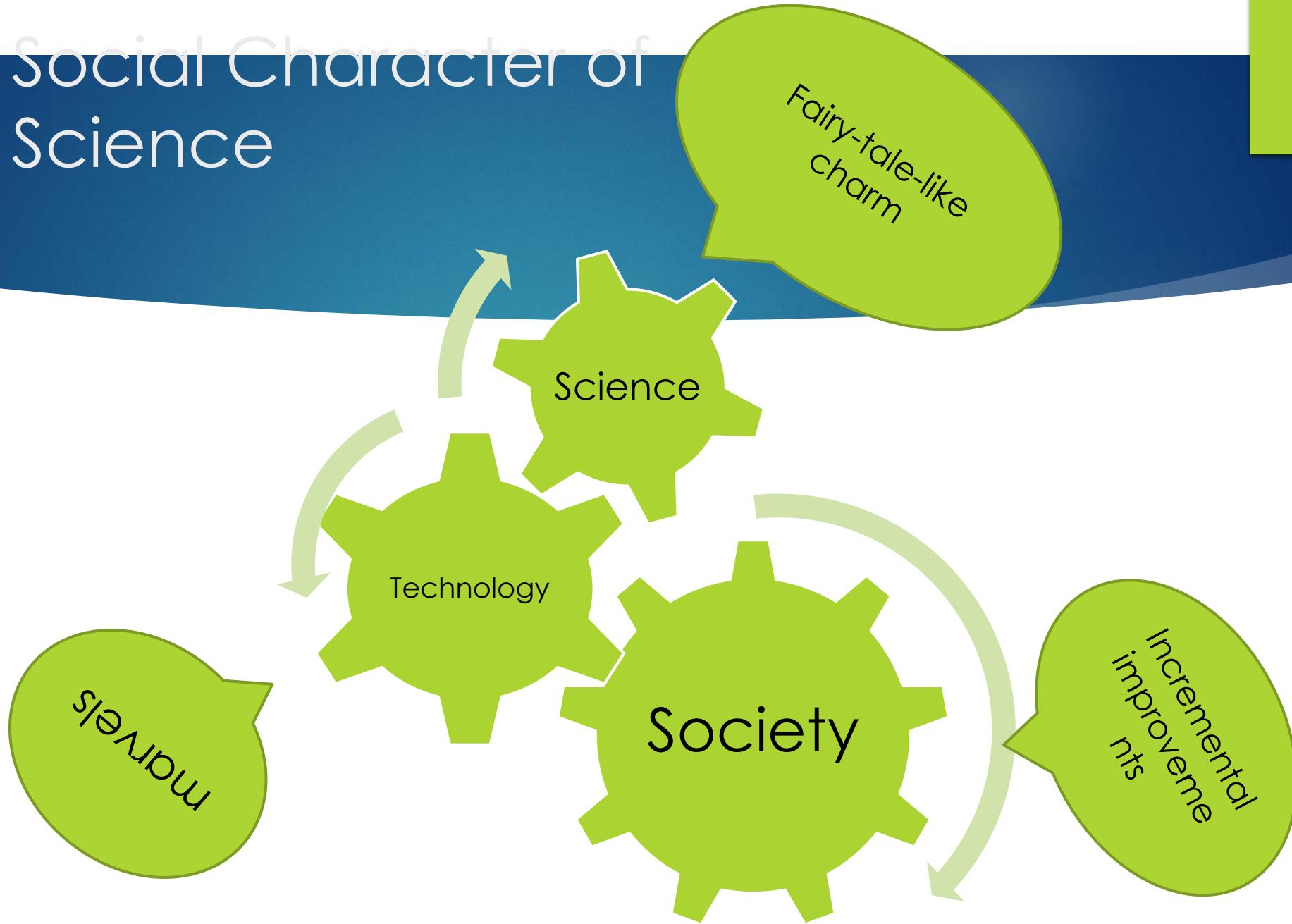
- ▶ Collective or Individual ?

Knowledge

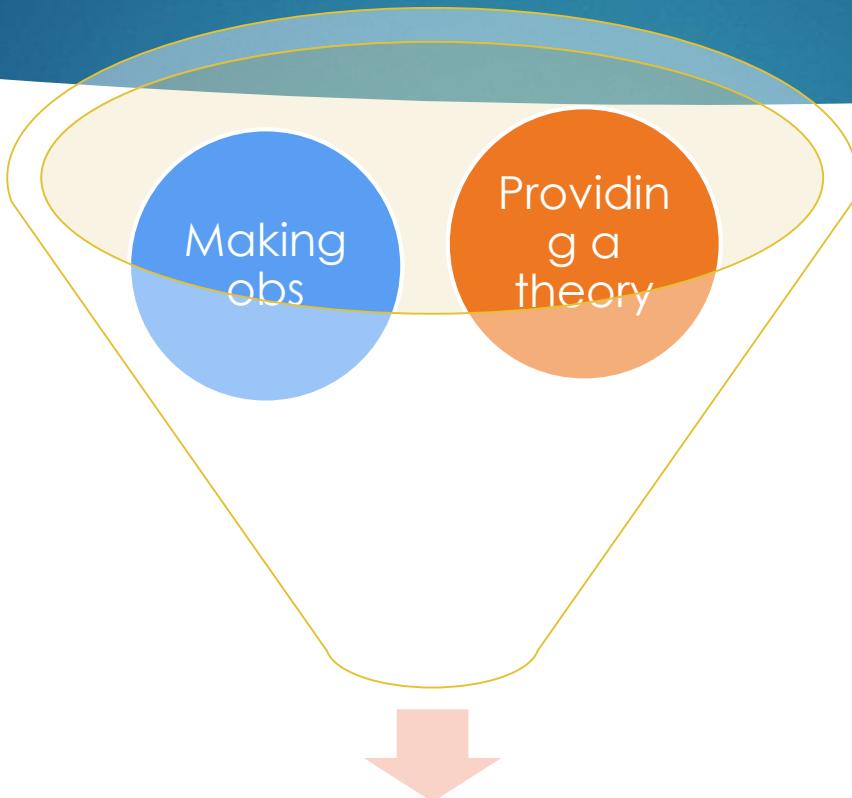
- ▶ Collective or Individual ?
- ▶ What about SCIENTIFIC KNOWLEDGE ?

- ▶ It may be a cliché that two heads are better than one
- ▶ In modern science, no claim gets accepted until it has been vetted by dozens, if not hundreds of heads.

