Science and Philosophy
Term Paper II
Quine and the Underdetermination Thesis

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for K. Brad Wray

In his paper *Two Dogmas of Empiricism* Quine aims to establish that no distinction can be maintained between analytic and synthetic statements and contends that "any statement can be held true come what may, if we make drastic enough adjustments elsewhere"[Quine, p296]. The truth-value of this claim has significant implications in the philosophy of science: much theory selection is based upon the assigned truth-value of various claims. Predictions made with Newtonian Physics can be held true if we are willing to make changes elsewhere. However, we have agreed to hold certain statements true, like the claim that the description of slow moving objects is valid for the description of fast moving objects, requiring us to abandon Newtonian Physics as an adequate description of the world. We must decide which statements ought to be held true and which ought to be adjusted when in conflict; furthermore we must decide when it is rational for one to revise one's belief system in order save a hypothesis from falsification, and when is it rational to give up the belief system entirely. We could have decided to assign a particular truth-value to claims made with Newtonian Physics and made revisions elsewhere. However, we will see that it is only rational to alter a theory when such alterations do not defeat the purpose of the theory. We will see that we can only alter scientific theories when the alterations do not undermine its predictive power.

Quine notes that even the law of excluded middle is being questioned in an effort to simplify quantum mechanics. For Quine the susceptability for revision of statements in a theory is a function of a statement's content. In essence, the central claims of a domain are the most susceptable to alteration in light of reliable observations. He says, "The edge of the system must be kept squared with experience". We should be reluctant to doubt reliable observation (yet we should also be reluctant to sacrifice our fundamental logical claims). We should endorse Quine's view because it is the purpose of scientific theories to model the real world, and therefore, the claims they make should not contradict observation. To allow our science to depart from observation would defeat the purpose of science as a predictive tool. And for realists such a departure would also be defeating; science would no longer adequately describe the world. The standpoint Quine is taking is, perhaps, wise: a regard for the value in observation will avoid Ninth Planet Hegelianism. That is, consistent comparison of theoretical prediction with observation will help avoid the formulation of absurd claims derived only from a priori claims. We have to recognize that our 'a priori' claims might be false.

In light of reliable experimental data we ought to make revisions to our belief system, where needed. Quine says, "conflict with experience at the periphery occasions readjustments in the interior of the field... But the total field is so underdetermined by its boundary conditions, experience, that there is much latitude of choice as to what statements to reevaluate in the light of any single experience."[Quine, p296]. But such revisions cannot be made to single claims in isolation. He contends that confirmation is confirmation of *sets* of statements: "The unit of empirical significance is the whole of science".[Quine, p296]

The difficulty is not resolved, however. There are cases in which our experimental observations conflict with deeply-rooted beliefs about logical truths. For instance, we have on one side of a conflict the basic logical claim *p or not p*, on the other side we have experimental observation, for instance, of single electrons apparently passing through two separate slits. We have the assumption that the electron passes through slits A *and* B or not A *and* B. Being a single electron we choose the latter - it ought to pass through A *or* B rather that A *and* B. Quine maintains that we should not deny the observation. But this does not mean that we must deny the value of *p or not p*. We have other options: we can reconsider our conception of the electron. In essence, we can question other assumptions. This is Quine's point: science does not afford us with process-of-elimination deduction. The underdetermination of science permits us to question all of our background assumptions in order to accomodate experimental observations.

This is what has been done in the past, as Quine recognizes. The shift from Newtonian to Relativistic Mechanics or the shift from Ptolemaic to Copernican Astronomy was not the denial of experimental observation; such shifts were the revision of belief systems in an effort to save various hypotheses. The shift from Newtonian Physics to Relativistic Physics was made in order to maintain the hypothesis that all motion (no matter how fast) can be described by physics. The adoption of Quantum Mechanics was carried out in order to save the hypothesis that phenomena, such as the blackbody radiation curve[1], can also be decribed by physics. In fact, all these shifts were made in order to save the hypothesis that the world is describably according to consistent physical law such as to accomodate prediction rather than ex-post facto description alone. In fact, the truth-value of this hypothesis is so valued that it, alone, has motivated an attempt to formulate a quantum-gravitation theory.

But why do such hypotheses validate the formulation of these various theories? Why can we revise our beliefs about space, time, and matter in the formulation of these theories yet we could not ammend Newtonican Mechanics, for example, to account for objects travelling at high speeds? Because such changes would entail 'except' clauses; 'except' clauses are changes in the rules in the middle of the game. We can say that Newtonian Physics is an accurate description of the world *except* for certain situations which Newtoninan Physics is not intended to describe. Home-runs count *except*, of course, when the first letter of your batter's last name is a 'P'. When we include this sort of arbitrary 'except' clauses in a theory the theory then serves only as a poor ex post facto description and would no longer be a tool

[1]Gasiorowicz, S.; Quantum Physics, Second Edition; published by John Wiley and Sons, Inc., 1996

for prediction. It is not rational to revise a theory when such revisions would undermine the purpose of the theory.