Phil. 4400
Notes #6: Thomas Kuhn

Kuhn trivia

- Author of *The Structure of Scientific Revolutions*
- Most cited 20th-century work in *Arts & Humanities Index*, 1976-1983 <http://home.comcast.net/~antaylor1/fiftymostcited.html>
- Originator of new sense of "paradigm", "paradigm shift"

Paradigms

- Exemplars of what a science is supposed to be like. Ex.: Newton's *Principia Mathematica*
- More broadly: The accepted general theoretical framework in a given scientific field. Ex.:

Aristotelian physics	Geocentric astronomy
Newtonian physics	Heliocentric astronomy
General relativity	Theory of the 4 elements
Theory of the 4 humors	Atomic theory
Germ theory of disease	Evolution
	Continental drift/plate techtonics

Two kinds of science

- Normal science: Puzzle-solving within the paradigm
  - Anomalies exist, but ignored. ***Anomalies****:* cases where nature defies paradigm-induced expectations
  - Resistance to any questioning of the paradigm.
  - Normal science is most science.
  - Normal science is valuable & useful.
  - Paradigms essential for science.
- Scientific revolutions:
  - *Anomalies* build up/gain attention.
    Note: Precise paradigms make awareness of anomaly possible.
  - New paradigm promises solutions.
    Note: No revolution without a better paradigm.
  - New paradigm supplants old.
    - Note: new paradigm is *incompatible* w/ old paradigm. Progress not cumulative.
    - Paradigms are "***incommensurable***": no neutral methods for resolving debate, b/c paradigms differ on the criteria of theory assessment
    - People who don't accept new paradigm become increasingly ignored (astrology example, 19)
    - Max Planck exaggerates in saying:

      A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die, and a new generation grow up that is familiar with it. (*Scientific Autobiography & Other Papers*, 33-4)

- Postrevolutionary textbooks hide the process.
  - Written from perspective of new paradigm.
  - Omit much history, things important to earlier paradigms.
  - Falsely portray science as cumulative.

Scientific progress, truth, &c.

- Paradigm shifts not cumulative progress
- Paradigm shift requires faith & non-empirical criteria (what questions are *important*, value of "simplicity", "elegance", etc.)
- A few holdouts remain,

> And even they, we cannot say, are wrong. ... [T]he historian ... will not find a point at which resistance becomes illogical or unscientific. At most he may wish to say that the man who continues to resist after his whole profession has been converted has *ipso facto* ceased to be a scientist. (159)

Phil. 4400
Notes #7: Scientific Irrationalism (Stove)

I. Some irrationalist quotations:

Popper:

"We must regard all laws and theories as guesses." (*Objective Knowledge*, 9)

"There *are* no such things as good positive reasons." (*The Philosophy of Karl Popper*, 1043)

"Belief, of course, is never rational: it is rational to *suspend* belief." (*PKP*, 69)

"I never assume that by force of 'verified' conclusions, theories can be established as 'true', or even as merely 'probable'." (*Logic of Scientific Discovery* [1968], 33)

"[O]f two hypotheses, the one that is logically stronger, or more informative, or better testable, and thus the one which can be *better corroborated*, is always *less probable*—on any given evidence—than the other." (*LSD*, 363)

"[*I*]*n an infinite universe* [...] *the probability of any (non-tautological) universal law will be zero.*" (*LSD*, 363)

Kuhn:

"One often hears that successive theories grow ever closer to, or approximate more and more closely to, the truth. [...] There is, I think, no theory-independent way to reconstruct phrases like 'really there'; the notion of a match between the ontology of a theory and its 'real' counterpart in nature now seems to me illusive in principle. Besides, as a historian, I am impressed with the implausability [*sic*] of the view." (*Structure of Scientific Revolutions*, 3rd ed., 206)

Feyerabend:

"[S]cience is much closer to myth than a scientific philosophy is prepared to admit. It is one of the many forms of thought that have been developed by man, and not necessarily the best. It is conspicuous, noisy, and impudent, but it is inherently superior only for those who have already decided in favour of a certain ideology, or who have accepted it without ever having examined its advantages and its limits." (*Against Method*, 295)

