Observation and Theory

Phil 20019
Topics in Philosophy of Science

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Introduction (1)

- It is hard to deny the importance of observation in science and everyday life.
- Many argue that observation is the prime, perhaps the only way, of knowing the world.
- Context of Discovery vs. Context of Justification

  - Observation can lead to the postulation of theories.
  - Observation is the ultimate arbiter in the evaluation of a scientific theory.

- What exactly do we mean by observation?

Introduction (2)

- Observation, as it is understood in this context, does not restrict itself to seeing, but refers also to the other forms of sensing, i.e. hearing, touching, smelling and tasting.
- Our senses are ‘extended’ by instruments.
- Examples of observation in science:
  - Seeing objects through a telescope or a microscope
  - Hearing the clicks made by a Geiger counter
  - Smelling certain chemical compounds
- The objects of observation seem to be in some robust sense intersubjective/public.

Introduction (3)

- Observation *reports*/*sentences* are:
  - meant to contain information about corresponding observations
  - taken to be evidence for or against scientific theories, i.e. the most basic empirical data in science.

- Example:
  - I see that the solution turns green
  - I then report this: "Solution *X* turned green at time *t*"
  - If the theory predicted this, we can say that it is *confirmed*; If not, we can say it is *disconfirmed*.

Theory-Ladenness (1)

- The activity of observation and observation reports seem to be affected by theory.
- At least four ways in which theories or at least prior beliefs influence observation.

1) They can determine which observations to perform.
2) They can affect the way we perceive.
3) They can assess the credibility and reliability of the observation report.
4) They can invade our observational vocabulary.

<u>Prominent Advocates:</u> Hanson, Kuhn and Feyerabend.

Theory-Ladenness (2)

1) Theory can determine which observations to perform.

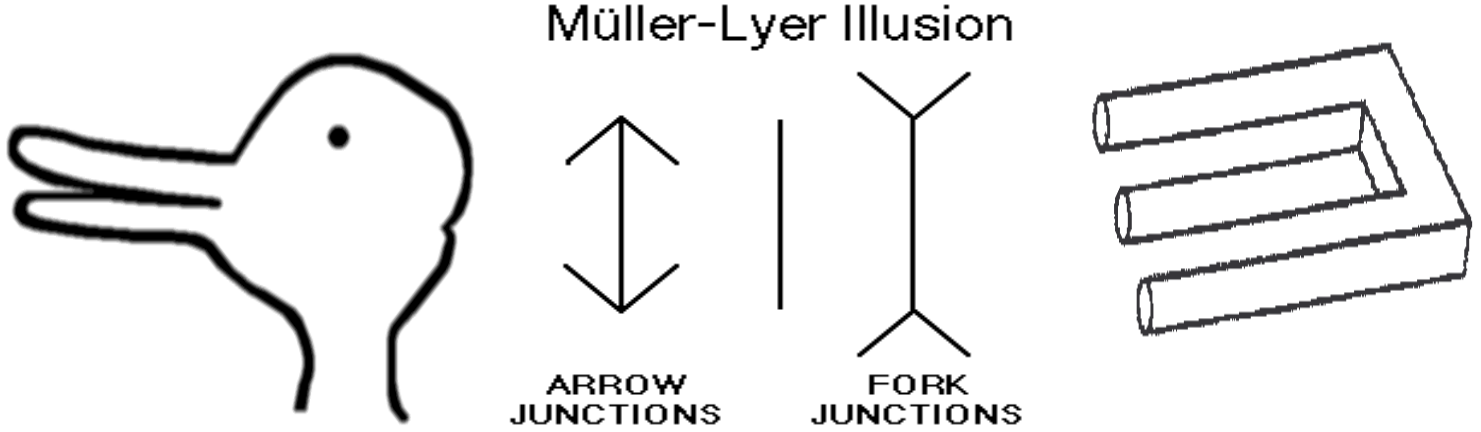
- Scientists are not in the habit of collecting data at random. Their investigations are guided by theory.
- Likewise, instruments are built and operated on the basis of theoretical knowledge. Which observations we make depends on the instruments we can build.

Example: Think of the Hubble Space Telescope.

Theory-Ladenness (3)

2) Theory can affect the way we perceive.

- Psychological experiments emphasise the effect our background theory or beliefs have on perception.



- Kuhn thinks that "…paradigm changes do cause scientists to see the world of their research-engagements differently"
- Hanson: A physicist looking at an X-Ray tube, "sees the instrument in terms of electrical circuit theory, thermodynamic theory, the theories of metal and glass structure, thermionic emission, optical transmission, refraction, diffraction, atomic theory, quantum theory and special relativity"

Theory-Ladenness (4)

3) Theory can assess the credibility and reliability of the observation report.

- Observation reports can be discarded on account of their inconsistency with the leading theory.
- Indeed, we sometimes calibrate our instruments in order to get the right empirical results.

Theory-Ladenness (5)

4) Theory can invade our observational vocabulary.

Arguing from meaning holism, Paul Churchland holds that the meaning of observation sentences depends in its entirety on the theories one holds.

Example: The meaning of colour terms has changed to reflect our theoretical understanding. Different colours, according to optics, arise from the different properties of the surface of objects, something that determine the wavelength composition of the light reflected from them.

Central Questions

- Are observation reports sufficiently independent from theoretical considerations to be able to count as objective evidence?

- If observation reports are not sufficiently independent, how can we test and justifiably choose between competing theories?

Salvaging Observations

- Theory-ladenness is innocuous if:

(1) Theories affecting observation are independent of the theory being tested – Peter Kosso

(2) We are aware of the particular theoretical contributions and

(a) can compensate for any theoretical bias

(b) can strip observation reports down to their observational core.

Salvaging Observations (2)

- Against the perception alteration argument:

  - Psychology also points out that perception can be impervious to some of our theoretical knowledge.

- Against the supremacy of theory over observation:

  - Scientists who differ profoundly in their theories, yet see the world in exactly the same way.

- Against the meaning holism argument:

  - Not all semantic properties of sentences/beliefs are determined by the theoretical context.

Food for Thought

- If theory-ladenness is so widespread and debilitating, why doesn't empirical testing come out positive all the time?

Reading

- Fodor, J. (1984) ‘Observation Reconsidered’, Philosophy of Science, vol. 51(1): 23-43.