Philosophy of Science

Lecture 9: Kuhn and Revolutionary Science

(and his critics)

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Today's Agenda

- Goal: To complete our discussion of Kuhn, focusing on his characterization of the period known as "Revolutionary Science."
  - We also want to understand what some of his critics and competitors have to say.

- Breakdown
  1. Kuhn on Revolutionary Science
  2. Lakatos' Research Program's
  3. Feyerabend's Epistemological Anarchism

1. Kuhn on Revolutionary Science

What is Revolutionary Science?

- Last time, we characterized Kuhn's vision of science as a cycle of "normal science" to "revolutionary science" (mediated by "crisis science") and back again.
  - Normal science: scientists fitting new observations within the framework by using established methods, argument-styles, and assumptions that are fundamental to the framework (i.e., puzzle solving through dogma).
  - Crisis science: puzzles become problems, and working scientists begin to question their dogma. But there is no new paradigm to take its place.
  - **Revolutionary science:** the period after crisis in which the rules, assumptions, methods, and argument-styles of the paradigm are abandoned, and rival paradigms are considered.
- Revolutions, for Kuhn, are not brought on by a "better idea." There must be something seriously wrong with the "old ideas" guiding the paradigm.
  - Hmm. Is this right? Can't a good idea spawn a new field or paradigm without replacing the old? (See Lakatos).

Revolutions are “Normal” but are not “Normal Science.”

- Kuhn thinks that scientific revolutions are inevitable, and are in fact *essential* to the scientific process.
  - In this sense, scientific revolutions are *normal…* in fact, Kuhn thinks of them as being part of the hallmark of science.
  - That is, science wouldn’t be science without them: “Science as a whole is a result of their interaction [with normal science] and nothing less.” (PGS p. 88).
    - An answer to the demarcation question?

- The revolutionary period is NOT like normal science…
  - They are characteristically disordered and directionless
  - There are no conceptual foundations which everyone agrees on.
    - E.g., “gravity” “mass” “energy” no longer mean what they did when the paradigm was intact; the very notions are up for grabs.
  - There are no fundamental assumptions that everyone takes for granted.
  - Unlike normal science, there is no set criteria for assessing good arguments/reasons.

The Incommensurability of Paradigms

- Revolutionary science presents such a drastic breakdown in our understanding that it becomes hard, if not impossible, to consider, compare, and contrast two different paradigms with one another.
  - Revolutionary science is *non-cumulative*: There is no way to see if there has been any "progress" from earlier paradigms to later (potential) paradigms.
    - The solutions to the old puzzles are lost.
  - People working (or indoctrinated) in different paradigms "speak different languages" in two senses:
    - (1) **semantic**: the meanings of foundational terms, like 'mass' and 'energy' and 'species' change on a holistic basis (recall Quineian holism)
    - (2) **evidential**: Within each paradigm, that paradigm seems superior to the others… because argumentative standards (standards for assessing evidence) are internal to the paradigm.
      - E.g., Biometrician-paradigm formulated a mathematical law that describes inheritance; Mendellian-paradigm formulated a mechanism. From within each paradigm, that paradigm seemed superior.

Bringing Order Back to Science

- Since there are no agreed upon rational standards for theory choice during revolutionary periods, the adoption of a new paradigm (according to Kuhn) is largely based on intuition, habit, and/or “leaps of faith”
  - So how do we tell what an “achievement” looks like? A gut feeling? How is that going to put the external-world skeptical worries to rest? (see next slide)

- There are thus two kinds of scientific-change within Kuhn’s picture:
  - (1) “normal” change within a paradigm, guided largely by dogma.
  - (2) “revolutionary” change between paradigms, guided largely by intuition, habit, and leaps of faith.

Objections to Kuhnian Revolutions (1)

- Problem #1 (irrational science): On Kuhn's account of scientific change, science ends up sounding remarkably irrational; and this is hardly a good answer to the skeptic that motivated our epistemological inquiry which is supposed to justify science as a legitimate way to gain knowledge!
- Argument:
  - (1) If Kuhn's right, then there are two kinds of change inter-paradigm (normal science) and intra-paradigm (revolutionary).
  - (2) Inter-paradigm change relies on dogma that we will (according to Kuhn) inevitably end up rejecting as being inaccurate.
  - (3) Intra-paradigm change relies on guesswork and intuition that gives rise to the skeptical worries to begin with, (pre-science skepticism).
  - (4) Innacurate dogma does not lead to knowledge; and so, fails to respond to skepticism.
  - (5) Intuition and guesswork that give rise to skeptical worries obviously fail to respond to skepticism.
  - (6) Thus, if Kuhn's right, then science fails to respond to epistemological skepticism and (scientific) knowledge is thereby IMPOSSIBLE!

