‘Beyond the Pillars’*

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Introduction

How does a community rationally agree that a novel scientific instrument is reliable? The community checks the instrument against already-accepted instruments or intersubjective observation. However, how is it possible for a community to rationally agree that a novel scientific instrument is reliable if no other instruments are available for cross-checking? The only available account of how an instrument can be checked is by appealing to what is what is checkable through public and agreed-upon methods. Consequently, it would seem impossible for any community to accept a scientific instrument that extends beyond already accepted methods.

My focus will be solely on a neglected part of Philip Kitcher’s overarching ‘Galilean’ strategy: he presents a strong companion in guilt argument in how we can reasonably infer that an instrument will continue to be reliable in environments suitably similar to ones in which we accept it as reliable. I argue Kitcher’s Galilean strategy does not account for a historical episode in history of science: Galileo and his allies improperly concluded early telescopes were reliable in different conditions. I then introduce an additional companion in guilt argument about the grounds for reasonably inferring the reliability of methods in all cases: consilience of reports amongst differing types of instruments provides an additional shared condition for accepting that a novel instrument is reliable in contexts in which no other instrument is available for cross-checking. Therefore, Kitcher’s Galilean strategy likely succeeds.

1 The vicious circularity of adopting scientific instruments

The Straits of Gibraltar were once thought to be the limits of the known world (Romm 1992, p. 11): ‘…the Pillars or Columns of Heracles …became a vivid symbol of the gateway or barrier between inner and outer worlds. For the most part they stood in the

*Cf. Wistrand 1946, 3–54 for an extended analysis of the Pillars of Heracles and the Greek phrase, *Exō tōn stēlōn*.

Greek imagination as a forbidding *non plus ultra*, a warning … not to proceed any further' (Romm 1992, p. 18).

In time, this geographical limit has 'come to stand for the boundary of the human condition itself…' (*ibid.*, p. 18), providing 'a metaphor of restraint and prudence' (Rosenthal 1971, p. 211) from speculation about 'soft places' (Gaiman 1993, p. 17) that are inaccessible to an epistemic community. These geographical boundaries metaphorically track epistemic boundaries: within these boundaries is a familiar 'lived-in space' (Tuan 1978, p. 7), but, as Pindar says, 'What lies beyond [the pillars of Heracles] is impassible for both the wise and the unwise. I shall not try [to go beyond], or I would be a fool' (*Odes*, §3.43–45).

An argument for adopting these epistemic boundaries is expressed as follows: consider how an epistemic community adopts a new scientific instrument. It is unknown whether the beliefs based on its use are erroneous or true. How can the realist argue for the reliability of the instrument while also arguing that beliefs based on its use are not erroneous? This is question-begging: approaching either horn on its own would assume the other horn is correct, but to approach both horns together would justify both horns based on a vicious circle:

In line with this metaphor, we cannot shift these epistemic boundary stones by introducing a new scientific instrument, and crossing these boundaries imposed on us by our sense-organs invites nothing but speculation about 'monsters', myths and fables. Appealing to the apparent reliability of the scientific instrument would be a viciously circular justification. This would license adopting the reliability of all methods, even those that are unreliable.

This problem is an indiscriminate bomb to any attempt at reasonably ascribing predictive success to scientific theories about the unobservable, thus targeting the first half of the 'no miracles' inference 'from predictive success, we can reasonably infer approximate truth'. Therefore, the epistemic community cannot appeal to the predictive success of scientific theories as giving reason to accept a new scientific instrument as reliable. The very predictive success of scientific theories *is at issue*.

Observation, so the anti-realist claims, can only be the accepted reliable method, and any new instrument introduced into a community fails to secure credibility in contexts that are not amenable to observation.

The realist must first diffuse this bomb in a way that does not appeal to a 'no miracles' argument or any variation of it, otherwise the realist's response runs up against a wall: the realist has no question-begging reasons for concluding that scientific theories about unobservables are predictively successful.

2 A solution: appealing to prior instruments and what is temporarily observable

Here is a proposed solution, taking into account the adoption of the telescope by Galileo and his critics alike: there were *other* methods available besides the telescope, long before the introduction of the telescope, and these methods were accepted by both Galileo and his critics: if the critic rejected the apparent reliability of these methods, two options were available: the critic could resort arguing for the possibility of a number of unknown and undetectable environmental factors that cast doubt on these methods.

If the critic posits these environmental factors, the critic is committed to the epistemic 'sin' the anti-realist attributed to the realist: appealing to unobservable, hidden causes.

If, however, the critic merely proposed the possibility of these hidden environmental factors that routinely lead independent methods into a confluence of error, then the critic has adopted a principle that is equally as effective against other similar cases of consilience: the critic has embraced a form of skepticism that itself indiscriminately bombs any check of the reliability of methods.

