SCIENCE

Instrumentalism vs Realism, Scienticism, Science and other disciplines

Problem of Demarcation revisited – why bother?

- Why do we bother?
- The **privileging of Science** over any and every other body of knowledge
- When there are rival candidates for a knowledge claim, which do we believe?
- Simple! Just ask which is the scientific theory and which isn't.
- But is this necessarily the right move?
- Consider how we have many different theories today that claim to be scientific when they are not.
- E.g.: healthcare claims like eating kale, drinking coconut oil, the whole 'eating clean' movement (read the Guardian's piece https://www.theguardian.com/lifeandstyle/2017/aug/11/why-we-fell-for-clean-eating)
- Also, is the assumption that that which is scientific is always epistemically superior to that which is not scientific correct?
- **Is science over-reaching in some areas such as ethics because it cannot provide us with such knowledge?**

Scientism

- Essentially, the **worshipping** of science, an over-reverential attitude towards science, thinking that science is the best or even the only valid form of intellectual endeavour
- To say that one is being unscientific is not merely an observation but to **pass judgment**, specifically a negative one – irrational, unjustified, foolish, perhaps even worthy of contempt
- The opposite holds for being scientific – rigorous, precise, justified, to be believed
- **But should we hold such an attitude?**
- Is Science really to be privileged over other disciplines? Think Math, Social Sciences, Humanities, Ethics, Aesthetics
- **Can Science even inform us on such matters?**

Science & other disciplines

- **How applicable is the Scientific Method** to other areas of exploration like Ethics, Aesthetics and the Humanities?
- Science: an empirical method of study into the workings of the (natural) world via the scientific method
- Insofar as a discipline is quantifiable and/or allows for experimentation, it seems possible to apply the SM to it
  - E.g. Economics – quantifiable variables like price, years, GDP/capita, import levels etc
  - E.g. Psychology – experiments are possible (e.g. Milgram experiment)
  - E.g. Aesthetics – that which is beautiful is that which the majority of people like or perhaps that which conforms to the Golden Ratio
- But not everything that is of the **social and/or mental world** is quantifiable and/or allows for experimentation
  - E.g. How to quantify thoughts? How to separate one from another?
  - Human beings have free will and are not inanimate/non-sentient variables who have no choice but to obey laws of nature like carbon atoms – so psych experiments might reveal to us how the *majority* of people might act in a given situation but not for any particular individual; no uniform behaviour

Science & Ethics

- Science: the study of what **is** as opposed to what **should be**
- The former – positive statements like 'there is a law of gravity'
- The latter – normative statements like 'thou shalt not kill'
- Hence, no matter how sophisticated the experiment or the measuring device, the SM would be **unable to tell us how to act ethically**
- E.g. Science cannot tell us how to resolve the Trolley Problem; at best, it can only inform us of the suffering involved etc. To then decide based on these consequences that we should, say, kill the one in order to save the five is to **appeal to the ethical principle** that we should act in such a way as to maximise utility and minimise suffering.
- Hume: science merely gives us the "is" but ethics is about the "ought"
- **No amount of "is" can give us an "ought"!**
- P1: Killing one to save five would maximise utility and minimise suffering *(Science can give us this)*
- P2: We should always act so as to maximise utility and minimise suffering *(Science cannot give us this)*
- C: We should kill one to save five (P1-2)

Science & the Humanities

- Humanities: subjects like Literature, Philosophy, Art
- Can Science reveal to us truths that are generated/obtainable through Literature?
  - Hope is the thing with feathers
    That perches in the soul
    And sings the tune without the words,
    And never stops at all

    And sweetest in the gale is heard;
    And sore must be the storm
    That could abash the little bird
    That kept so many warm.