"One of my motives for writing *Against Method* was to free people from the tyranny of philosophical obfuscators and abstract concepts such as 'truth', 'reality', or 'objectivity', which narrow people's vision and ways of being in the world." (*Killing Time*, 179)

Stove:

"We should for a moment try, though it is almost impossible, to take in the full grotesqueness of the contemporary situation in the philosophy of science. We have already encountered Popper, a grown man and a professor, implying that it is a guess—that is, *something like a cricket captain's call of 'heads'*—that the sun does not go round the earth every day. But here is Kuhn, perhaps the most learned and certainly the most influential of living historians of science, writing in such a way as to imply that, like a great many people in 1580 and a few uncommonly ignorant ones even now, he *does not know that it is false* that the sun goes round the earth every day!" (*Anything Goes*, 47)

Main points:

Popper: - There's no reason to believe anything.
- Every scientific law is 100% certain to be false (and that's cool).

Kuhn: - There is no reality.

Feyerabend: - Science is myth.
- We should abandon 'truth', 'reality', and 'objectivity'.

II. The historical root

Scientific developments:

1687: Publication of *Philosophiæ Naturalis Principia Mathematica* by Isaac Newton. ("Mathematical Principles of Natural Philosophy")

17th - early 20th century:
- Newtonian physics (esp.: N's laws of motion + N's theory of gravity) is held in extremely high regard.

20th century: Three developments overthrow classical physics:
- Special relativity
- Quantum mechanics
- General relativity

The philosophical reaction:

Horrors! We must ensure that this *never, ever* happens again . . . by believing nothing!

Bonus speculations** (mine)**:

- Political correctness, intellectual egalitarianism
- 19th-century idealism
- Cultural relativism

III. The philosophical root

Deductivism: The thesis that only deductively valid inferences can provide a reason for believing anything.

• Note: Not the same as inductive skepticism. Premise from which inductive skepticism is inferred.
• Stove's basis for identifying this:

(I) All observed bachelors have been slobs.
Therefore (probably), all bachelors are slobs.

- Hume says this "presupposes" something like: "The unobserved things will resemble the observed things."
- Note that this is *the validator* of (I).
  Validator: The premise that must be added to an argument to make it deductively valid.
- Assuming that an inference must presuppose its validator is tantamount to assuming deductivism.

Phil. 4400
Notes #8: (Il)logical Postivism

I. Basic concepts

- *Empiricism :* There is no synthetic, a priori knowledge. (Hume, Berkeley, perhaps Aristotle)
- *Verificationism :* The (cognitive) meaning of a statement is given by the conditions under which it would be verified or refuted. Corollary: If it cannot, in principle, be known whether S is true or false, then S is "meaningless".
- *logical positivism* : empiricism + verificationism ⇒ There are 2 kinds of meaningful sentences:
  a) Analytic (or contradictory) sentences: These are true (or false) in virtue of the meanings of words; "verified" by all (or no) possible experience.
  b) Contingent & empirically testable sentences.

Comments:

- Practical vs. in-principle verifiability
- Strong & weak sense of "verifiable".
- The meaning of "meaningless". Fails to assert a proposition, not truth-apt.
  - Cognitive meaning vs. 'emotive meaning'.

II. The implications of positivism

1. Mathematics: Analytic. Says nothing about reality. Leads to formalist philosophy of mathematics.
2. Logic: Like mathematics.
3. Ethics: meaningless. Leads to non-cognitivism.
4. Religion: meaningless.
5. Metaphysics: meaningless.
6. Philosophy: Only legitimate function is to clarify language usage.

III. Arguments for positivism

IV. Objections

1. How is the verification criterion known?
2. Positivists confuse metaphysics with epistemology, truth with justification. There can be facts we can't know. Why can't there be statements that we can't know whether they are true?
3. Sentence meanings are compositional. The meaning of a sentence is determined by whether the individual words are meaningful & combined in an appropriate way. There is no guarantee that such combinations will always turn out to be verifiable. (Example.)
4. Examples of unknowable things:
   - What happened before the Big Bang.
   - How many hairs were on Aristotle's head on his 35th birthday.
   - Religious claims.