Social Character of Science



The Crucial TWO steps



Large part of science
does not stop here

The important third step

That makes all the differences to
the lives of non-scientists

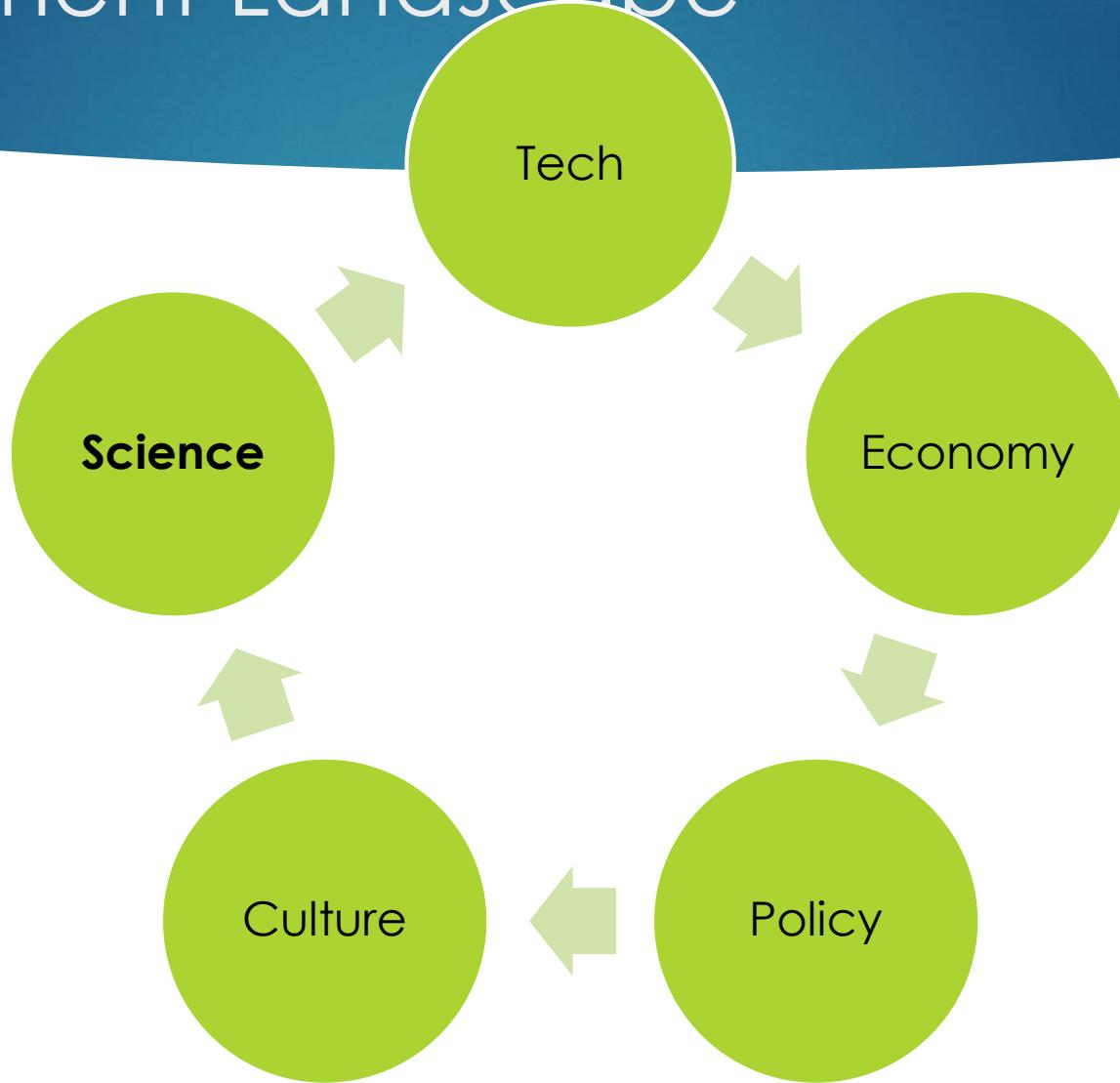
- It predicts the outcome of deliberate actions under specified conditions and it does so with reasonable accuracy most of the time

Social take-away

Science enables us not just to interpret the world but provides us with the potential to change it in a predictable manner

This, when combined with others, transforms the potential ability of science to change the world into a better reality

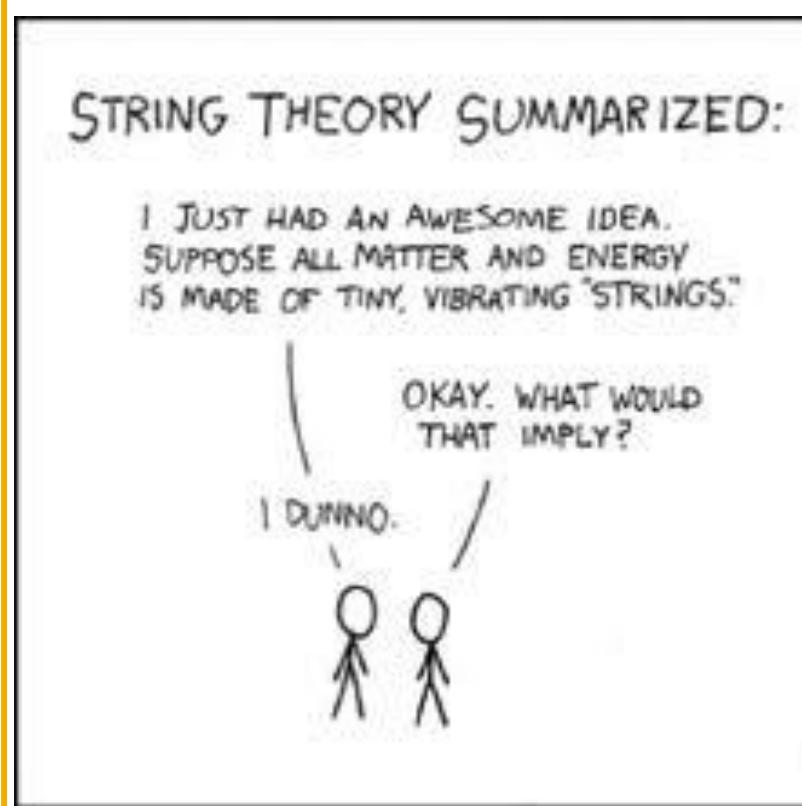
Development Landscape

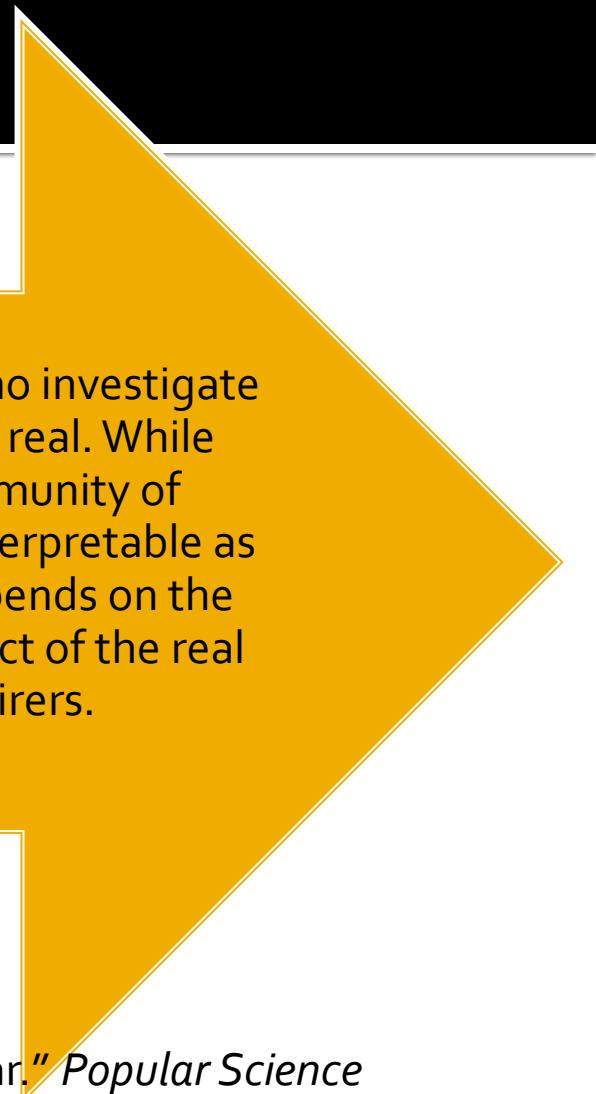


Social Theories of Scientific Knowledge

Social Theory of Scientific Knowledge

- Critical discussions -> Justifiability of (true) beliefs
- Avoiding falsity/partiality of belief/opinion framed in the context of just one point of view
- Achievement of knowledge is hence a social/collective matter (not an individual one)





