Philosophy of Science

Lecture 7: The Duhem-Quine Thesis

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Today's Agenda

- Goal: To understand the famous Duhem-Quine thesis and why it is a problem for science.

- Breakdown
  1. Basic Underdetermination
  2. Holist Underdetermination
  3. Contrastive Undeterdetermination
  4. Solutions to the Underdetermination Problem

1. Basic Underdetermination

One Observation, Many Explanations

- The Undeterdetermination problem is a very straightforward epistemological problem for any observation-based approach to theory development.
- Basic Underdetermination Problem:
  - there is a phenomenon, you want to explain that phenomenon.
  - You, and others, generate a variety of competing (incompatible) explanations.
  - You go out and test your explanations, to see who's correct, but you find that all of the observations you make are consistent with all of the competing explanations.
  - In this case: the data acquired underdetermines the correct explanation.

An Example of Underdetermination

- Data: correspondence between rise in cartoon watching and rise in violent children.
  - Explanation 1: cartoons cause violent behavior
  - Explanation 2: violent children are more drawn towards cartoons
- The correspondence alone doesn't tell us which explanation is correct:
  - Correlation does not imply causation.
- More data is needed to decide between the two: the correspondence observation is not enough to decide (determine) which, if either, explanation is correct.

- But this isn't much of a problem, since we have no reason to think that this applies to science (or knowledge-acquisition) as a whole.

2. Holist Underdetermination

“no hypothesis is tested in isolation”

Holism In General

- One of the most significant attacks on Logical Positivism came from Quine's "Two Dogma's of Empericism."
  - Quine defended a view of meaning that was opposed to the LP's verificationist theory: a holist theory of meaning.
  - But his holist theory of meaning was also used to draw a significant point about the nature of scientific testing and theory change… an underdetermination problem

- **Holism (in general)**: the claim that you cannot understand a particular thing without understanding its place in a larger whole.

Holism About Meaning

- A holist about meaning, then, claims that you cannot understand the meaning of a word (or, perhaps, that the meaning of a word is *determined*) by its place in a larger system of meanings.
  - Your understanding of one word depends on your understanding other words.
    - For example, understanding ‘bachelor’ to mean unmarried adult male, our understanding of the meaning of ‘bachelor’ depends on our understanding the meanings of ‘unmarried’ ‘adult’ and ‘male’. But our understanding of those terms depends on further meanings.
    - These meanings might not bottom out at any “primitive” concepts; but rather, get interdefined within a web of belief.

Holism About Testing

- A similar sort of holism applies to scientific testing, which ultimately leads to an underdetermination problem.

- **Holism about Testing:** it is impossible to test a single hypothesis in isolation from any others (i.e., you can't just test one hypothesis at a time); testing always involves testing an interconnected network of claims.
  - For one: only a network of claims, working together, permit us to make interesting predictions.
    - (e.g., in the syntactic view of theories, it's a set of axioms that imply interesting theorems that we then test; we don't just test one axiom at a time; we make interesting predictions by combining laws together)
  - For another: There are always "auxiliary" hypotheses, about, for example, the accuracy of our measuring devices (e.g., our barometers), the environment in which the observation is made (e.g., that the lab is really free of interfering entities/forces), etc.

The Problem of Holistic Testing

- One consequence of this is that if a test doesn't match a prediction, then something in that network of hypotheses is false, but we don't know which. The data is underdetermined.
  - As far as we know, it is one of the auxiliary hypotheses that should be abandoned, rather than the hypothesis we initially wanted to test.

- Solution?
  - Science has a way of working its way through these problems. Isolating the issue is just the next step in the scientific progress

- Worry: but for each step of this isolation process, there's going to be a holistic worry that crops up… ad infinitum!!

Hypotheses vs. Theories

- The holistic problem was articulated in terms of individual hypotheses, and how they can only be tested as a network of hypotheses, rather than one hypothesis at a time.