5. There are many examples of synthetic, a priori knowledge.
   • Mathematics.
   • Ethics.
   • Metaphysics.
   • Miscellaneous other a priori knowledge, often neglected by philosophers:
     "Nothing can be both completely red and completely blue."
     "If a person wants to do A, knows that he can do A, and has no reasons to refrain from A, then he will do A."
     "If A is inside B, and B is inside C, then A is inside C."
6. Circularity: How do you know whether S is "verified" by an observation or not? Must understand the meaning to know what verifies/fails to verify it.

V. The History of Positivism:

1. Motivations for positivism:
   • Scientism: worship of science & mathematics; disparagement of other intellectual endeavors.
   • Positivists seek a blanket way to dismiss all work in metaphysics. Hence the verification criterion.
   • It is fun to sound "hard-headed".
   • Heavily influenced by Hume.
2. Verificationism becomes early 20th-century dogma, almost universal in analytic philosophy. They did not feel the need of arguments for it.
3. Leads to acceptance of all the implications under (II) above.
4. Scientists are brought into this credo, esp. hard scientists.
5. Scientists & mathematicians develop positivist-inspired theories (relativity, quantum mechanics).
6. Most philosophers later reject the verification criterion (while holding on to empiricism). Scientists, however, still maintain it.
7. The implications of positivism, under (3) and (5), however, remain accepted orthodoxy.
8. The orthodox theories are now used to argue for empiricism ("science has shown that positivism is true").

Lessons:

• Philosophical fashions come and go. Cases in point: (a) scholasticism, (b) 19th century idealism, (c) illogical positivism.

Phil. 4400
Notes #9: A Priori Knowledge

I. Important distinctions

Analytic/Synthetic:

Analytic: A sentence S is analytic iff the negation of S can be transformed into a formal contradiction by substitution of synonymous expressions and formally valid inferences. (Or: iff S can be transformed into a logical truth by substitution of synonymous expressions and formally valid inferences.)

Synthetic: S is synthetic iff S is (meaningful but) not analytic.

Empirical/A priori:

Empirical: S knows that P empirically = S knows that P, and S's justification for P essentially contains/involves observation.
- *Observation:* sensory perception or introspection. On my view: a thing whose justification consists in the fact that one has a sensory or introspective appearance.
- *"Essentially":* Means that an observation is a necessary part of the justification; if the observation is removed, then the belief is no longer justified.

A priori: S knows a priori that P = S knows that P, not empirically.
• *Possible kinds of a priori kn.:*
1. Innate knowledge
2. Knowledge acquired through reason/intuition

Necessary/Contingent:

Necessary: Could not have been otherwise.

Contingent: Could have been the case, and also could have not been the case.

Empiricism/Rationalism:

Empiricism:
1. General idea: All knowledge of objective reality is empirical.
2. Modern interpretation: No synthetic a priori knowledge.
3. Role of reason: operates on information provided by observation.

Rationalism:
1. There is a priori knowledge of objective reality.
2. There is synthetic a priori knowledge.
3. Role of reason: (a) operates on information provided by observation, and (b) provides some information of its own.

II. Examples of A Priori Knowledge

A. Logic

Examples:

"Anything implied by a true proposition is true."
Law of Identity: "Whatever is, is."
Law of Non-Contradiction: "Nothing can both be and not be."

Law of Excluded Middle: "Everything must either be or not be."
Principle of induction

Argument:

1. Some principles of logic are known.
2. No principle of logic is known by observation.
3. All inference presupposes the truth of one or more principles of logic.
4. Therefore, principles of logic cannot in general be known by inference. (From 3.)
5. Any thing known empirically is known by observation or by inference.
6. So principles of logic cannot in general be known empirically. (From 2, 4, 5.)
7. So some principles of logic are known non-empirically. (From 1, 6.)

B. Ethics

Examples:

"Happiness is intrinsically better than misery."
"If A is better than B and B is better than C, then A is better than C."