The opinion which is fated to be ultimately agreed to by all who investigate is what we mean by truth, and the object represented is the real. While often read as meaning that the truth is whatever the community of inquirers converges on in the long run, the notion in turn is interpretable as meaning more precisely either that truth (and "the real") depends on the agreement of the community of inquirers or that it is the effect of the real that it will in the end produce agreement among inquirers.



Peirce, Charles S. "How to Make Our Ideas Clear," *Popular Science Monthly* 12: 1878: 286-302. Reprinted in Peirce, Charles S. 1958. *Selected Writings*. ed. by Philip Wiener. New York: Dover Publications. pp. 114-136





The Vienna Circle (and the philosophical position of logical empiricism) chaired by Moritz Schlick

- Logical empiricism and uncritical form of positivism
- Natural Science as a potent force for progressive social change

PREMISES:

- Meaningful question can be answered by methods of Science
- Social conditions promote the growth of scientific knowledge

It states the scientific world-conception of the Vienna Circle, which is characterized "essentially by two features. First it is empiricist and positivist: there is knowledge only from experience. Second, the scientific world-conception is marked by the application of a certain method, namely logical analysis."

People Associated with VC

- Moritz Schlick
- Gustav Bergmann, Rudolf Carnap, Herbert Feigl, Philipp Frank, Kurt Gödel, Otto Neurath, and Friedrich Waismann
- Bertrand Russell, Ludwig Wittgenstein, Albert Einstein.
- Karl Popper, Carl Hempel

Unified (vision of) Science

Some Upshoots of Vienna Circle:

- Construction of a constitutive system
- Link and harmonize the achievements of individual investigators
- Clarity and neatness to eliminate the problems of ambiguity

You are NOT good in Maths?
Have a good Mathematician friend!



<https://www.youtube.com/watch?v=udHB3tftPz4>

Social Dimensions

- Natural sciences flourished because some leading philosophers saw them as POTENT FORCE FOR SOCIAL CHANGE
- REASONS:
 - Grounded in observation (EMPERICISM)
 - Public forms of verification
 - Science for them constituted a superior alternative to what they saw as metaphysical obscurantism (which led to bad thinking/politics)

Non-evidential Community Factors

Scientific judgment is determined by social factors

- Professional/personal interests
- Political ideologies





THE AMAZING MEETING

THE AMAZING MEETING

Thatcherism

British Conservative Ideology (1979-90)

Classical Liberalism and Welfare State:

- Tight control over money supply , privatization and constraints on labour movement
- Less of curiosity –driven science
- Science -> meaningful technology ->drive economic growth
- Shift of priority

Social/sociological Theories of Scientific Knowledge

12 Sept 2024

Big Science, Trust, and Authority

Big Science

- Organization of large number of scientists bringing different bodies of expertise to a common research project
 - LHC Project
 - Human Genome project

Big Science, trust and Authority



Trust

- If A knows ' p ' on the basis of evidence ' e ', B has reason to think A trustworthy and B believes ' p ' on the basis on A's testimony of p , does B also know p ?

Only what one has observed oneself could count as a good reason for belief, and that the testimony of another is, therefore, never sufficient warrant for belief.



Things you can do!



It is epistemologically reliable because the results of experiments and studies are checked by independent repetitions. In practice, however, only some results are so checked and many are simply accepted on trust

MODELS OF SOCIAL CHARACTER OF SCIENTIFIC KNOWLEDGE

Constructivist

- Reconciliationist
- Integrationist
- Social empiricism
- Critical contextual empiricism

CONSTRUCTIVISTS



- Larry Laudan



- James Brown



- Alvin Goldman

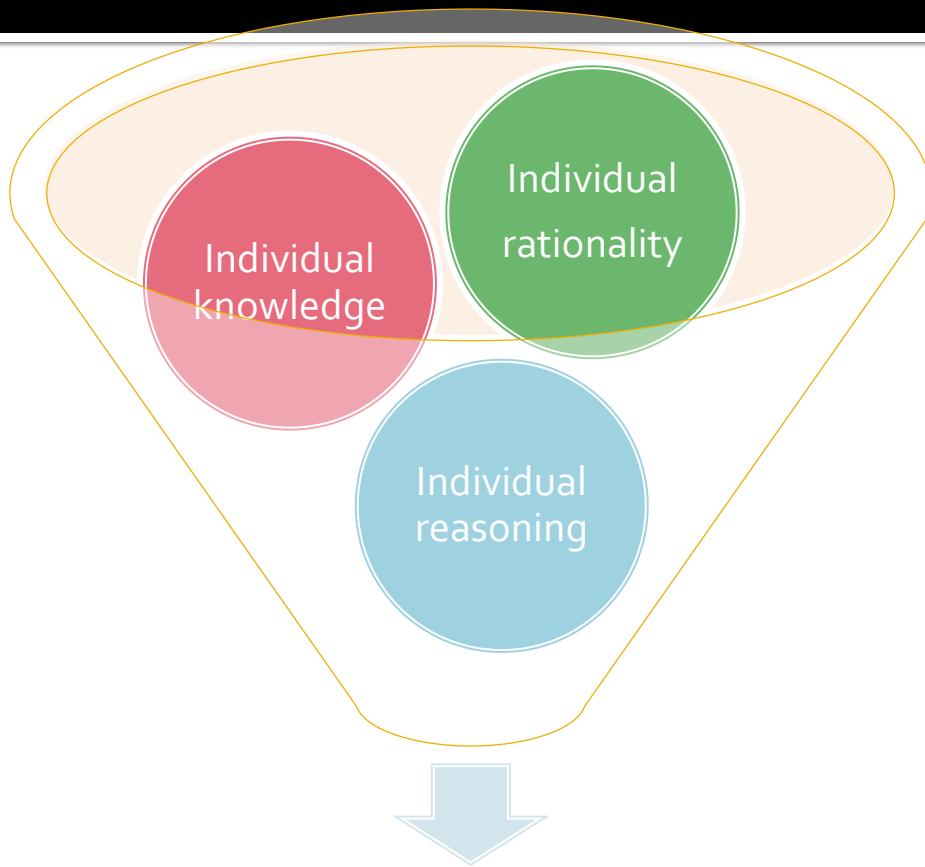


- Susan Haack

Rationality of Science vs Sociological (mis)interpretation

- No universal principles of rationality
- Context-independent principles of evidence