Although the unaided eye has little fidelity at great distances, and cannot pick out purported entities such as sunspots or moons orbiting Jupiter, the eye is still capable of determining the general location and brightness of stars in the sky at considerable distances, so long as their luminosity is great enough. So consider the reports of two supernovae, one in 1572 by Tycho Brahe and another in 1604. All apparently reliable eyewitnesses reported the same sudden brightness in the sky at the *same* time and in the *same* location in the sky.

It would be absurd to deny the credibility of these reports. This unexpected and novel brightness was not a mass hallucination. If members of a community independently attest to the occurrence of an event or observation of an object on *Earth*, their mutual testimony was sufficient for the scientific community to agree that each observation is reliable.

But consider Antonio Lorenzini (1605), who declared in response to the reports of the supernova that since there could be no new stars in the heavens, the sudden brightness in the night sky could only have occurred within the distance between the Earth and the planetary spheres (Shea 2005).

While there had been communal observation, observation *alone* does not call into question the imperfection of the heavens, since the new light in the sky could very well be *within* the orbit of the planetary spheres, not outside its orbit. In short, the critics rightly worried that Galileo and his allies had misidentified a comet as a 'new star'.

Any attempt to establish the imperfection of the celestial spheres would have to bottom out with observation, but Lorenzini produced an explanation for the phenomenon that was not amenable to observation, since eyesight alone could not determine the

distance of faraway objects with any precision.

This problem, however, was short lived, since while Lorenzini's reply rests on the failure of eyesight to reliably determine distance with precision, there were scientific instruments available that could reliably determine *relative* distance, and on occasion determined exact distance on Earth with great precision: methods of determining stellar parallax showed that the two supernovae in the sky could *not* be anywhere but beyond the planetary spheres.

The 'astronomer's staff' and other methods for measuring parallax on the battlefield had incredible overlap with other measurements of distance, and in fact frequently supplanted these measurements on the grounds that, if used correctly, and in the appropriate contexts, it was far more reliable than previous methods.

This approach, however, would appear at first glance to be pushing back the issue at hand over the reasonableness of adopting the reliability of the telescope to *another*, earlier scientific instrument that was accepted as reliable: the reliability of measuring stellar parallax could very well be called into question when directed at the heavens, preserving the perfection of the celestial spheres.

This would present a regress of trustworthiness: the reliability of the telescope could have been adversely affected by the salient differences between the celestial and terrestrial realms. The astronomer's staff and observation revealed that both the celestial and terrestrial realms were imperfect based on its measurement of the distance of the two 'new stars'. However, the reliability of the astronomer's staff and observation could have been adversely affected by the salient differences between the two realms.

However, the critic would have to assert a claim that the anti-realist considers an epistemic 'sin' that is far worse than any sins of the realist: the critic asserts that in order for the astronomer's staff to be plausibly unreliable, there existed some unobservable property of the instrument or environment that causes methods of measuring parallax to be routinely unreliable, but there is no available method to track this unobservable and all present methods fail to track this unobservable. This is a stipulation about the hidden structure of the world that the anti-realist presumably rejects on the grounds of refraining from asserting without good reason the existence of unobservables.

Furthermore, the critic is faced with the problem of this unobservable cause for the purported unreliability of a method has no serviceable stopping point. If the critic appeals to some unobservable cause that routinely and systematically casts doubt on the trustworthiness of a new method, then the critic has no way to stop this doubt from encroaching into the sphere in which accepted methods are reasonably accepted to be reliable.

2.1 Shared grounds of consilience

The above sketch of an argument is, in brief, two attempts at shifting the burden from the realist to the anti-realist's shoulders, in line with Kitcher's Galilean strategy. While the critic is caught in a problem of asserting a thesis about some unobservable feature of the environment systematically producing error, the realist is not off the hook just yet. The realist still needs to provide a *reason* for accepting the reliability of methods, and on this point, Kitcher falls short of providing additional grounds for accepting a method beyond this companion in guilt argument. In brief, adopting a realist position does not come for free; it must first be *earned* by explaining what exactly is shared between methods we accept and methods we can reasonably come to accept.

What grounds reasonably inferring that a method is trustworthy for observables? Consider, for example, a lone individual that insists that a putative event or entity is independent of their private experience–in other words, they claim to have exceptional abilities to see ghosts or speak with the departed, the ability to read minds, to move objects without touching them, or to have extrasensory and precognitive abilities, e.g. a 'spider-sense' (Lee and Ditko 2013). The problem of determining if these individuals have these abilities is *directly* comparable to the introduction of new scientific instruments into an epistemic community, and in fact the standards that we use for determining if an individual has exceptional abilities is but a special instance of the general standard for assessing the reliability of new methods.

