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'Working in a new world': Kuhn, constructivism, and mind-dependence

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ABSTRACT

In *The Structure of Scientific Revolutions*, Kuhn famously advanced the claim that scientists work in a different world after a scientific revolution. Kuhn's view has been at the center of a philosophical literature that has tried to make sense of his bold claim, by listing Kuhn's view in good company with other seemingly constructivist proposals. The purpose of this paper is to take some steps towards clarifying what sort of constructivism (if any) is in fact at stake in Kuhn's view. To this end, I distinguish between two main (albeit not exclusive) notions of mind-dependence: a semantic notion and an ontological one. I point out that Kuhn's view should be understood as subscribing to a form of semantic mind-dependence, and conclude that semantic mind-dependence does not land us into any worrisome ontological mind-dependence, pace any constructivist reading of Kuhn.

1. Introduction

Thomas Kuhn's *The Structure of Scientific Revolutions*[1] has without any doubt marked a turning point in the way history and philosophy of science has been practiced since. Against the irenic picture of scientific growth marshaled by the logical positivists, Lakatos, and Popper, Kuhn put forward a new picture of how science grows and unfolds, which was bound to attract endless controversies in the decades to come. Paradigm-change and incommensurability have become part of the toolkit in history and philosophy of science, and continue to spark debates. In this paper, I want to focus my attention on one of the most famous and controversial aspects of Kuhn's view, namely the claim that "though the world does not change with a change of paradigm, the scientist afterward works in a different world".[2] By latching onto the work of Nelson Goodman and *Gestalt* psychology, Kuhn argued that scientists never engage in the simple activity of interpreting given data. Experimental data cannot provide a hook to mind-independent reality because laboratory manipulations and measurements are paradigm-dependent. Moreover, different paradigms display different conceptual resources that make possible for scientists (before and after a scientific revolution) to see the world differently.

Kuhn contended for example that Aristotelians saw a falling stone as "a change of state rather than a process (…) the relevant measures of motion were therefore total distance covered and total time elapsed, parameters which yield what we should now call not speed but average speed. Similarly, because the stone was impelled by its nature to reach its final resting point, Aristotle saw the relevant distance parameter at any instant during the motion as the distance *to* the final end point rather than as that *from* the origin of motion".[3]

Kuhn argued then that it is the conceptual switch from motion as distance *to* a final end point, to motion as distance *from* the origin that "underlies and gives sense to most of his [Galileo] well-known 'laws of motion". This conceptual switch was in turn made possible by "the impetus paradigm" and the Scholastic doctrine of the latitude of forms.[4] According to the impetus theory, a stone gains

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[1] Kuhn (1962).

[2] Kuhn 1962; third ed. 1996, p. 121.

[3] Kuhn, 1962,

[4] Kuhn, 1962, p. 124.

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increasing impetus as it recedes from its starting point, and hence starting point (rather than end point) became the relevant parameter in assessing the motion of falling stones. Similarly, Aristotle's notion of speed changed over the Medieval period to include both what we now call 'average speed' and what became later known as 'instantaneous speed'. Hence Kuhn's conclusion:

> But when seen through the paradigm of which these conceptions were a part, the falling stone, like the pendulum, exhibited its governing laws almost on inspection. (…)[Galileo] had developed his theorem on this subject together with many of its consequences before he experimented with an inclined plane. That theorem was another one of the network of new regularities accessible to genius in the world determined jointly by nature and by the paradigms upon which Galileo and his contemporaries had been raised. *Living in that world*, Galileo could still, when he chose, explain why Aristotle had seen what he did. Nevertheless, the immediate content of Galileo's experience with falling stones was not what Aristotle's had been.[5]

The other example Kuhn mentioned in relation to the claim of "working in a new world", is the passage from affinity theory to Dalton's atomic theory, whereby the gas mixtures were reinterpreted in terms of specific combinations of whole-number ratios of atomic elements. Kuhn claimed that Dalton successfully operated the conceptual switch from mixtures to compounds because as a meteorologist, he thought that the absorption of gases by water remained a mystery that affinity theory could not explain, and as such he was immune from the chemical paradigm of his time.[6]

How should we understand Kuhn's claim that scientists before and after a revolution 'work in a different world'? Ian Hacking[7] has famously argued that the world consists of individuals, and as such it does not change during a scientific revolution. Yet, the world scientists work in and act upon is not a world of individuals but a world of kinds, and kinds typically change during a scientific revolution. More recently, Paul Boghossian has discussed Kuhn's influence for constructivism, and in particular for a weak form of constructivism about rational explanation, as the view that evidence is never sufficient to underpin our beliefs.[8]

