

Holism And Underdetermination

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1 THE DUHEM THESIS

‘the physicist can never subject an isolated hypothesis to experimental test, but only a whole group of hypotheses; when the experiment is in disagreement with his predictions, what he learns is that at least one of hypotheses constituting this group is unacceptable and ought to be modified; but the experiment does not designate which one should be changed.’

Examples: Cell phone charging; Faster-than-light neutrino measurement, dark matter, game theory.

The main hypothesis always needs the addition of *auxiliary hypotheses* in order to test. This makes the process of falsifying a hypothesis much harder.

Gillies doubts that the Duhem thesis holds for the case of Kepler’s first law. Question: What are the auxiliary hypotheses in this case?

In the case of Newtonian mechanics with respect to planets in our solar system we need to add in lots of other auxiliary hypotheses in order for the theory to have observable consequences. What are the auxiliary hypotheses in this case?

Often it is not clear when to change the main hypothesis and when to change one of the auxiliary hypotheses. Consider Uranus/Neptune, and Mercury cases.

2 THE IMPOSSIBILITY OF A ‘CRUCIAL EXPERIMENT’

Duhem infers from this discussion that *crucial experiments* are not possible.

Crucial experiments are those which allow us to become certain that one hypothesis is true.

There are two reasons why this is not possible. Firstly, we cannot be sure we have thought of all possible hypotheses. Secondly, we cannot rule out even other hypotheses we have thought of, because it might just be the auxiliary hypotheses which are false.

3 UNDERDETERMINATION

If this is all true, then it looks like there are alternative theories that experiments can't tell between. One theory, for example, where we reject the main hypothesis, and other, for example, when we reject some auxiliary hypotheses. (Consider the game theory case, or the Ptolemaic vs Copernican views of the solar system.

How do we judge between those theories?