This approach of checking a purported exceptional ability applies not just to observation, but to any number of abilities, such as employing mathematical abilities or critical reasoning, and is explicable if we recall that the problem of self-checking of scientific instruments does not apply solely to technology, but to *all* methods and behaviour: the principled *rejection* of a new ability or method relies on the exercising of mutually supporting, independent methods from members of the epistemic community to show that the purported new ability or method systematically fails to cohere with other methods.

To put this defence of consilience in a more positive light, *the principled acceptance of a purported new ability or method for observables is consilience with other accepted methods for observables*. Upon reflecting on the value of observation, observation is not considered valuable in-itself, but valuable in virtue of the fact that it is *generally reliable*. However, if one should ask why any ability to observe was accepted by an epistemic community, the answer is the same as in the case of an individual with exceptional abilities: any determination of the reliability of observation is not based on its use, otherwise any observation self-legitimises itself, but grounded in some additional property, *consilience* with other methods accepted by members of the epistemic community.

Communal checking of putative exceptional abilities by appealing to other accepted methods is the *only* available check of methods, both technological *and* biological/psychological.

Consilience is also the only available check of the average abilities of an epistemic community, as well as below-average abilities. The methods of an epistemic community are trustworthy when their results align themselves with the testimony of other members of the community that use these same methods, for example, 'It is *absurd* …to suppose that someone could see the very same afterimage that I see, or feel the very same pain that I feel…However, to say that I see a thing to be met in space, such as a hand or a soap-bubble is to say that it might have been perceived by others as well as by myself' (Morris and Preti 2015, p. 3).

Consilience provides the reasons for accepting the reliability of the sense-organs of others, but consilience between our *own* sense-organs provides the grounds for accepting their reliability. The only other explanation available for how each of these independent methods produces a coherent and mutually supporting web of beliefs would be that each method only *appears* to track some aspect of the subject of my purported causal interactions, but I am being systematically mislead in everyday circumstances.

Galileo needed only to appeal to the basic principle that was shared with the very grounds for accepting the reliability of observation, as well as numerous other accepted methods: the possibility of gross experimental error of a token observation or a confluence of environmental factors producing a visual trick disappears through *repeated intersubjective checking with similar token observations*. It does not matter if the method used is biological or technological, so long as the check is independent, repeated, and produces the same or similar results.

Lastly, this explains when it is reasonable to infer that the reports from scientific instruments *override* observation when at its limits: in 1631 Pierre Gassendi repeatedly observed the transit of Mercury and recored the size as 'entirely paradoxical smallness'. The repots of Gassendi's telescope routinely overlapped with contemporaneous telescopes, and independently reported a number of fine grained features of planets and moons. Gassendi had previously relied on testimony from pretelescopic observations, such as Ptolemy, in forming the belief that Mercury's diameter was one-fifteenth of the diameter of the Sun. As Van Helden (1985, p. 3) optimistically says, 'The telescope made it possible to subject this traditional scheme of sizes and distances to scientific scrutiny. With this instrument Gassendi could falsify Ptolemy's estimate of the apparent diameter of Mercury; indeed, he was almost forced to do so against his own will!'

2.2 A further expansion of trust

The expansion of the scope of the accepted reliability of the telescope continued so long as there were consilience between mutually independent kinds of telescopes. The grounds for making that inference–namely, the shared checking of a method by comparing it with other methods–provides a strong companion in guilt argument: if one

sinks, the other sinks with it; the aphorism,' a rising tide lifts all boats', accurately describes how if both methods have shared explanatory grounds, if the grounds should be defeated, both are defeated (all else being equal), and if accepted, both are accepted. If consilience is denied generally, then the critic of the telescope is caught in the following problem of a *companion in guilt*: denying that consilience of methods for unobservables provides reason to believe one of these methods is reliable effectively defeats the only agreed-upon check for whether the consilience of methods for observables (e.g. timekeepers) provides reason to believe a timekeeper is reliable.

If the critic of the reliability of the telescope accepts consilience *only* as providing grounds for accepting sense-organs and other scientific instruments for observables as reliable, and not for scientific instruments immediately outside the scope of what is observable, the critic must explain in which contexts consilience will routinely go awry without appealing to the machinations of unobservable and undetectable features of the instruments and environments.

Thus, the Galilean argument inspires measured confidence when previously there was prudence: the 'traditional expression of the limits on knowledge *ne plus ultra*–"no farther"–was defiantly replaced with the modern *plus ultra*–"farther yet"' (Shapin 1998, p. 20). It is appropriate, therefore, that in a case of historical irony,[1] 'The location of the Pillars [of Heracles] later had to be moved to accord with the fact that the Straits themselves had become penetrable' (Romm 1992, p. 17).

1. Cf. Schulten 1925; Strabo 1931, §3.5.5.

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