The goal of this paper is to clarify what sort of constructivism (if any) is licensed by Kuhn's claim. I will go back to Kuhn's example about Galileo's falling stone and elucidate the sense in which it can make sense to say—as Kuhn did—that scientists before and after Galileo *saw* the falling stone differently. I will then draw conclusions about the implications of Kuhn's view for constructivism by ruling out a prominent sense of mind-dependence, which I think has been mistakenly associated with Kuhn. My goal is to take Kuhn's claim as a springboard for analyzing two possible ways of understanding the 'working in a new world' claim: (1.) an ontological sense; and (2.) a semantic sense, respectively. These two possible readings deliver two distinctive notions of mind-dependence, which—one way or another—seem to be at work in Kuhn's contentious claim. I argue for three main points (the first historical, and the remaining two more philosophical):

I. Pace Kuhn, there is a lot of historical continuity between the way Galileo saw the falling stone and the way in which the Aristotelian-Scholastic tradition saw it.

II. Kuhn's 'working in a new world' claim is better understood as implying a form of semantic mind-dependence.

III. Kuhn's semantic mind-dependence does not license ontological mind-dependence, *pace* readings of Kuhn as advocating some form of fact-constructivism.

Before plunging into the philosophical points II. and III., let us go back to Galileo and the falling stone.

2. Galileo and the falling stone

The purpose of this Section is to clarify from a historical point of view three main things: first, how Aristotelians saw the falling stone; second, how Galileo's change in the way in which he could 'see' the falling stone was in continuity with important Medieval studies that built on Aristotle's view; and third, to clarify from a historical point of view what Galileo *saw new* in the falling stone.

First, what did Aristotelians see in the falling stone? Aristotle, just like Galileo after him, saw the falling stone as accelerating, although he was not clear about either the cause of the acceleration or its kinematic features. Aristotle seemed to have believed that bodies tend to accelerate the closer they get to their natural place: for example, falling stones would accelerate nearer to the earth as much as fire would accelerate nearer to the upper region (*qua* fire's natural place). Aristotle explained this acceleration of motion in terms of the body increasing either its weight (falling stone) or its lightness (fire), the nearer it came to its natural place. Medieval commentators of Aristotle, such as Simplicius, interpreted Aristotle's view in terms of the body regaining its 'form' in a more complete way in proximity of its natural place.[9] But an alternative view (defended by Hipparchus) was also available in Medieval times to explain why bodies moved more swiftly the nearer they were to the earth: acceleration of falling stones could have been due to a decrease in the amount of air underneath, as opposed to an increase in the weight of the stone itself. Heavy bodies would fall faster near the Earth because the air underneath them would provide less resistance. A third view, popular with Arabic commentators of Aristotle, such as Avicenna and Abū'l-Barakāt in turn explained acceleration in terms of two opposing forces: what they called a violent *mail* as a force inherent in the body and driving it towards a place different from its natural one; and a natural *mail* as a force that would instead conduce the body to its natural place. The violent *mail* would slow down the body in its initial descent, while the natural *mail* would increase the speed of the body. This view eventually resulted in the impetus theory of John Buridan in the first half of the fourteenth century, where acceleration was explained by the increase of an intrinsic force called *impetus* due to some form of permanent natural gravity. With Nicole Oresme, impetus was no longer regarded as due to some natural gravity of the body, but as due to an initial acceleration, increasing along the descent. In this way, the impetus theory provided a uniform framework for the explanation of both free fall and projectile motion.

Coming to the second aforementioned point, there is significant continuity between Galileo's research on free fall and the Aristotelian tradition, filtered through Medieval scholars. Pace Kuhn's 'working in a new world' claim, there are at least three main

[5] Kuhn, 1962, p. 125. Emphasis added.

[6] Kuhn, 1962 pp. 133–5.

[7] Hacking (1993), p. 289.

[8] Boghossian (2006), pp. 118–125. Boghossian concludes that Kuhn's incommensurability does not open the door to any such weak constructivist thesis, Kuhn's influence on constructivism notwithstanding.

[9] In what follows I draw on M. Clagett (1959), which is the book Kuhn refers to in the passage where the 'working in a new world' claim is put forward in relation to Galileo's falling stone.