

Objectivity & Values in Science –pt.I (cont.): How value-laden are scientific theories and facts? Thomas Kuhn’s “Essential Tension” (as seen by the “later” Kuhn and by Ernan McMullin)

KUHN’S (1973 MACHETTE LECTURE) “OBJECTIVITY, VALUE JUDGMENT AND THEORY CHOICE”

- Responds to the critical fallout resulting in his seminal *SSR (Structure of Scientific Revolutions*¹)
- Sought to quell criticism of Lakatos and others who accused him of “subjectivism,” “relativism,” and presenting a picture of “science governed by mob rule.” (Lakatos)
- (Recall Lecture VI (9/18/07)) Primarily concerned with clarifying nature and role of **epistemic (cognitive) values** and **contextual values**² involved during periods of **normal science** and during periods of **crisis (or revolutionary science)**. One can see his defense/response to his critics here as accusing them of *equivocating rules with values*:

“I am suggesting...that the **criteria of choice**³ with which I began function not as **rules**, which **determine** a choice, but as **values**, which **influence** it.”

-(CC1998, 111)

“What from one viewpoint may seem the **looseness and imperfection of choice criteria conceived as rules** may, **when the same criteria are seen as values**, appear an **indispensable means of spreading the risk** which the introduction or support of **novelty**⁴ always entails.”

- (CC1998, 112)

¹ 2nd edn., (1970), 3rd edn. (1996)

² Though Helen Longino coined those exact expressions years after Kuhn. So Kuhn doesn’t use those exact terms. Nevertheless, his essay *refers* to such notions.

³ As employed by the scientist, whether s/he chooses one result over the other, one theory over the other, or (in cases of crisis) one paradigm over the other.

⁴ Recall how Kuhn treats this issue (as for instance discussed in page 6 of Lecture VI notes). Novelty is problematic, as normal science tends to subvert it. Novelty can become an *inescapable issue*, however, when a significant number of *anomalies* confront an extant paradigm. Nevertheless, as Kuhn argues here and elsewhere, it’s perfectly ‘rational’ for a scientist to continue to defend a paradigm, regardless of the number of anomalies confronting it.

“The existence of a **feedback loop**⁵ through which theory change affects the values which led to that change does not make the **decision process** circular⁶ in any damaging sense.”

- (CC1998, 115)

1. Kuhn’s rough-and-ready set of “big five” cognitive values:

A.) Accuracy: “[A] theory should be **accurate**: within its domain, that is, consequences deducible from a theory should be in demonstrated agreement with the results of existing experiments and observations.” (103) “[F]or present purposes, I take [accuracy] to include not only quantitative agreement but qualitative as well. Ultimately it proves one of the most decisive of all the criteria, partly because it is less equivocal than the others but especially because predictive and explanatory powers...depend on it, [and] are characteristics that scientists are particularly unwilling to give up.” (104) Nevertheless, “[h]owever important it may be...accuracy **by itself** is **seldom or never** a sufficient criterion for theory choice.” (ibid.)

B.) Consistency: “[A] theory should be **consistent**: not only internally or with itself, but also with currently **other accepted theories applicable to related aspects of nature.**” (103)

C.) Broad Scope: “[A] theory’s consequences should **extend far beyond** the **particular observations, laws, or subtheories** it was initially designed to explain.” (103)

D.) Simplicity: “[C]losely related [to C.] it should be **simple**, bringing **order to phenomena** that in its absence would be individually isolated and, as a set, confused.⁷” (103)

⁵ Between, for instance, **constitutive or epistemic values internal to a scientific paradigm** and **contextual values external to it.**

⁶ Recall from **Lecture VI** : . “**Like the choice between competing political institutions, that between competing paradigms proves to be a choice between incompatible modes of community life...the choice is not and cannot be determined merely by the evaluative procedures characteristic of normal science, for these depend in part upon a particular paradigm, and that paradigm is at issue. When paradigms enter, as they must, into a debate about paradigm choice, their role is necessarily circular...The resulting circularity does not, of course, make the argument wrong...[however] the status of the circular argument is only that of persuasion. It cannot be made logically or even probabilistically compelling for those who refuse to step into the circle.**”

(-T. Kuhn, CC1998, 88)

⁷ To contrast, even in the Medieval, Ptolemaic astronomy was recognized as sorely lacking in this area. Remarked King Philip II of Spain (in the 14th century) to his tutors, frustrated with its mathematical intricacies and ad-hoc devices: “If the Lord had indeed ordered the Heavens in such a manner, I believe I

E.) Frutifulness/Fecundity: “[A] theory should be **fruitful of new research findings** ...disclos[ing] new phenomena or previously unnoted relationships among those already known.⁸” (103)

“Among a number of quite usual answers I select five, not because they are exhaustive, but because they are individually important and collectively sufficiently varied to indicate what is at stake.” (ibid.)