    I've heard it in the chilliest land,
    And on the strangest sea;
    Yet, never, in extremity,
    It asked a crumb of me. (Emily Dickinson, "Hope is the thing with feathers"
- Poetry uses metaphors and imagery to express claims (or truths) that are not so amenable to the language of science, which is (supposedly) direct and plain
- To paraphrase the poem into scientific language would be to lose something quintessential as well
  - Imagine: "hope is a chemical reaction within our bodies that can be found across all human beings" - bleargh

Science & Math

- Can we **conclusively** say that one is **better or more important** than the other?
- Depends on our criteria: utility, fundamental, certainty, objectivity
  - Any other criteria?
- Utility – Science can give us truths of the world being synthetic a posteriori but if Math is analytic a priori, it cannot. Thus, Science > Math
  - But what of the unreasonable effectiveness of Math?
  - Is Math that which reveals to us the inner workings of the universe or is it Science?
  - Put another way, **can we do Science without Math?**
- Fundamental – which is more fundamental? Which discipline is **necessary** in order for the other to function/progress?

Science & Math

- Certainty:
  - Math generates knowledge claims via the axiom-theorem method, utilising **solely a priori** and **deductive** reasoning
  - Science arrives at its claims via the SM which is **empirical** (thus open to all the problems of empiricism) and utilises inductive reasoning.
  - **So Math > Science**
- Uncertainty Of Science:
  - Problem of Induction – cannot guarantee results
  - Falsification fails as a response to the POI
  - Contrastive Underdetermination means that don't even know if theory choice is correct thus uncertainty
  - Selection bias of variables/ Salience Theory-ladenness – what they think to be important variables might well turn out not to be
  - Empiricism's uncertainty – corrigibility of sense perception, or even if perception is incorrigible, there are LIMITS to sense perception such that even if we grant a scientist's observations, there could well be something that he's not observing and it is THAT variable which is crucial, not the ones that he observed
- Unless Math is empirical…
- What of Intuitionism?
- What of Godel's Incompleteness Theorems? Do they show that Math is merely as certain as Science?
- Are there ways to mitigate the uncertainty in Science? – think controllability, repeatability and peer review

Science & Math

- What of Objectivity?
- Recall: to say that X is objective is to mean that X's existence is **mind-independent** such that if no human beings were to exist, it would still be in existence
- Recall: Math is typically seen to be objective (Platonism, or even Empiricism). But let's not forget Intuitionism and Formalism (Math as constructed and thus subjective)
- Yet objective can also mean **non-biased.** If so, the 'universal' bias of a Kantian-like filter of consciousness means that Intuitionism also views Math to be objective
- What of Science?
- In short, because it is an empiricist endeavour, it is objective; it believes that the entities that Science studies exist regardless of human beings
- But… Instrumentalism vs Realism slides… (later)

Science & Math

- Mind-independent aside, focusing on objectivity as **neutrality or non-biasedness**, is Science objective? Or as objective as Math?
- Verificationists and Falsificationists – essentially, yes
- Kuhnians – Nope. Because of Theory-Ladenness and Incommensurability of Paradigms
- No such issue for Math – the language of Math is universal (formal language of signs and symbols) while there doesn't seem to be any real revolution in Math, at least not in the same way as Science
  - Different cultures across different times and spaces generated the same kind of math, different base and notation systems notwithstanding
  - Euclidean and Riemannian geometry *could* be seen as different math paradigms because they seem to contradict each other but it's just different systems as it were and they **don't fight for the same space**, i.e. they are not trying to explain the exact same thing, **unlike** Science.
  - E.g. Heliocentric vs Geocentric – both are trying to explain planetary motion and thus cannot co-exist

Realism vs Instrumentalism

- As seen before, Realism can be about many different things.
- For example, about the existence of the external world in general, or about the world as we experience it (i.e. phenomenal world), or about certain kinds of things, like mathematical objects/entities
- This debate is also found in Science, usually on what are called the unobservables
- E.g. atom, electron, quarks, strings, etc.

Realism

- In Science, realism holds that the entities that science talks about **exist independently of minds** and that science can say *true* things about them. This is true of both observables and unobservables.

- E.g. electrons and molecules exist and behave in the way that scientists say they do.

Instrumentalism

- The view that **unobservable** entities are **fictions** that are used to predict the behaviour of observable entities.
  - E.g., in the kinetic theory of gases, an instrumentalist would say that the unobservable 'billiard balls' are posited in order to predict the expansion of gases when heated under constant pressure; they don't exist per se.
- Thus, for the instrumentalist, the content of a scientific theory involves nothing more than the set of claims that can be substantiated by observation and experiment.
- Theories are nothing more than **useful instruments** for helping us to correlate and predict the results of observation and experiment.
- **Why?** The motivation seems to be to **restrict science to those claims that can be justified by scientific means**, and so avoid unjustifiable speculation.
- E.g.: The Logical Positivists/Empiricists/Verificationists were instrumentalists.
- Recall: for them, in order to have meaning, a term/statement needs to be verifiable.
- But an unobservable is, by definition, not empirically verifiable; nor is it analytic.
- Hence, such statements have no meaning and no truth value.

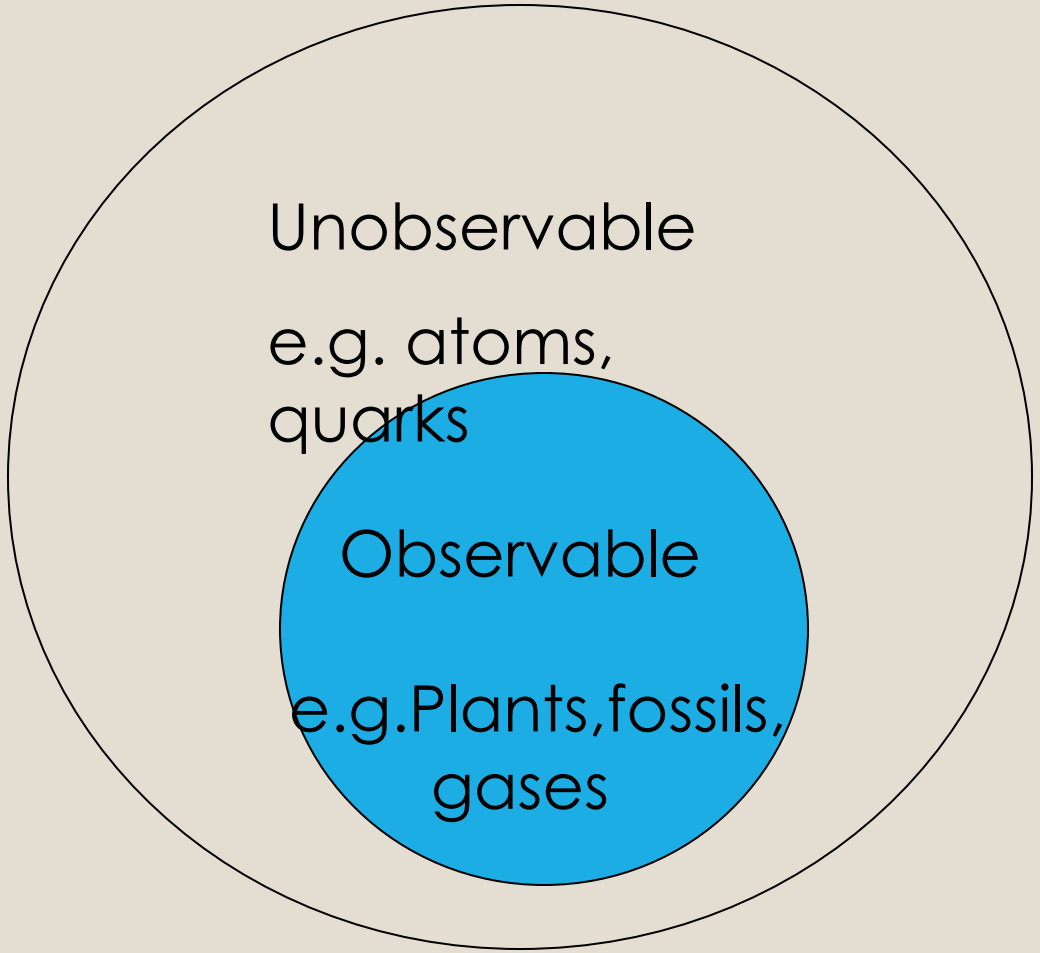
Instrumentalism

- Still, although these theories are not real and can prove to be untrue, they can play a positive role in helping to **order and discover observable phenomena**.
  - E.g. Although Maxwell's original electromagnetic theory as representing states of an ether was wrong, these speculations led him to an electromagnetic theory of light and was eventually to lead to the discovery of radio waves
- Hence, it seems plausible to evaluate theories **solely** in terms of their ability to order and predict observable phenomena (as opposed to whether they are real)
- Thus, **the theories themselves can be discarded** when they have outlived their usefulness while the observational and experimental discoveries to which they have led can be retained.
- Just as past theories and the unobservable entities employed by them have been discarded, so we can expect our present ones to be.
- They are simply **scaffolding** to help erect the structure of observational and experimental knowledge and they can be rejected once they have done their job

Difference between Realism and Instrumentalism

- **Both believe that the observable world exists**
- They disagree on the unobservable world
- For the Realists, the unobservable exists
- The Instrumentalists disagree
- In other words, the instrumentalists are non-realists with respect to the external world.

Observable and Unobservable



Arguments for Realism

- 1) No miracles
  - Most theories that posit unobservable entities are apparently **empirically successful**
  - If these entities didn't exist, then a **miracle** needs to exist