- For the Constructivists:
 - Scientists are persuaded by
 - what they regard as the best evidence or argument
 - the evidence most indicative of the truth by their lights
 - Arguments and evidence are the appropriate focus of attention for understanding the production of scientific knowledge



Rationality of Science



- Constructivist

Reconciliationist

- Integrationist
- Social empiricism
- Critical contextual empiricism

RECONCILIATIONISTS



■ Ronald Giere

Incorporated scientists' interest as one of the parameters of the decision matrix/theory

■ Mary Hesse

Network model: social factors are coherence conditions operating in tandem with logical constraints



■ Philip Kitcher

Compromise between extreme rationalists and sociological debunkers



- Constructivist
- Reconciliationist

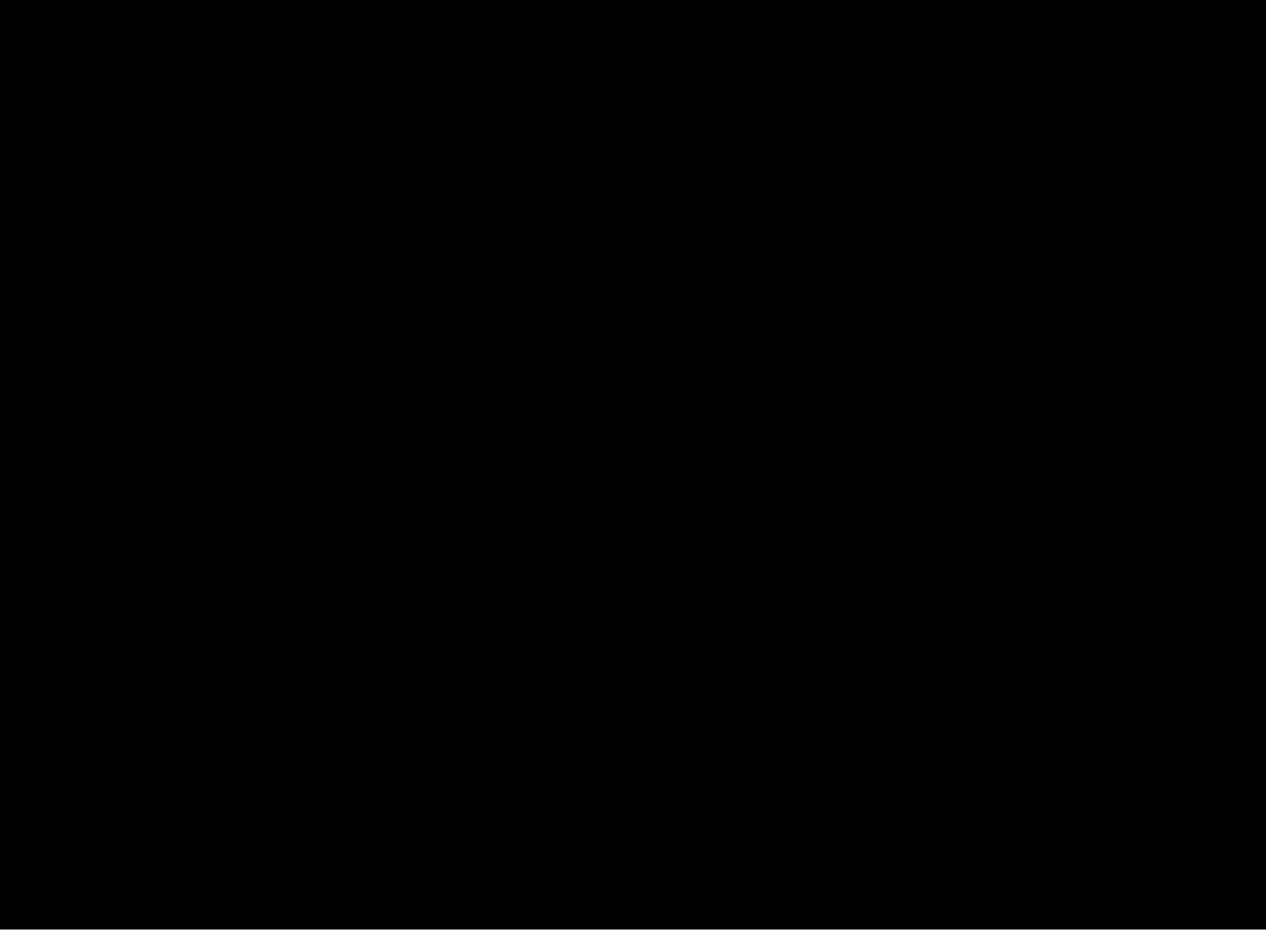
Integrationist

- Social empiricism
- Critical contextual empiricism



■ Lynn Nelson

- No principled distinction can be made between theory, observation and values.
- What counts as evidence is fixed by the entire complex of a community's theories, values and observations
- Community- a shared complex and primary knower



- Constructivist
- Reconciliationist
- Integrationist

Social empiricism

- Critical contextual empiricism

■ Miriam Solomon



- Focuses on scientific rationality , but denies a universal principled distinction among the causes of belief.
- Biases influence belief.
- Biases are not necessarily distorting, can be productive of insight and rational belief
- *It's the greater amount of empirical success that prevails*



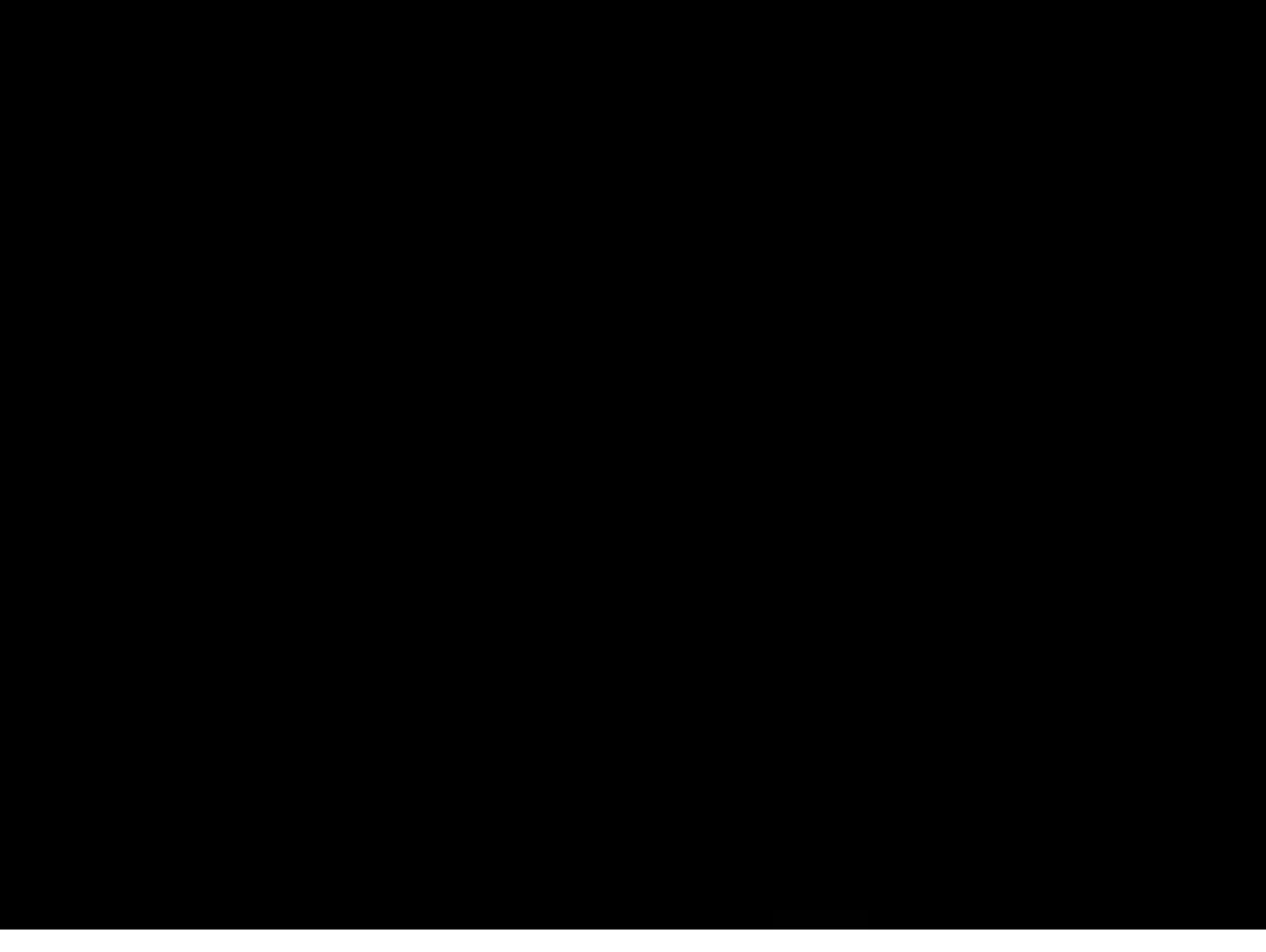
- Constructivist
- Reconciliationist
- Integrationist
- Social empiricism