Argument:

- Similar to above.
- No ethical truth is known by observation.
- No ethical truth can be known by inference from wholly non-evaluative premises.

C. Mathematics

Examples:

"2 + 2 = 4"
"Two points determine a line."
"P(A or B), when A and B are mutually exclusive, = P(A) + P(B)."
"If there exist objects *a* and *b*, then there is a set containing them, {*a*, *b*}."

Arguments: Why these are not just like empirical generalizations (e.g., "All men are mortal"):

1) One instance suffices for knowing a mathematical generalization. Further instances do not increase probability.
2) They can be certain.
3) They are *necessary*. We can't entertain a hypothetical in which they are false.

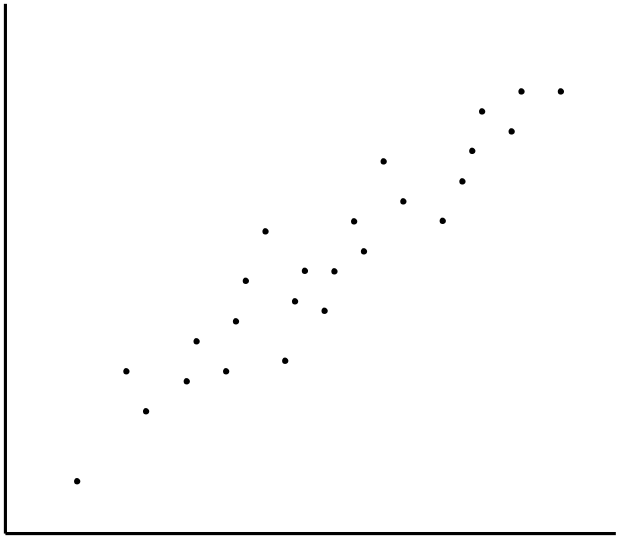
Phil. 4400
Notes #10: Simplicity

I. The problem of simplicity

- Simplicity widely appealed to in science & other empirical reasoning
  - Scientific ex.: Ptolemaic vs. Copernican astronomy
  - Ordinary ex.: the appliance failures; the detective
- Kinds of simplicity: kinds, tokens, & principles
  - Kinds matter: chemistry, elementary particle theory
  - Tokens also matter:
    - The neutrino case
    - Neptune
  - Simplicity of principles:
    - Law of gravity ex.: Which of these is simpler?

$$F_G = \frac{Gm_1m_2}{r^2} \qquad F_G = \frac{Gm_1m_2}{r^{2.0001}}$$

    - The curve-fitting problem: How would you fit a curve to these data points?



- Questions:
  1. Why is simplicity a virtue?
  2. What is simplicity?

II. Some failed accounts

A. The pragmatic account

- Simpler theories aesthetically pleasing
- Easier to work with
- *Problem:* Pragmatic value of avoiding error swamps the above pragmatic values.

B. The efficient convergence account

- Occam's Razor is (a) guaranteed to reach the truth eventually, if the truth is attainable, and (b) minimizes the number of changes of opinion one may be forced into (among methods satisfying (a)).
- Consider 3 methods:
  (1) Assume A's exist, unless proven otherwise. Problem: violates (a)
  (2) Assume A's exist, until 1 million unsuccessful attempts to detect A's. Problem: violates (b)

(3) Assume A's exist, until 1st A is detected. Most efficient method.

- *Problems:*
  - Why care about efficiency?
  - Doesn't guarantee truth, doesn't guarantee probability of truth
  - Doesn't even minimize *expected* # of changes of opinion

C. The empiricist account

- *First version:*
  1. In the past, simpler theories have generally proven better than complex theories.
  2. Therefore, simpler theories will probably continue to be better than complex theories. (induction)
  3. Therefore, we should continue to rely on the criterion of simplicity.