Objections to Kuhnian Revolutions (2)

- Problem #2 (regress problem): If science really is a cyclical process of normal-to-revolutionary science without end, as Kuhn thinks, then there cannot be any "final" truth for science to discover.
  - Just as Aristotle faced a backward-looking infinite regress that made knowledge impossible (since there is no "first premise"), Kuhn faces a forward-looking infinite regress that makes knowledge impossible… there's always a new paradigm in the waiting.
    - …and, moreover, there's no way of saying that each new paradigm is "more correct" or closer to the truth than the previous, because paradigms are incommensurable!
    - Kuhn's response: better paradigms have more "puzzle-solving power".
      - incommensurability bites back : but since the language of paradigms differ, each paradigm has it's own set of puzzles; there's no way to contrast puzzle solving power at all!
- Problem #3 (counterexample): There are some worries that Kuhn is overgeneralizing (or overstating) his view.
  - Some point out that not all revolutions are born from crisis. There was no Crisis giving rise to Copernican astronomy, or in Evolutionary biology (pre-Darwin), or in molecular biology.
    - Kuhn's response: well, revolutions are <u>USUALLY</u> brought on by crisis.

An Objection to the Historical Turn in Phil. Science

- My retort to Kuhn's response: his historical evidence, and the whole historical turn in phil science that it motivates, is substantially weakened by these issues…
  - if Kuhn cherry picks his examples from history, then we have no more reason to believe "usually" than we do "always."
    - Since there are counterexamples to "always," it seems that he's cherry picking his examples. We therefore have no reason to think that he's describing anything "essential to science" by distinguishing normal from revolutionary science.
    - He's just babbling on about history, drawing extremely sketchy and speculative conclusions.
      - History (of science) is bunk! (a cheeky slogan derived from Henry Fords infamously ignorant quote)
      - (or more carefully...) maybe the logical empiricists (or Popper) were on to something with their idealized inquiry after all.

The “X-rated” Chapter X

- PGS, and many others, are most critical of Kuhn’s Chapter X.
  - Once solution to the “regress problem” in the previous slides is to think that there is no objective “scientific truth” at all.
- Kuhn seems to suggest that when a new paradigm is adopted THE ENTIRE WORLD CHANGES! “scientists are working in a different world”
  - Not in the sense that scientists change, technology changes, etc.; but rather, the fundamental nature of the universe changes.
    - That’s kind of nuts, right? Even for a philosopher.
- … At least that’s how his commentators interpret him, when he says things like the following:
  - “in the absence of some recourse to that hypothetical fixed nature that “he saw differently,” the principle of economy will urge us to say that after discovering oxygen Lavoisier worked in a different world.” (Kuhn 1996, 118)
    - PGS spits venom upon hearing “principle of economy” and “the hypothetical” in reference to the idea that there’s one reality that all scientists try to discover.

In Defense of the X-rated

- Should we be so quick to judge? “in the absence of a the recourse to hypothetical fixed nature…” it seems like he’s saying
  - “if there isn’t a single objective external world in which we all inhabit (which might be considered crazy), then revolutionary scientists are simply jumping ship from one world to another.”
- And “… the principle of economy” seems to do nothing more than rule out the (even crazier) idea that scientists work in a multiplicity of worlds

- In short, maybe we should interpret Kuhn as simply begging no questions against the “external world pluralist” which is a possible, although very intuitively implausible, philosophical position.

2. Lakatos’s Research Programs

From Reality to Idealization

- Popper's student Imre Lakatos was aghast at much of what Kuhn had to say.
  - If Kuhn was right, then science progresses by an irrational mob-mentality.
    - Kuhnian science is based on a trust of scientists' intutions and habits
  - He sought to "rescue the rationality of science from the damage" (PGS p. 103) of Kuhn by putting into place strict rules to govern scientific change.
    - Lakatos' science is based on a distrust of intuition and habit.
- He agreed that science was actually messy, but advocated a return to the idealized science that characterized Popper and Log. Empiricism's approach to the philosophy of science.
  - He thought we should write up "rational reconstructions" of science that make scientists' decisions look rational, when in fact they are sometimes not rational
    - (to err is human; but to philosophize is divine).

