

Objectivity & Values in Science –pt.II: What is Scientific Truth? Grover Maxwell’s “The Ontological Status of Theoretical Entities” & Richard Boyd’s “Lex Orandi est Lex Credenti”

Scientific Realism vs. “Anti-Realism”¹: Some General Remarks

- (Recall **Lecture I**, how philosophy of science draws from other major branches of philosophy like **epistemology**, **metaphysics**, **philosophy of language**.) **Realism** vs. “**Anti-Realism**” draws from a “hard problem” concerning the question of **representation, truth, and meaning** as discussed by Plato. In other words, this is fundamentally *not* a new issue!
- (**Plato, ca. 5th cent. B.C.**) The paradox of *representations*: A.) **Descriptive**: What is a “perfect representation of *X*” other than *X* itself (or some exact replica)? B.) **Normative**: What is *meant* by a “good” representation, given that *all representations distort*? Are such standards of appraisal dependent on the *interests and perspectives* of the beholder, or can one come up with objective criteria?²
- (**Nicholas Cusanis, 15th cent. A.D. Scholastic and NeoPlatonist**) There are *no analogies* that can depict the mind’s attempt to seize truth.³ At best, there are *illustrations*. One illustration⁴ depicts truth as a circle and the mind’s attempt to grasp or comprehend it as a series of inscribed polygons. Cusanis, astute mathematician that he was, pointed out correctly that no matter how many sides we add to our inscribed polygons (illustrative of the degree of refinement our attempts become) such *n* –sided polygons will *never* converge to become the

¹ “Anti-Realism” was a term coined by philosopher Hilary Putnam (ca. 1960). It’s supposed to encompass *all* views that deny in the realists’ claim (whether metaphysical, epistemological, methodological or some combination thereof). This includes “**instrumentalism**” (generally understood to be the notion that the chief aim of scientific theories are to serve as *instruments*, whether for the goal of predicting and controlling nature, socio-technological, socio-political, etc.) “**empiricism**” (generally understood to be the notion that the chief aim of scientific theories is *empirical adequacy*, i.e. that the theory “saves the phenomena,” i.e. that whatever story the theory *T* is telling us about is going on in nature, this story *must* satisfy the constraints set by observed phenomena—whether in the rigorous laboratory/testing sense or in the more informal sense of direct observation, and all intermittent cases.) Michael Dummett (in *Truth and Other Enigmas*) criticized the notion of “anti-realism” as too broad to be meaningful, in any interesting sense.

² Recall **Lecture VIII**. Of course, Plato’s notions of objectivity were far different from those of the present-day social epistemologists and philosophers of science like Helen Longino!

³ In this respect, he is going against Aquinas’ notions of the functions of analogies, in yielding positive information. (Note also the reference to Aquinas in Boyd (33)).

⁴ *De Docta Ignorantia*

circle!⁵ Representations (i.e. n -gons) are one thing, truth is another! “When the mind attempts to step outside such limitations, “it is seized in paradox.”

- **(Philip Kitcher, 21st cent).** In the light of the above issues, recall Kitcher’s analogy of scientific theories functioning like *maps*. *Pace* Plato’s theory that there can be objective norms (in Plato’s strict sense) Kitcher points out instead that the *ontology* of a map’s entities is *constituted* by the *interests* of the agent. A map of the subway routes is fundamentally different from a topographical map. All maps aim to *reliably* depict features of the world they pick out, but such *reliability* is fundamentally circumscribed and determined by the *specific* and *practical* interest of the agent/“theorist as cartographer.”⁶

...So, in the light of such metaphysical, epistemological, and methodological hard problems/questions, **would you argue that the essential aim of a scientific theory T is “[T/t]ruth?”** (Note that the T/t metaphysical distinction. One can, for instance, (like the Platonist) talk of **Truth** in some fashion that is **ultimate and transcends all language and cognition**⁷, or one can instead speak of a notion of **truth** (like William James, and C.S. Peirce⁸, and others) **in terms of some cognitively or linguistically mediated notion** like “reaching the end of inquiry” (Peirce), etc. **If you answer the above question in the affirmative, then you’re a scientific realist. If, on the other hand, you suspend judgment here (remain ‘agnostic’) or deny the claim (i.e. you believe the essential aim and nature of scientific theories is something else⁹), well...then you’re not.**

Richard Boyd (1985): “Lex Orandi Est Lex Credenti”¹⁰

“I have argued that **scientific realism** provides the only **scientifically reasonable explanation**¹¹ for the **reliability**¹² certain important features of **scientific methodology** which are crucial in **experimental design** and the **assessment of experimental evidence.**” (4)

⁵ In present day set theory, we understand this because $\aleph_0 < \aleph_1$, i.e. a *discrete* infinity < a *continuous* or *uncountable* infinity. (Note that Aristotle already intuited this in his remark that “a line does not consist of a set of points, no matter how many.”)