- *Second version:*
  1. Science has been very successful.
  2. The best explanation of this is that scientific methodology is truth-conducive.
  3. So, probably scientific methodology is truth-conducive. (From 1, 2)
  4. Simplicity is central to scientific methodology.
  5. So, probably simplicity is a mark of truth. (From 3, 4)

- *Problem:*
  - Neither version explains why simplicity is a mark of truth.
  - First version may be circular: induction relies on a form of simplicity
  - Second version circular: Inference to the best explanation relies on simplicity criterion

D. The axiomatic account

- Axiom: Simplicity is evidence of truth.
- Argument for this: a) We intuitively favor simpler theories.
  b) Other accounts of virtue of simplicity fail.
- *Problems:*
  - It doesn't seem self-evident.
  - Other accounts don't fail.

III. Some probabilistic theories

A. The boundary asymmetry account

- A boundary asymmetry: degree of complexity is unbounded in 1 direction:
  - There is a lower bound to degree of complexity
  - No upper bound
- Probability distributions must be *normalizable*: probabilities must sum to 1.
- How is this possible with an infinite set? Answer:
  - Countably infinite: convergent series, decreasing probabilities.
  - Decreasing probability density, integrates to 1.
- Hence, more complex hypotheses must have lower probabilities.

B. The numerousness account

- There are more complex than simple theories
  - Consider parameters in equations
  - Relate to ontological parsimony
- Indifference to degree of complexity → lower Pr. for complex theories

C. The likelihood account

- *Important concepts:*
  Likelihood of H (relative to E): P(E|H).
  Model: theory with values of some parameters left unspecified.
  Specific theory: theory with values of all parameters specified.

1. Compare two theories, Simple and Complex, with the same evidence E:

$$P(S|E) = \frac{P(S) \times P(E|S)}{P(E)} \qquad P(C|E) = \frac{P(C) \times P(E|C)}{P(E)}$$

$$\textit{Hence,}\ \frac{P(S|E)}{P(C|E)} = \frac{P(S) \times P(E|S)}{P(C) \times P(E|C)} = \frac{P(S)}{P(C)} \times \frac{P(E|S)}{P(E|C)}.$$

This is the ratio of the *priors* of S and C times the ratio of the *likelihoods* of S and C.

2. The likelihood theory: S has the higher *likelihood*, P(E|S).
   a. Simpler models accommodate narrower ranges of data.
      - More adjustable parameters → wider range of data
      - Ex.: Quadratic vs. linear equations
   b. Total likelihood is 1.
   c. Hence, simpler model has higher likelihood *within the range* of possible data it accommodates.

3. Hence, S is better supported by E, if S accommodates E.

An illustration of the likelihood account:

- The appliance-failure case. Lamp & computer fail

  H1 Power failure.
  H2 Light bulb burned out & computer crashed.

  - H1 clearly simpler, better
  - Adjustable parameters:

    H1: time of power failure
    H2: time of light bulb failure, time of computer crash

- The appliance-failure, Hawaii version.
  - H1 still simpler
  - H2 clearly better.
  - Reason: H2 has higher likelihood.

    H1: parameter must be set to a relatively narrow range (a few hours)
    H2: both parameters can be set independently, wide range (6 months)

Phil. 4400
Review of Unit 2

Know something about these people's views:
Kuhn
Popper
Feyerabend
Ayer
Passmore
Russell
Huemer

Know these concepts:
paradigm
normal science
anomaly
scientific revolution
deductivism
analytic/synthetic
a priori/empirical
boundary asymmetry
likelihood
model
adjustable parameter

Know these theses:
The historical root of irrationalism, acc. to Stove
The philosophical root of irrationalism, acc. to Stove
Incommensurability of paradigms
Empiricism
Verificationism
Logical positivism
Rationalism
Pragmatic account of simplicity
Axiomatic account
Boundary asymmetry account
Numerousness account
Likelihood account

Be familiar with these arguments:
Why arg. for inductive skepticism presupposes deductivism
Objections to positivism:
  Self-undermining of verification criterion
  Compositionality objection
  Circularity problem
Why logic is a priori
Why ethics is a priori
Why mathematics is a priori
  Necessity argument
  Certainty
  Effect of further instances
Why simpler theory accommodates narrower range of data,
  + why it has higher likelihood
  + why this is good
Objection to pragmatic view of simplicity
Appliance-failure (+ Hawaii) examples—how they support likelihood account