- One might also apply the holist underdetermination problem to entire theories instead of hypotheses: what we have is a network of interconnected, theories.
  - Every theory depends on other theories for their articulation and understanding; just like the meaning of terms.

3. Contrastive Underdetermination

"Theories have a hard time getting a leg up on their competitors"

Holism vs. Contrastivity

- The holist underdetermination problem relies on the idea that hypotheses/theories cannot be tested in isolation.
  - That's Quine's problem

- The contrastive underdetermination problem relies on the idea that theories have competitors; there are serious epistemological problems for the idea that one theory can be rationally chosen over its competitors…
  - CU is like the basic underdetermination problem… on steroids!
  - Let's credit this one to Duhem (a physicist and philosopher of science).

Competition Between Theories

- Data: Some phenomenon is observed (e.g., light bends in some medium)
  - Theory 1 accounts for phenomenon
  - Theory 2 also accounts for that phenomenon and is incompatible with Theory
  - 1.
- Problem 1: the two theories are empirically equivalent.

  - Solution: ok. Maybe that's right in SOME cases. And that's a problem. But MOST of science doesn't have this problem.
- We just need to acquire more data, and then see which theory it supports… sound good?

A Deeper Problem

- Maybe it is good…
- But what happens when our interpretation of that new data depends on an interpretation of that data which makes an appeal to a different theory - a theory with its own competitors?
  - If there is undeterdetermination with respect to that theory, and its competitors, then the underdetermination problems strikes again, with a vengeance.
  - Repeat this worry again and again, and we really have no way to decide between theories, EVER!
- Maybe that's being too speculative?
- Perhaps not…

The Contrastive Problem: Observation is Theory-Laden

- The Strongest form of the contrastive underdetermination problem can be stated as an argument:
  1. What we observe always depends on a theory of what it is that we are observing (slogan: observation is theory laden).
  2. There are always alternative possible theories of what we are observing that compete with one another.
  3. Given 1 and 2, if the only way that we can decide between theories is observation, then we are stuck in a never-ending loop of underdetermination between competitors!
  4. The only way that we can decide between theories is observation.
     - Note: I added this premise after recording the lecture in order to make the argument deductively valid.
  5. Therefore, we can never rationally decide between competing scientific theories!

- Yikes!

4. Solutions to the Underdetermination Problems

A Solution to Both the Holist and Contrastive Problems?

- Perhaps there's something **besides evidence** that allows us to place greater credence on one hypothesis over another

- But what that might be?
  - Option 1: Social-structure-of-science theorist suggest that scientists themselves are in the privileged position of making this decision.
    - E.g., Trust scientists since they're the authority!
  - Option 2: holistic tempering relative to some set of theoretical virtues.
    - Virtues such as simplicity, scope, familiarity, etc…
    - E.g., when a test fails to live up to a prediction, one should aim to make the smallest number of changes to the overall web of hypotheses/theories in order to accommodate the unexpected data. (keep intact as much of the web as you can)

Discussion Questions

- In this lecture, we learned about two serious worries for the epistemology of science:
  - the holist underdetermination problem (we can never learn the truth because we can never figure out which of our hypotheses is wrong)
  - the contrastive underdetermination problem (we can never learn the truth because observation, by virtue of being theory laden, is insufficient to help us decide between competing theories (because of a regress of theory selection)

- Discussion Questions:
  1. What do you think of the holistic account of testing hypotheses? Is it really impossible to test a hypothesis in isolation?
  2. Do you think that the holism worry is made more severe by suggesting that theories can never be tested one-at-a-time, but rather, only as a group? Or is this problem less of a problem than the holistic underdetermination of individual hypotheses? Explain why you think that there is a difference in severity.
  3. Is the observation-is-theory-laden worry really as bad as it's made out to be? Are ALL observations really theory laden?
  4. Which problem is worse for science, the contrastive problem or the holist problem? Why?
  5. Do either of the proposed solutions in section 4 actually work? Why or why not?