Critical contextual empiricism



■ Helen Longino

Contextual Empiricism- Relations between data
and theory are mediated by background
assumptions





*...which is all
because of their idiotic
policies on –*

*Wait a minute. Cool down. Let's
just stick to what the data tell us.*

- The individuals participating in the production of scientific knowledge are historically , geographically and socially situated and their observations and reasoning reflect their situations.

Social Interactions between and within scientific communities

What counts as knowledge is determined by such interactions



Scientific communities do institutionalize some critical practices (exp-peer review). Such practices/institutions must satisfy conditions of effectiveness in order to qualify as objective

IN HIS PRESENTATION, TIMO CANDIDLY DESCRIBES THE BUSINESS OF NATURE:

① BASICALLY,
SCIENTISTS GIVE
US THEIR WORK
FOR FREE...

② ...THEN WE HAVE
VOLUNTEER SCIENTISTS
REVIEW IT FOR US
FOR FREE...



③ ...THEN WE BUNDLE IT
ALL UP AND SELL IT
BACK TO THEM FOR
A PROFIT.



AWARDS/INCENTIVES?

- Motivation
 - Or
 - Choking?
- Breakthrough ideas do not happen overnight
- “We know a thousand ways not to build a light bulb”- Thomas Edison

Mathew Effect

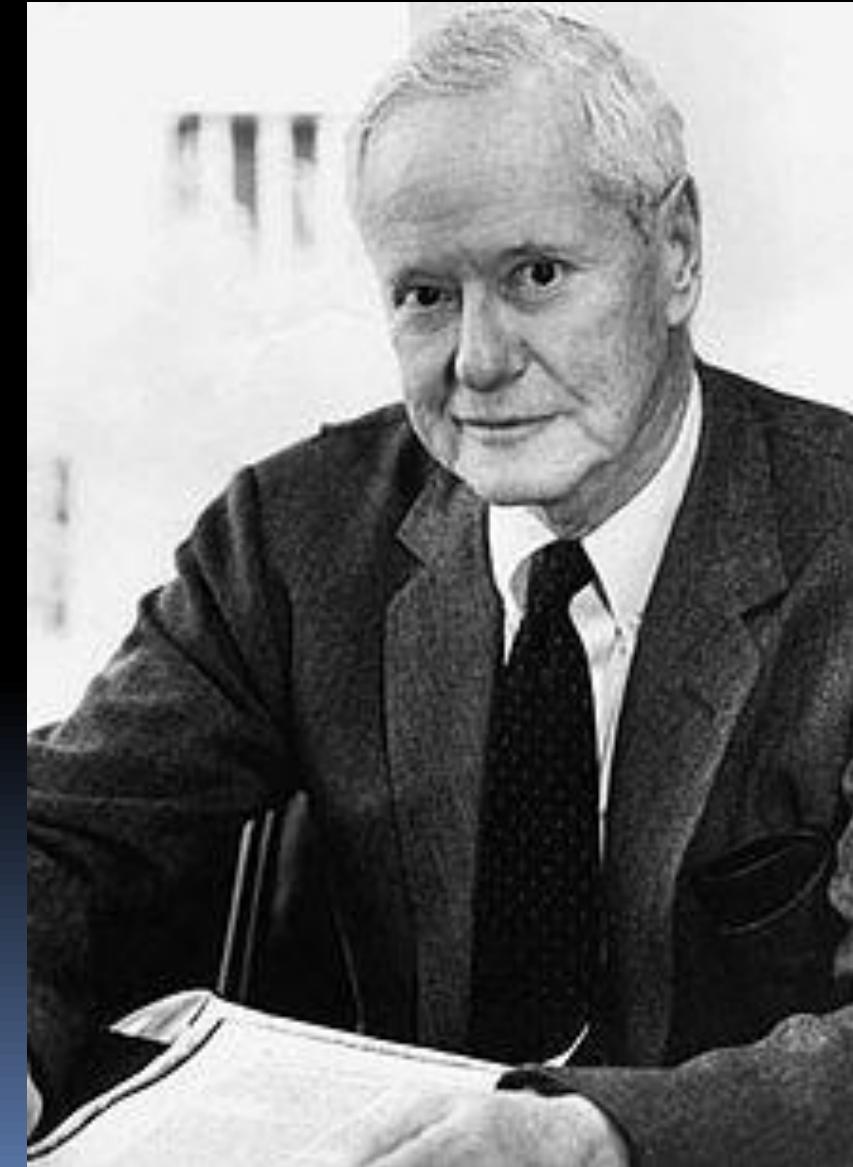
**FOR TO ALL THOSE WHO HAVE, MORE WILL BE GIVEN,
AND THEY WILL HAVE AN ABUNDANCE; BUT FROM THOSE WHO HAVE NOTHING,
EVEN WHAT THEY HAVE WILL BE TAKEN AWAY.**

MATTHEW 25:29



Robert K Merton

- 1910-2003
- American Sociologist
- Harvard, Columbia University



Mathew Effect

- Rich getting richer and poor getting poorer
- Eminent scientists will often get more credit than a comparatively unknown researcher, even if their work is similar; it also means that credit will usually be given to researchers who are already famous
- For example, a prize will almost always be awarded to the most senior researcher involved in a project, even if all the work was done by a graduate student. This was later jokingly called Stigler's law/eponymy

The skewed pattern of recognition

- appears principally
 - (i) in cases of collaboration and
 - (ii) in cases of independent multiple discoveries made by scientists of distinctly different rank

Stigler's Law of EPONYMY

- "No scientific discovery is named after its original discoverer."
- Stigler named R. K. Merton as the discoverer of "Stigler's law", consciously making "Stigler's law" exemplify itself.