  - **Objection**: but what of those other theories of unobservable entities that were **empirically successful** but now considered to be **wrong**?
  - E.g. Newton's particle theory of light, the caloric theory of heat etc.
  - Anti-realist/Instrumentalist: Although the theoretical parts of those theories have been rejected, those parts of them that were based on observation have been retained.
  - E.g.: Newton's observations concerning chromatic aberration and interference, Coulumb's law of attraction and repulsion of charged bodies and Faraday's law of electromagnetic induction have been incorporated into modern science.
  - The **enduring** part of science is that part which is based on observation and experiment.
  - The theories are mere scaffolding which can be dispensed with once they have outlived their usefulness.

Arguments for Realism

- 2) Pragmatic
  - Science is about progress
  - But progress can only happen (according to Falsification) if there is **genuine conflict** in scientific theories
  - **If all these 'unobservables' do not exist, then how is there any genuine conflict?**
  - Hence, for progress to occur, we must postulate the idea that unobservables exist

  - **Objection**: science could be made up of paradigms.

Arguments for Instrumentalism

- 1) Underdetermination
  - For any group of observations, there can be more than 1 theory to explain it, i.e. that the observations **underdetermine** which theory is true (contrastive underdetermination)
  - Thus, it is **chauvinistic** to say that your theory is true and that the alternatives are untrue.
  - Instrumentalists can point to the **history of science** where theories of the past have been rejected as false and the entities postulated are no longer believed to exist.
  - E.g. Newton's corpuscular theory of light served science well for over a hundred years but it is now regarded as false; there are also no such things as the corpuscles that Newton's optics implied.

Arguments for Instrumentalism

- **Objection 1**: Underdetermination is true BUT some theories are just better than others
- E.g. Simplicity or Predictive power

- **Objection 2**: few actual examples of underdetermination in the history of science where scientist couldn't choose between theories in real life

- **Objection 3**: Instrumentalists are **selective** in applying underdetermination as theories of observables are also liable to the problem of underdetermination.

Essay Qns Exercise

- 1) Discuss the view that scientific knowledge is the most important kind of knowledge for the progress of a society. (2007 A levels)
- 2) We cannot know about what cannot be falsified. Discuss. (2013 A levels)
- 3) Mathematics is a matter of invention not discovery. Critically assess this view (2018 A levels)
- 4) Assess the extent to which science gives us knowledge of the world. (2020 A Levels)