Paradigms vs. Programs

- Lakatos was particularly critical of the idea that only one paradigm governs a field of science at a time.
  - He thought of paradigms as “research programs” and there were many competing research programs within a field at a time.
- **Research Program:** a set of shared assumptions, methods, and argumentative standards within a field of inquiry (perhaps developed from an “achievement” that is used as a model) that competes with other sets of shared assumptions (etc.) for dominance over a field (and funding).
- There are two components to every research program, for Lakatos.
  - (1) The **Hard-Core**: The set of assumptions and ideas that are *essential* to the program.
  - (2) The **Protective belt**: the less-fundamental ideas that are used to apply the hard-core to actual phenomena.
    - The theories that get tested in scientific practice are developed by combining the hard-core with the protective belt.

Lakatos on Scientific Change and Progress

- As with Kuhn, there are two kinds of scientific change:
  - *Inter-program change*: changes are made to the protective belt (to accommodate the predictive failures of the program when it is subjected to experimental testing)
    - **The Rule**: changes to the protective belt must be *progressive.*
    - A **progressive** research program is one in which predictive power is increased; the program can accommodate a greater number of observed cases, or is able to achieve more precision with respect to the cases (observations) that it already accommodates.
      - e.g., increases accuracy to an extra decimal place.
    - A **degenerating** research program is one in which changes to the protective belt do not enhance predictive power, and are only able to accommodate existing puzzles about the program.
  - *Intra-program change*: changes are made to the whole collection of research programs that are active in a scientific field at the time.
    - **The Rule:** Although he thinks that the most progressive research programs will attract the greatest attention, he thinks that degenerating programs should be protected (at least for a while) in case there is a breakthrough.
      - How long should we wait for a breakthrough? Until the money runs out (Lakatos doesn't say this, but it might be a satisfying answer for you pragmatists)?

3. Feyerabend’s Epistemological Anarchism

The Wild-man

- The most interesting figure in the Kuhn debates was Paul Feyerabend.
- He advocated a complete abandonment of any adherence to method.
  - No paradigms, no research programs.
- For Feyerabend, scientists should employ ANY method which seems to have some hope of some success, but do not adhere to that method after the success unless you must.
  - Call this “epistemological anarchism”

Anarchy and Scientific Progress

- His justification for Epistemological Anarchism? He argued that science is best thought of as an art – a creative enterprise.
  - Just as there are movements in art, there are movements in science;
  - but just as it is part of artistic progress to break away from a certain movement, so too is it part of scientific progress.

- Why should we think this? Why should we not think of it as a precisely structured endeavor like math?
  - Because history teaches us to doubt observation (e.g., what was needed to advance Copernican astronomy), and what we take to be obvious. We have to break free of our fundamental prejudices in order to make progress.

Too Wild?

- Epistemological Anarchism is considered extreme.
  - Feyerabend advanced the idea that we could, and should, challenge *accepted reason* (i.e., the status quo assumptions that characterize "common sense") in any given circumstance, since science might profit from it.

- The train problem:
  - PGS dislikes this reason. He think it's analogous to saying that we should abandon our daily commuting practices (e.g., that our usual train will take us to our desired destination) because it ***might*** be better off for us.
    - (e.g., our normal train might crash, be delayed, or we might meet our future spouse on another train).
- But perhaps that's not what Feyerabend needs to say. Perhaps he's just suggesting that we should feel free to take a different commute, just to see what happens.
  - We should not be compelled to take a different train; we should just withhold blind acceptance of the idea that our regular train is the best way to get to work.

Discussion Questions

- In this lecture, we learned about how Kuhn characterizes revolutionary science (thereby completing our study of his view on scientific change), some of Kuhn's problems, and some of the alternative views that his critics developed.
  - Lakatos' research programs
  - Feyerabend's epistemological anarchism
- Discussion questions:
  1. Is Kuhn correct that science needs to face a crisis in order to advance? Or might a new paradigm get kicked off simply with a great achievement or idea, without there being any problems to the dominant paradigm? Why do you think that?
  2. Can Kuhn convincingly respond to any of the three problems we raised against him: irrational science, regress, and counterexample? If so, how? Are any of those problems absolutely convincing that Kuhn is wrong?
  3. Are you convinced by the cherry-picking problem that we should return to the idealized approach to phil. science exhibited in the work of Popper, the Logical Empericists, and Lakatos? Why or why not?
  4. Do you think that PGS's attack on Kuhn's Chapter X is fair? Or are you convinced by my reply, made on behalf of Kuhn?
  5. Of the three thinkers covered today – Kuhn, Lakatos, and Feyerbend – who do you think presents the most compelling, and who presents the least compelling, visions of how science does and should progress? Why?