

HPSC 1001/1901/2101/2901

WHAT IS THIS THING CALLED SCIENCE?

Semester 2, 2020

Lecture 12: Kuhn and Revolutions

From lecture 11:

1. Pre-paradigm science...
2. Normal science...
3. Accumulation of Anomalies...
4. Crisis...

– then –

5. Scientific Revolution

A new paradigm arises and takes over, and normal science resumes.

Revolutions defined (p. 92): "non-cumulative developmental episodes in which an older paradigm is replaced in whole or in part by an incompatible new one."

Revolutions, for Kuhn, involve a fundamentally different kind of change from normal science. Revolutions are also essential to science. It is not just that they are expected to occur. For Kuhn, revolutions have a "function" within the whole process.

They have a function, but what they involve is a kind of *breakdown* – a breakdown of the confident, cooperative habits of work seen in normal science.

Here is a central message in Kuhn's work:

The special features we associate with science arise from a combination of normal science – an orderly, organized, well-disciplined process – along with periodic breakdowns of this order. Science 'as a whole' is a result of their interaction.

Before looking at the combination, a closer look at revolutions themselves.

This was the most controversial part of K's work. He was interpreted as describing a kind of chaotic, irrational change

in science. There was some exaggeration in this part of K's book, and also exaggeration by his interpreters and critics.

Two sets of issues to think about:

(i) how revolutions occur – what processes are found in this second kind of change.

- and -

(ii) the relations between before and after.

(i) How revolutions occur:

Final rejection of one paradigm occurs simultaneously with the acceptance of a new one. A crisis is not sufficient to completely drop the old paradigm – we need a replacement.

There are no 'pure' falsifications – rejections of big ideas in the absence of a new paradigm to replace them. Contrast with Popper.

But also, the switch to a new paradigm does not occur just because it appears and looks better than what was there before. A crisis is part of the shift.

In Kuhn's original view (in *Structure*), there *has* to be a crisis in the old paradigm. Otherwise scientists are not motivated to consider radical change.

This led to historical criticism of Kuhn. Was there really a crisis in the state of astronomy before Copernicus, biology before Darwin, or linguistics before Chomsky?

Maybe. Or did the revolutionaries just come up with *better ideas* which led people to switch?

Kuhn later softened on this point -- see his 1970 "Postscript," (p. 181). Crises are not absolutely required, but the "usual" way it's done. Still, maybe it's not even "usual"?

What goes on in a revolution? Kuhn said change to a new paradigm is like a "conversion" phenomenon, also like a "gestalt switch." People just start to see things differently.

K did not think that traditional concepts of rationality and evidence are totally misguided. But if they are expressed in broad terms that are common to all paradigms, they don't really tell people what to do. If they are expressed in ways that enable people to make real choices, they will be specific to some paradigms and not others. The useful, non-trivial versions of the rules for theory choice that guide scientists are internal to paradigms -- they are liable to change with a paradigm change.

Methods are also debated. What skills are relevant?
How should this field be approached? What is an important question and what is irrelevant? A paradigm is a complete way of looking at some part of the world and our investigation of it. Now, a new one has to be established.

Because so much is 'up for grabs' during a revolution, for Kuhn, revolutions are also *capricious*. They are affected by idiosyncratic personal factors, accidents of history, etc. He refers to "idiosyncrasies of autobiography and personality" (p. 153). Some reasons for people changing their mind "lie outside the apparent sphere of science entirely" (pp. 152-3).

Descriptive versus normative questions are important here. See Kuhn's title of section IX. "Nature and Necessity" of revolutions.

Necessity: is he saying *they will always happen*, or that *we need them*?

I think Kuhn thinks that both apply.

See also the first sentence of CC reading from this section of Kuhn's book: what is the *function* of revolutions? Function in the sense of serving a purpose? How should we interpret this talk?

My interpretation: Kuhn is suggesting that revolutions have a function in a sense that includes the idea of *benefit*. The function of revolutions is to allow science to be influenced occasionally by unpredictable factors. This is part of science's creativity.

Important quote:

The examples of discovery through paradigm destruction examined in Section VI did not confront us with mere historical accident. **There is no other effective way in which discoveries might be generated.** (p. 97)

This quote complements the ideas we were looking at yesterday, end of lecture. Relations between level 1 and level 2 properties. Remember this from yesterday:

Perhaps the most striking feature of the normal research problems we have just encountered is how little they aim to produce major novelties, conceptual or phenomenal. (35)

The scientific enterprise as a whole does from time to time prove useful, open up new territory, display order, and test long-accepted belief. Nevertheless, *the individual* engaged on a normal research problem *is almost never doing any one of these things.* (38)

The field uncovers dramatic discoveries *despite* the goals of the individuals in the community. They just want to solve their puzzles, not overthrow the paradigm. But this close attention to the details of nature does tend to lead to surprises and novel discoveries that overthrow the current paradigm. Those discoveries can only result from socially organized, detailed, cooperative work – work guided by faith in the current paradigm.

And (continuing on from yesterday's themes), the chaos of a crisis is needed to get people thinking really differently, trying out entirely new approaches.

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Next topic: comparisons of before and after. What tends to be gained across a revolution? What is scientific *progress*, if science includes (and requires) these chaotic upheavals?