Biggest
effect of
"mathew
effect"

Stigler's Law of Eponymy

Stephen Stigler
Professor of Statistics, University of
Chicago



"If an earlier, valid statement of a theory falls on deaf ears, and a later restatement is accepted by the science, this is surely proof that the science accepts ideas only when they fit into the then-current [sick] state of the science."



No scientific discovery is named after its original discoverer

- Hubble's law: Doppler Shift in Cosmology (Georges Lemaitre)
- Pythagorean theorem (Babylonean Mathematicians)
- Halley's Comet (Astronomers of 240 BC)

Exp: Marillier Shot vs the Dilsoop in Cricket (Marillier is lesser known , played less matches and hence those shots were not seen played by him by most....vis-a-vis Dilshan playing the scoop in the 2009 ICC T20 world cup and hence noticed and talked by many)

George Stigler (Economist)

- “If an earlier, valid statement of a theory falls on deaf ears, and a later restatement is accepted by the science, this is surely proof that the science accepts ideas only when they fit into the then-current state of the science.”
- He gave several examples in which the original discoverer was not recognized as such

Scientific Community

- A functional unity?
- Universal functionalism ? (some functions of some things may be dysfunctional to some others)
- Indispensability ? (whether every Sc community performs specific function. Impossible to decipher which functions are vital and which are not)

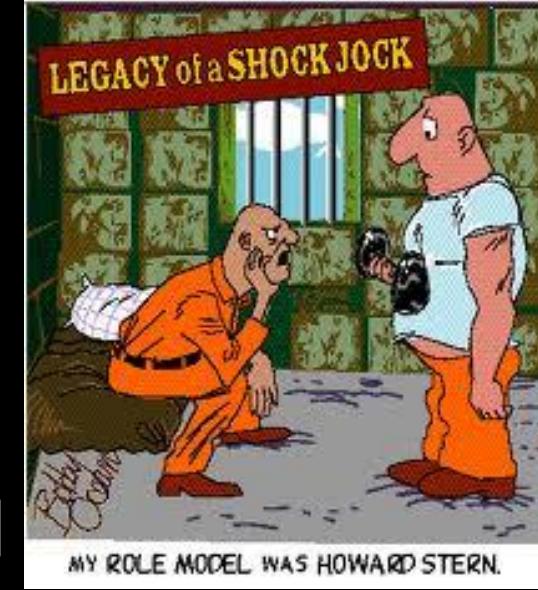
Reference Groups

- the group to which the individual relates or aspires to relate
- the individual's frame of reference and source for ordering his or her experiences, perceptions, cognition, and ideas of self
- Provides the benchmarks

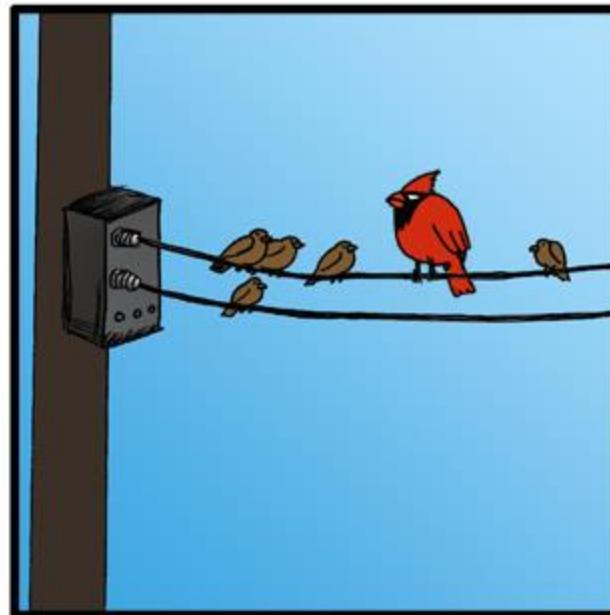
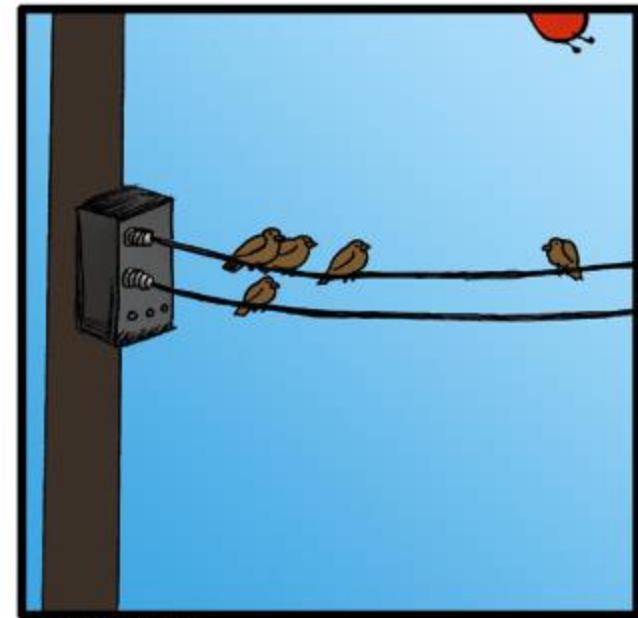


Role Model

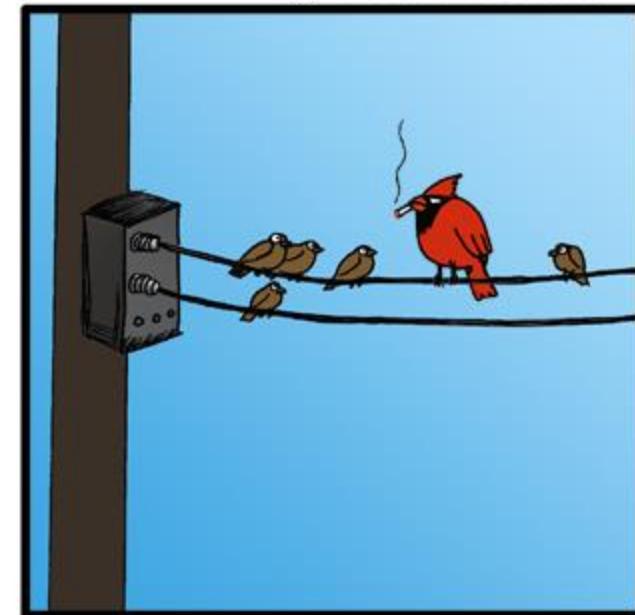
- Person who serves as an example
- Person whose behavior is emulated



Milo the Cloud



by Sean Archer



Self-fulfilling Prophecy

And

Unintended Consequences



<http://youtube.com/watch?v=I0XRRgrlXfo>

Self-fulfilling Prophecy

Robert K Merton (Sociologist, Columbia University)

- a prediction that directly or indirectly causes itself to become true, by the very terms of the prophecy itself
 - *For instance: when Mrs. X falsely believes that her marriage will fail, her fear of such failure actually causes the marriage to fail.*
- A *false* definition of the situation evoking a new behaviour that makes the original 'false' conception come 'true'.
- People's beliefs influence their actions
- This specious validity of the self-fulfilling prophecy perpetuates a reign of error. For the prophet will cite the actual course of events as proof that he was right from the very beginning



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The classic Case of Oedipus

Warned that his child would one day kill him, Laius abandoned his new-born son Oedipus to die, but Oedipus was found and raised by others, and thus in ignorance of his true origins. When he grew up, Oedipus was warned that he would kill his father and marry his mother. Believing his foster parents were his real parents, he left his home and travelled to Greece, eventually reaching the city where his biological parents lived. There, he got into a fight with a stranger, his real father, killed him and married his widow, Oedipus' real mother.