⁶ Recall Elizabeth Anderson’s remark (in the article on feminist epistemology and philosophy of science), that the “world does not present itself ready-made with its own categories of description and classification.” There are many ways to ‘cut up the pie,’ so to speak.

⁷ Whether or not you believe that such Truth is ultimately *attainable* by the human reason or any other mental faculty is a separate, *epistemological* and *methodological* issue. (Recall, for instance Cuasanis’ negative response, as mentioned above.)

⁸ American 19th century philosophers, founders of the school of *pragmatism*.

⁹ Boyd explicitly refers to van Frassen’s notion of “something else,” i.e. *empirical adequacy*.

¹⁰ “[A] theological precedent...attributed to Pope St. Celestine I... ‘the rule for praying is the rule for believing,’ or (in freer translation) ‘believe what is necessary to ‘rationally reconstruct’ liturgical practice.’ For ‘liturgical practice’ put ‘scientific practice’ and you get the strategy for the defense of realism employed here.” (Boyd (1985) 32) (Note affinity with Kitcher here)

¹¹ Is this point circular? (recall Kuhn’s remarks here). If so, would you consider this viciously or virtuously circular? (Of instance, would such a notion sway anyone on the antirealist paradigm?)

¹² Recall Kitcher’s use of this notion...it underwrites Kitcher’s epistemology of ‘theory-as-map.’

- **Reliability**

“If scientific realism is **true**, then **the methodological practices of science provide a reliable guide to approximate truth** about theoretical matters...only scientific realism could provide a satisfactory **explanation** for this **fact**.” (ibid)

Note1: This is quite a loaded statement, filled with notions that demand a clearer account (the color-coded phrases are philosophically charged)! (The reader can't just presuppose naively that s/he's on the same page when it comes to issues like 'fact' and 'explanation', for instance.) Being charitable to Boyd, we can assume for spatial considerations, he can't get into much depth concerning issues like theories of scientific explanation. Nevertheless, it would have been nice had he at least *alluded* to what metaphysical notion of “truth” is her presupposing? (“T” or “t”- truth?) Especially since he advertises that he's presenting his case in a 'non-question begging way.

“The arguments I am discussing here are directed against only the selectively skeptical antirealist; I have nothing to say to ‘the Skeptic.’”¹³

Consider theory *T* vis-à-vis body of evidence *E* (where *T* is of the garden-variety, 'normal science' sort). How does *E* 'confirm' *T*?

1. **Projectability:** (A notion we'll explore in greater depth). Recall the Problem of Induction. The idea of projectability is related (to a lesser extent). Basically, one would expect a theory to do more than merely account for concrete instances of observed patterns. (A theory is not a theory if its explanations of a pattern draw only from the concrete context of the pattern. 'Eleven women showed up for class today, because I'm counting 10 men and 11 women' is *not* a theory.) Theoretical terms should *project* or provide accounts for how and why the theory can

¹³ Those of you who have had PHIL100 know what he's referring to here. If not, recall Longino's remarks. One can always engage in (for instance) Category 3 conceptual hypothesis criticisms (questioning the relevance of evidence *E* to hypothesis *H*) to the point in which it becomes a game of diminishing returns. Or more generally stated, there's no rational reason why one *cannot* embark on an open-ended series of 'why?' questions to one's heart's content. ('The Skeptic' for instance, would ask whether s/he is dreaming all the time and how would be able to tell if one is *not* dreaming? Recall Descartes' *Meditations*.) Philosophers speak of the 'paralysis of analysis' engendered by excessive critical inquiry, hence Longino's rough-and-ready notion that criticism must be "transformative". There's certainly no rational reason why one could not, in principle, slide down the slippery slope from critical to skeptical enquiry. It's just not a very fruitful strategy. David Hume stated that 'custom and convention' (i.e. our *habits*) safeguard us from such a morass. Kant said something (in my opinion) subtler. Kant sought to distinguish skeptical from critical inquiry and pointed out that one reaches a skeptical terminal-point precisely when one 'steps outside' the boundaries set by reason. Such a signal occurs in the case of the *Antinomies* of pure and practical reason. For example, a skeptic might argue that there is no certainty concerning the existence of a free will, since one can come up with equally good arguments for and against it. To which Kant responded that a critical thinker would argue that notions like 'free will' serve as regulative ideals. That is to see, our practical reasoning works toward this goal, or presupposes such a notion in its activity. But this does not mean that from the standpoint of pure reason, one can ever supply a metaphysical argument for or against such a notion. To Kant, all such latter attempts are useless.

extrapolate outside (not merely *interpolate within*) some empirical context. “*T* will receive significant evidential support from *E* only if *T* represents a projectible pattern in possible observational data.” (5)

2. **Experimental controls versus artifacts** (Another notion we’ll explore in greater depth.) Consider the ‘confirmation’ of “cold fusion.”¹⁴ Upon subsequently more careful attempts to replicate the results of the sudden rise of temperature of the sample, the consensus was that the spike was accounted for by an electrical short-circuit in one of the probing devices. This is an example of an *artifact*.¹⁵ “It will...be...inappropriate to accept *T* as well confirmed unless there is reason to believe that the experiments involved in the production were well-designed.” (Recall Hawthorne’s article on Inductive Logic, seeking to test a hypothesis *H* deals not just with instances of evidence *E*, but also associated *C* and *B* factors, i.e. factors fixing the conditions *C* in which *E* was obtained (presumably in a way that involve assumptions independent of *H*¹⁶) as well as background assumptions *B*.)
3. **Sampling**: A “methodological analogue of the pure epistemologists’ problem of induction...*T* will typically have infinitely many different observational consequences, and **the problem of assessing the extent to which *E* confirms *T* comes down to the question of which (typically relatively small) finite subsets of those consequences are such that their confirmation bestows significant confirmation on all the rest.**” (5-6) Example: Statisticians speak of ‘statistically significant’ samples (whether sampled in a random way, systematic way, or stratified way.) “What is important is that we—rightly—expect experimental confirmation of a theory to warrant our belief that it will prove instrumentally reliable in a wide range of applications whose limits we cannot set in advance.” (6)

- **Boyd casts all three issues above in the following manner:**

-Their inevitable theory-dependence

(Concerning 1.) (Against conventionalism) “As Kuhn insists, the ontology of the received paradigm is crucial in determining the range of acceptable problem solutions.” (7)

¹⁴ A recently ignoble chapter of scientists rushing to claim prestige and prizes, and essentially suspending (a’ la Longino) the mechanisms and criteria/values of ‘transformative criticism.’

¹⁵ During periods of ‘revolutionary science’ (according to Kuhn and others) what is anomalous in a previous paradigm (and often written off as an ‘artifact’) can become *exemplary* in the new paradigm. For example, in the geocentric paradigm, Jupiter was not supposed to have moons. Galileo observed them with his telescope. However, because telescopes had been around before a full theory of geometric optics was developed, the Geocentrists argued that Galileo was observing ‘an artifact’ attributed as a lens aberration.

¹⁶ Kuhn of course argued that this is often not such an easy matter!

(Concerning 2.) “[W]hile there are infinitely many epistemically possible experimental artifacts...**scientific attention is payed only to a small finite number as methodologically relevant number...in each case the relevant methodology depends on the theoretical structure of the currently accepted theories.**” (9)

(Concerning 3. –Recall Popper) “It is a fair statement of the most basic methodological principle governing the assessment of experimental evidence that a proposed theory *T* should be tested under conditions representative of those in which it is most reasonable to think that the theory will fail.” (10)

-Induction about observables

(Recall Hawthorne’s article) “[I]n practice, inductive inferences in science extend to inferences with **theoretical** premises and **theoretical** conclusions...Just as there are theory-dependent judgments of the ‘degree of confirmation’ of instrumental claims...so there are theory-dependent judgments of the plausibility of various theoretical claims in the light of our considerations both experimental and theoretical.” (13)

Note2: if that sounds circular, it is! (Is it virtuous or vicious?)

Boyd’s affirmation of the ‘virtuous circularity’ underwritten by scientific realism:

“So theory-dependent are the most basic principles for the assessment of experimental evidence that it must be concluded that these are principles for applying the knowledge which is reflected in the currently accepted theories **as a guide to the proper methods for the evidential assessment of new theoretical proposals; any other conclusion makes the instrumental success of science a miracle...the reliability of scientific methodology in guiding induction about observables turns out to be largely parasitic upon the reliability of the methodology in applying existing theoretical knowledge to guide the establishment of new theoretical knowledge.**” (14-15)

Grover Maxwell (1958)

- Recall ‘crobres’ thought-experiment (1054-1055). Argues essentially of a realist ontology concerning unobservable entities that Boyd fleshes out in greater details concerning a theory’s reliability (the virtuous circle alluded to above). *At best*, the antirealist would counter (according to Maxwell) that such entities are *artifacts*.

Note3: Given the issues of theory-dependence alluded to above, is this a charitable characterization (against phenomenalism, in particular)? Could one remain metaphysically agnostic? (Is Maxwell committing an 'either/or' fallacy?)