

***The Philosophers' stone and the Manhattan project - lessons in scientific realism.***

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Ever since Plato we have asked ourselves how we can be sure that knowledge truly represents the world itself. How can we be sure that our knowledge is not just ideas in our own minds? Such concerns have formed key themes in the work of many philosophers, notably Immanuel Kant and in our own time Richard Rorty. We might be tempted to think that science must be true because science works, but both Constructivism and Instrumentalism give good accounts of why science might work without being true.

Two traditional defenses of the truth of science are the fruitfulness and the predictive power of scientific theories. On this basis some scientific theories should succeed and, crucially, others should fail. This talk compares the testing of Aristotelian science via the search for the Philosopher's Stone (SPS) with testing the atomic physics of the early 20<sup>th</sup> century via the Manhattan Project (MP).

Both SPS and the MP are examples of major innovative scientific projects that were strongly based on the core scientific models of their day. SPS was based on Aristotelian science, namely the four element model of matter being composed of earth, air, fire and water imbued with the four qualities of heat, cold, dryness and wetness, and that matter could therefore be transmuted by manipulation of the basic elements and qualities. MP was based on the new atomic theory of the early 20<sup>th</sup> century, that all matter was composed of subatomic particles, and that certain of these particles could in the right circumstances be converted into energy.

If we analyze these two projects within a constructivist framework they show strong similarities of process. They are both examples of theory based "puzzle solving" science. As large scale projects they both utilize the conventional industrial models of their day, SPS as multiple cottage industries over many continents and centuries, MP as a single large industrial complex similar say to the automobile industry. They both relied on secrecy and security. They were both driven by issues of power, whether financial, political or military.

Similarly as instances of instrumental knowledge both Aristotelian science and 20<sup>th</sup> century atomic theory both served equally well to explain the observed phenomena of their day.

The huge difference however was in outcome. SPS, despite longstanding and wide ranging research, never actually transmuted one form of matter into another. MP however produced not just one but two separate types of reaction

that converted matter (via both uranium and plutonium respectively) into awesome and devastating amounts of energy.

Philosophical realism is *not* the claim that we have a comprehensive account of the world itself. Neither does it claim that *all* of our current representations of the world must be true. Rather, philosophical realism is the claim that purportedly factual statements may tell us something about states of affairs in the world itself. The failure of SPS and the novel and dramatic success of MP is consistent with a stance of philosophical realism in respect of scientific theory. The Manhattan Project was perhaps the ultimate exercise in scientific realism.

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September 2011.