And then, this...

- In Indian epic *Mahabharata*, the ruler of the Mathura kingdom, **Kansa**, afraid of a prophecy that predicted his death at the hands of his sister Devaki's son, had her cast into prison where he planned to kill all of her children at birth. After killing the first six children, and Devaki's apparent miscarriage of the seventh, **Krishna** (the eighth son) was born. As his life was in danger he was smuggled out to be raised by his foster parents Yashoda and Nanda in the village of Gokula. Years later, **Kansa** learned about the child's escape and kept sending various demons to put an end to him. The demons were defeated at the hands of **Krishna** and his brother Balarama. **Krishna**, as a young man returned to Mathura to overthrow his uncle, and **Kansa** was eventually killed by his nephew **Krishna**. It was due to **Kansa**'s attempts to prevent the prophecy that led to it coming true, thus fulfilling the prophecy.

Possible Implications (in science)

- Scientists can be led astray by their beliefs and prejudices
 - Expectancy Bias,
 - Observer's bias. and
 - Interpretation bias
- Deliberate ignorance (of)
- Systematic distortion of research findings because of subjective influences

Mathew Effect

FOR TO ALL THOSE WHO HAVE, MORE WILL BE GIVEN, AND THEY WILL HAVE AN ABUNDANCE; BUT FROM THOSE WHO HAVE NOTHING, EVEN WHAT THEY HAVE WILL BE TAKEN AWAY.



Stigler's Eponymy

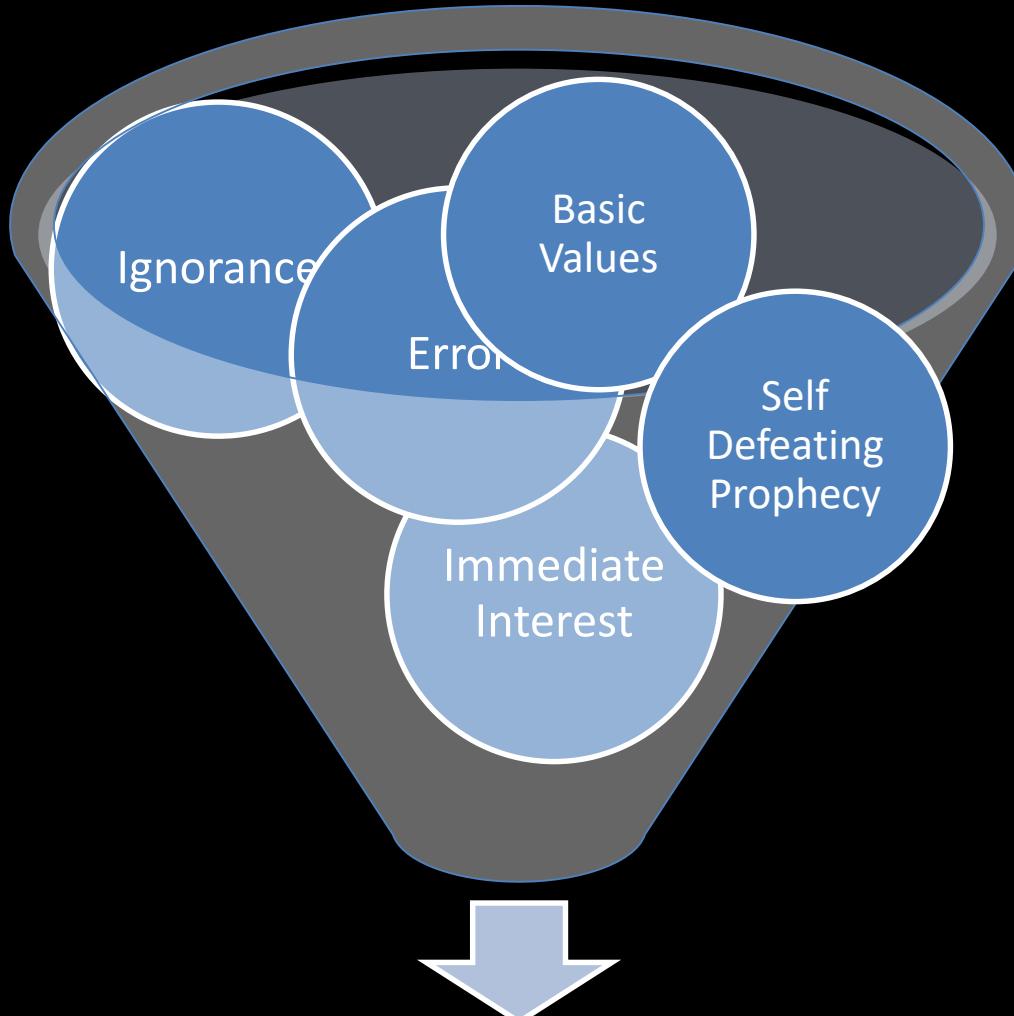
"If an earlier, valid statement of a theory falls on deaf ears, and a later restatement is accepted by the science, this is surely proof that the science accepts ideas only when they fit into the then-current [sick] state of the science."



No scientific discovery is named after its original discoverer

Unintended Consequences

- outcomes
that are not
the ones
intended by a
purposeful
action

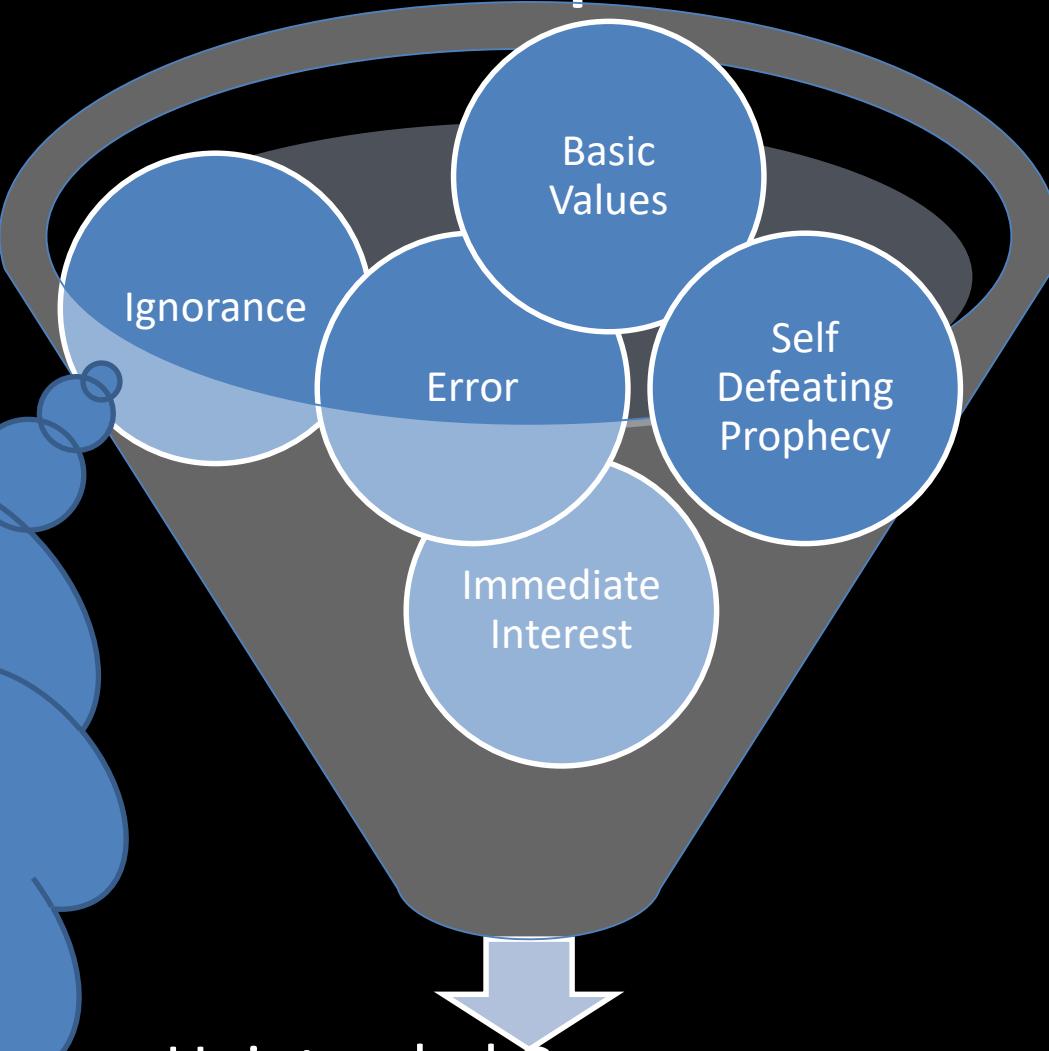


Unintended Consequence

Unintended Consequences

- outcomes
that result
from

May lead
to
incomplete
analysis

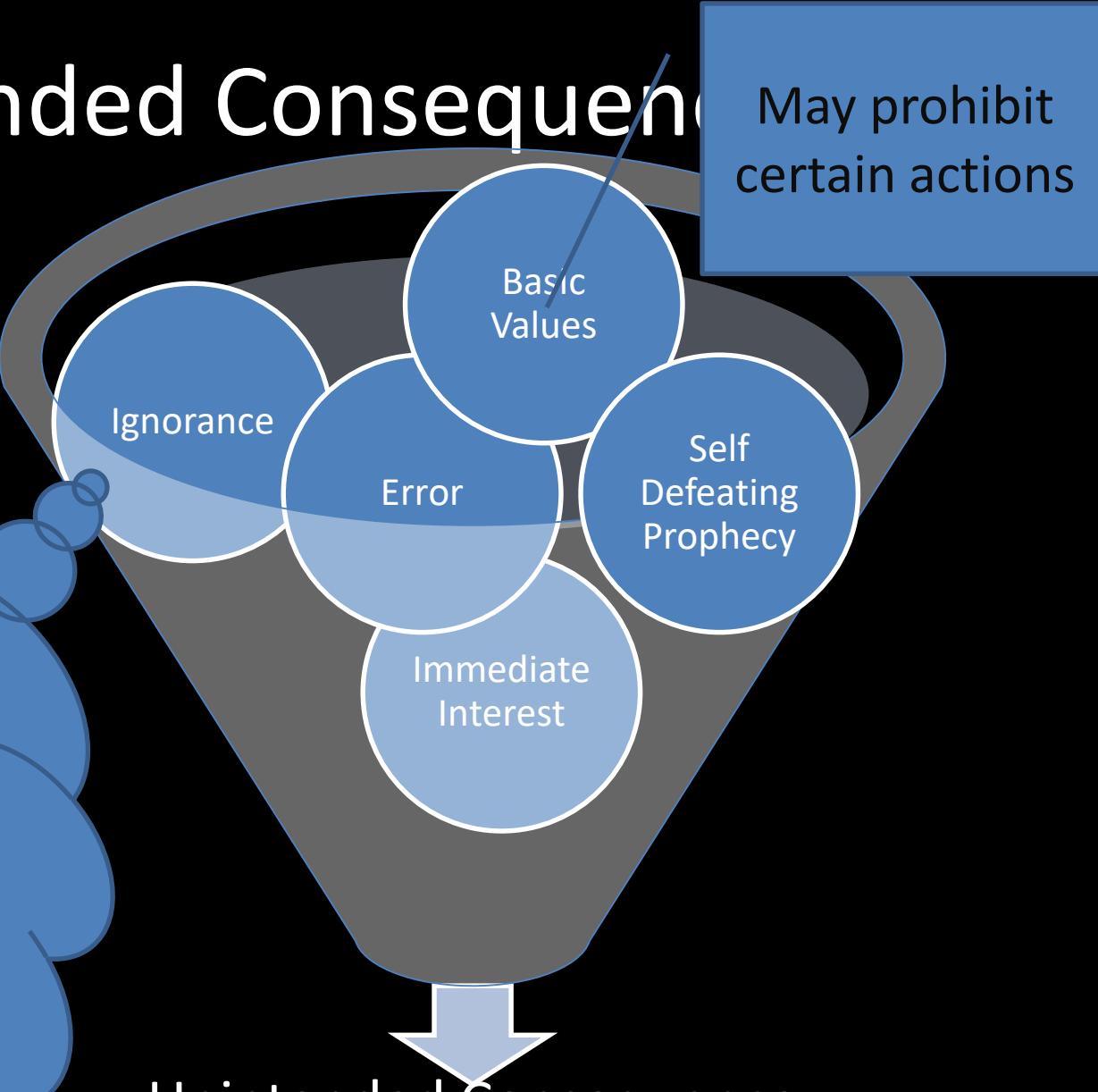


Unintended Consequence

Unintended Consequences

- outcomes that result from the

May lead to incomplete analysis



Unintended Consequences

- outcomes that result from the action

May lead to incomplete analysis

Unintended Consequence

Incorrect analysis of the problem

May prohibit certain actions

Basic Values

Ignorance

Error

Self Defeating Prophecy

Immediate Interest

Unintended Consequences

- outcomes that result from the action

May lead to incomplete analysis

Incorrect analysis of the problem

Basic Values

Ignorance

Error

Immediate Interest

Self Defeating Prophecy

May override long-term interests

May prohibit certain actions

Unintended Consequence

Unintended Consequences

- outcomes that were not intended

May lead to incomplete analysis

Incorrect analysis of the problem

Ignorance

Error

Immediate Interest

Basic Values

Self Defeating Prophecy

May prohibit certain actions

Fear of some consequence drives people to find solutions before the problem occurs

May override long-term interests

Unintended Consequence