Note 1 : The Cognitive Values (A.) – E.) are imprecise:

-Individuals may haggle over how to apply them (including their relative importance) in concrete instances.

-Moreover, applying more than one in an instance can be construed as *conflicting*:

“[A]ccuracy may, for example, **dictate the choice** of **one theory**, **scope the choice** of its **competitor**.” (103-104)

Example: Ptolemaic versus Copernican Paradigm:

Cogn value	Ptolemaic Paradigm	Copernican Paradigm
Accuracy	-Based on measured results at the time (and their associated accuracy/resolving power --or lack thereof by contemporary standards), the system was <i>empirically adequate</i> , i.e. able to quantitatively predict to an arbitrary degree of accuracy, (given enough additions of equants and epicycles, etc ⁹ .)	-Not more accurate than Ptolemy’s system until Kepler radically revised it 60yrs after Copernicus’ death.
Simplicity	Computationally laborious (see note 7. above)	Simpler than Ptolemaic system only in a very weak conceptual sense. Calculations, however, proved just as laborious.
Consistency	Internally consistent Externally consistent with the extant terrestrial physics of the time, which explained how pumps operate, why clouds move slowly, etc.	Internally consistent Not externally consistent with the extant terrestrial physics! “The consistency criterion spoke unequivocally for the Geocentric tradition.” (105)

could have shown Him a better system myself!” (See Peter Pesic’s (2000) *Labyrinth : the Quest for the Hidden Meaning of Science*, MIT Books.)

⁸ Recall **Lecture IV**, Lakatosc uses the same criterion to distinguish a *progressive* research programme.

⁹ This is due to the mathematical technique of superimposing circular, i.e. classes of periodic functions, which is comprised today by the powerful methods of Fourier synthesis/analysis.

“Perhaps they [scientists] **interpret simplicity differently** or **have different convictions** about the range of fields within which the consistency criterion must be met. Or perhaps they **agree about these matters but differ about the relative weights** to be accorded to these or to other criteria when several are deployed together. **With respect to divergences of this sort, no set of choice criteria yet proposed is of any use.**” (105)

Examples of contextual values informing cognitive values:

-Kepler’s choice of Copernicanism strongly motivated by his immersion in NeoPlatonic and Hermetic thought.

-“German Romanticism predisposed those it affected toward ...acceptance of energy conservation.” (106)

Kuhn’s (rhetorical) question:

“[H]ow [can] philosophers of science [have]...**so long neglected the subjective elements** [read: **contextual values**] which, they freely grant, **enter regularly into the actual theory choices made by individual scientists?** Why have these elements seemed to them an **index only of human weakness**, not at all of the **nature of scientific knowledge?**” (106)

1. **Against ‘Bayesian’, decision-theoretic, and other attempts to formalize scientific reasoning (e.g. logical positivists, etc.)** Some make the unwarranted assumption that in the long run, such subjective factors prove themselves as ‘transient impurities,’ “they...expect that further research would eliminate residual imperfections and produce an algorithm able to dictate rational, unanimous choice.” (106-7)

Response: Even granting that such a methodological assumption is in principle a “correct one,” *in practice* “where the choice is at issue between scientific theories **little progress has been made toward the first of these desiderata** [presupposing that individual choice-criteria can be unambiguously stated] and **none toward the second** [specifying some appropriate weight function across two or more choice criteria.]” (107) Moreover “the factors..call[ed] objective are insufficient to determine in full any algorithm at all...I continue to hold that algorithms of individuals [making choices] are all ultimately different by virtue of the **subjective considerations** with which each must complete the objective criteria before any computation is done.” (109)

2. **(Recall Lecture I): Against ‘dogma’ of two contexts (discovery/justification)**¹⁰ Advocates argue that context of discovery factors, including such ‘subjective’ issues, though playing an essential role in the discovery/invention of new theories, nevertheless fall outside the business of philosophy of science, which involves the

¹⁰ First proposed by Reichenbach (1935)

evaluation of 'objective' criteria by and through which theories are tested, judged, promoted.

