Introducing the Philosophy of Science

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Introduction

• Why is this method of obtaining knowledge assumed to be so reliable?
• How does it differ from other forms of knowledge?
• Why do politics and social studies seek to have themselves accredited as sciences?
Introduction

• Science is special because it is based on facts.
• Facts are claims about the world that can be directly accessed through careful, unprejudiced use of the senses.
• Science is based on what we can see, hear and touch. It is not based on personal opinions or speculation.
Introduction

• If we use logical, valid reasoning to determine laws and theories from these unprejudiced facts, then we arrive at sound, objective knowledge.

• Before the 17th century, knowledge was largely based on authority, the authority of Aristotle and the Bible.

• Then this authority was challenged by the scientific method.

• Galileo and his experiment with a 100 pound and one pound object was a prime example.
Introduction

- British empiricists: John Locke, George Berkeley and David Hume
- Positivists: originated from August Comte.
- Empirisists - all knowledge should be obtained from ideas implanted in the mind from the senses.
- Positivists - the same but focused on the logical relationship between scientific knowledge and facts.
- Common point knowledge should be derived from facts that are obtained through observation.
Common-sense view of science

Common sense view of science states that:

• facts are obtained by carefully observing without prejudice through your senses (unprejudiced seeing?)
• facts come before theory and they are independent of theory (facts before theory?)
• facts are a reliable, infallible foundation for scientific knowledge (infallible facts?)
“Unprejudiced seeing”

- Two assumptions
  - Firstly that people can directly access knowledge about the world
  - Secondly that two normal people who look at something will see the same thing.
- Identical light rays will hit both people’s eyes and create the same images.
- The same information will then travel to the brain of each person through the optic nerve and they will see the same thing.
“Unprejudiced seeing?”

- Two people viewing the same object do not always see the same thing. Figure 1 on page 6.
- What do you see? Is it a staircase or just a collection of lines. If it is a staircase, is it one from above or below?
“Unprejudiced seeing?”

- What is the difference between taking a photograph and seeing through the human eye?
- The way in which the final image is recorded.
- Optic nerves pass from the retina to the central cortex of the brain.
- The brain’s interpretation of what the optic nerve records is what constitutes seeing.
“Facts before theory?”

- Scientists observations are not only determined by the light that falls on their retinas but also by their experience, knowledge and expectations.
- Scientists learn to be competent with microscopes.
- Microbiologists watching two cells dividing need to have been trained to observe this.
- Medical student needs training to understand X-ray diagnosis of pulmonary diseases.
“Facts before theory?”

• We do not have immediate access to the world via our senses.
• It is mediated by our knowledge and expectations.
• The gathering of knowledge cannot be equated fully with taking a picture with a camera.
• When the light rays hit our retinas (and not all retinas are the same), it is interpreted by our past knowledge about similar images and about thoughts we have surrounding them.
Some qualifying points

• Firstly, this is not to say that the light rays that hit our retinas have nothing to do with what we see but our culture, expectations can influence it

• Secondly, it is also not to imply that what we see in a variety of circumstances remains mostly the same but it is not identical
“Facts before theory?”

• Language constitutes facts
• Science is based on statements of fact rather than the facts themselves
• Experience is not enough, we need to write about the facts, present theories
• When we say that knowledge is obtained from facts – we have statements in mind not perceptions
• Therefore, it does not make sense to say that statements of fact are acquired via the senses
“Facts before theory?”

• Before you can observe a fact you need some linguistic conceptual framework to describe it.
• A child learning what a ball is, is confronted with many examples of non-balls before he is able to identify a ball
• A fact-finding mission in the field of Botany to discover new species of plants requires you to recognise existing species and this requires a conceptual framework
• You need prior knowledge to observe facts
“Infallible facts?”

• We assumed that observational statements are always true but history shows this not to be so.
• Copernicus predicted that the earth circulated the sun in an orbit outside Venus and inside Mars. His prediction would mean that Venus and Mars would change in size during the course of the year.
• This was not able to be perceived by the human eye so his theory was discredited. But the invention of the telescope made this observation possible.
• Facts and knowledge are both fallible.
Conclusion

• It is not accurate to say that science is founded on unquestionable solid facts established by infallible observation.
• The background and expectations of the observer influence what one sees.
• Sometimes the instruments we used to observe are not sophisticated enough.
• Judgements about the truth of observations also depend on existing knowledge and sometimes this knowledge is fallacious.
Are scientific facts still useful?

• Just because we need prior conceptual knowledge does not negate the fact that knowledge has a factual basis that is established by observation.
• A conceptual framework is needed for the formulation of facts and observation is needed to establish the truth or falsity of these statements.
• If we say that giraffes are carnivorous, then observation would show this statement of fact to be false since all giraffes are herbivores.
• Scientific knowledge and facts are interdependent.
Essay question

Describe the common sense view of science and explain what it is not accurate. Motivate whether you think this altered view of science still makes it useful? (25 marks)
Observation in Science

• Moon illusion is a common phenomenon.
• High in the sky – appears much smaller than when it is low on the horizon.
• However – do not have to put trust on the subjective judgement about the moon size.
• But what do we do to reduce subjective view of the moon size.
• Can mount a sighting tube fitted with cross wires – so that its orientation can be read on a scale.
Observation in Science

• This can be done when the Moon is high on the sky and repeatedly done when it is horizontal.

• Findings- the moon remain unchanged – indicating that there is no significant variations and differences between the scale readings in two cases.
Observation in Science

• Key points to learn:

• Observation statement constitute worthy of forming basis for science – straightforwardly tested by senses and withstands those tests.

• OS – their validity can be tested in ways that involve routine, objective procedures that do not necessitate fine, subjective judgements on the part of observer.

• This brings out the Active, public character of the vindication of OS.
Observation in Science

• Small price has to be paid for the notion of an observable fact.

• That price is that OF are to some degree fallible and subject to revision.

• If OF passed the testes – does not mean that it will survive new kinds of tests that become possible in the light of advances in knowledge and technology.

• E.G. The earth is Stationary and second – the apparent size of Mars and Venus do not change appreciably during the course of the year.
Observation in Science

• Therefore we can conclude that observation worthy of forming basis for scientific knowledge are both objective and fallible.

• Objective – because they can be publicly tested by straightforward procedures And

• Fallible – they may be undermined by new kinds of tests made possible by advances in science and technology
Essay Question

• Discuss how observation statement can form the basis of scientific knowledge. Answer your question by providing relevant examples to show understanding of the topic. (5 pages is Fine).