Response: Two context 'invocation' does not even provide a useful or plausible idealization! "I suspect that my critics have been misled by...textbook science." (107-8) Indeed, such contexts are really subsumed by a context of *pedagogy*. "[E]xemplary applications...[d]oubtless were *part* of the evidence at the actual time decisions were being made, but they represent only a fraction of the considerations relevant to the decision process." (108)

For instance: Foucault's pendulum demonstrating the rotation of the Earth was developed *long after* Geocentric paradigm was abandoned!

3. **A type of 'Whig history' (confusing the actual with the ideal) seems prominent among philosophers of science, as though the extant theory was a foregone conclusion (by selectively discussing the evidence of the favored theory's explanatory scopes).**

Response: "Even historians do not claim to deal with the full factual complexity of the situations they describe...these [Whig historic] simplifications emasculate by making choice totally unproblematic." (109)

Rules ⇒ Values

I.) Seen as **values**, the effectiveness of criteria A.) – E.) do **not depend on dictating** a particular choice. (Jurisprudence analogy; free speech is a value, not a rule.)

II.) Seen as **values**, the effectiveness of criteria A.) – E.) can account for *rationality* of scientific behavior (where rule-based approach views as irrational). "More important, it allows the standard criteria to function fully in the earliest stages of theory choice...the period when...on the traditional view, they function badly or not at all." (111)

II.) "Such a [value-based] mode permits rational men [and women] to disagree, and such disagreement would be barred by the shared algorithm which philosophers have generally sought." (111)

Open questions: 1) Historically conditioned standards (accuracy over time has moved more toward a quantitative direction)

2.) **Incommensurability:** "Communication between proponents of different theories [paradigms] is inevitably partial...**an individual's transfer of allegiance from theory to theory is often better described as conversion than as choice.**" (117) "Rosetta stone" analogy of difficulties of translating across paradigms...perhaps such a Stone is best exemplified by sets of concrete and confirming technical results/ published papers? "[I]f the new theory is to survive,

[learners/adherents] will find that at some point in the language-learning process they have ceased to translate and begun instead to speak the language like a native [speaker]. No process quite like choice has occurred, but they are practicing the new theory nonetheless...the factors that led them to risk ...conversion...are just the ones this paper....has labeled theory choice.” (117-118)

ERNAN MCMULLIN’S REVIEW AND RESPONSE TO KUHN: “RATIONALITY AND PARADIGM CHANGE”

“The radical challenge of *SSR* is directed not at **rationality** but at **realism**.”
-CC1998, 132

“Kuhn’s way of securing scientific rationality by focusing on the values proper to theory choice might well have led him to a more sympathetic appreciation of realism. I am not saying that rationality and realism are all of a piece...[b]ut a closer study of the values to which Kuhn so effectively drew attention should, to my mind, raise a serious question about the adequacy of an instrumentalist construal of the puzzle-solving metaphor.”
(-ibid)

Contra Incommensurability Thesis

“Kuhn emphasized the discontinuities of language across theory change so strongly that he left no room for the possibility of convergence, for the possibility that...[scientists] not only solve more puzzles than those of yesteryear but also tell us, with a high degree of likelihood, what actually happen[s].” (135)

One could argue a case for scientific realism by adopting some (or all) of Kuhn’s values A.) – E.)!

“What I have tried to do here is to...note special epistemic weight carried by certain of [Kuhn’s] values [coherence, fecundity] ...[i]t is hard to make sense of the role played by these values if one adopts an instrumentalist standpoint that Kuhn feels compelled to advocate. The case for scientific realism rests in large part on these ‘superempirical’ values...when we ask about a particular theory, how likely is it that it is true (...how likely ...the explanatory entities it postulates actually exist) **it is to these virtues that we are inclined to turn.** To say a theory simply ‘saves the phenomena’ though this carries *some* epistemic weight, leaves open the suspicion of its being *ad hoc*....When a theory is evaluated in a historical context, when its success in unifying domains over time or in predicting new sorts of phenomena are taken into account, that conviction [of its truth] begins to emerge. **Theories are not assessed simply as predictors, they are confirmed purely by the enumeration of consequences.” (135)**

Critique of Revolutionary Mechanisms:

