Review of "Aristotle's Revenge" by Edward Feser

Book: Edward Feser, *Aristotle's Revenge: The Metaphysical Foundations of Physical and Biological Science* (Neunkirchen-Seelscheid: editiones scholasticae, 2019)

Introduction

How should we understand the world and how it works? What is the nature of reality itself? In the modern era, the natural sciences are taken to be the study of reality. The success of the natural sciences is due to the correspondence their theories have to how reality seems to function, and the ability to apply the knowledge gained from the natural sciences for the betterment of humanity. While the natural sciences are always developing, their explanatory power and technological advancement has gained our trust that they do in fact teach us what reality is and how reality functions.

The philosopher Edward Feser however demurs from this depiction of reality. Rather, he asserts that Aristotelian philosophy is properly basic and that the operation of science presupposes Aristotelian categories and terms. In his book *Aristotle's Revenge: The Metaphysical Foundations of Physical and Biological Science*, Feser seeks to prove that his version of Aristotelianism is superior to the scientific worldview in understanding the world. Feser claims that he has no problems with the empirical findings of science, but only their interpretation (pp. 55-56). Thus, science according to Feser has been confused with a "mechanistic" philosophy of nature, but we can reject that philosophy of nature for the true philosophy of nature presupposed by science, (Neo-) Aristotelianism!

Feser makes his argument in the book by first contrasting these two philosophies and arguing for the need for Aristotelianism (Chapter 1), arguing that the scientific method is deficient and must be supplemented by seeing the scientist as a subject having perception (Chapter 2), and then addressing the issue of the relation of science and reality (Chapter 3). In chapter 4, he deals with questions concerning space, time and motion. In chapter 5, he addresses quantum mechanics and questions of computation, and in chapter 6 he deals with biology and biological life. Through this book, he argues for the need to hold to Aristotelianism as properly interpreting science, and that we should understand the world in that manner rather than what the prevailing scientific mindset teaches.

In this review, I will be addressing certain major issues of concern I have with Feser's arguments. As someone who is trained in the sciences and is also rather well-read in philosophy, I find Feser's case unproven and his arguments flawed, as will be seen below.

First principles – The default of Aristotelian ontology?

> But a problem with this view is that it entails that dogs, trees, stones, and the like are not really substances. The true substances are the fundamental particles, and to be a dog, a tree, or a stone is just for these particles to take on a certain kind of accidental form. Yet this seems clearly wrong insofar as these and other natural objects appear to have causal powers that are irreducible to the sum of the causal powers of fundamental particles. … (p. 30)
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> Another problem is that from the Aristotelian point of view, the atomist doesn't really get rid of substantial form and prime matter at all, but simply relocates them. Supposed that to be a dog, a tree, or a stone really is to have a merely accidental form, and that the only true substances are the fundamental particles. We would still have to regard them as composites of substantial form and prime matter, for the reasons given in the arguments from limitation and from change. (p. 31)
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> The basic idea of the first line of argument is, again, that a form is of itself universal, so that we need a principle to explain how it gets tied down, as it were, to a particular thing, time, and place. … Matter – the matter of this individual bowling ball, of that individual wheel, and so forth – is what does this job. (pp. 27-28)
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> On an Aristotelian analysis, a real change involves the gain or loss of some attribute, but also the persistence of that which gains or loses the attribute. For example, when a banana goes from being green to being yellow, the greenness is lost and the yellowness is gained, but the banana itself persists. If there were no such persistence, we would not have a change to the banana, but rather the annihilation of a green banana and the creation of a new, yellow one in its place. (p. 28)
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> Without prime matter, there could be no substantial change, because there would be no subject of change that persists through the change. (pp. 30)

In chapter 1, Feser contrasts "mechanism" (reality is like a machine governed by rules) with Aristotelianism, and claims that Aristotelian categories are essential for understanding science. Since this is true, the atomism of modern science (a key component of "mechanism") is not feasible as an understanding of how things are truly constituted. On this issue, Feser utilizes Aristotle's view of form and matter to put forward two arguments to show how modern atomism fails to explain the nature of things: an argument from limitation and an argument from change. But has Feser actually proven his point?

In the argument from limitation, Feser argues that even if atoms were constitutive of substance, they still need to have "substantial form" and "prime matter."[1] However, in

[1] It must be stated here that while there is a rejection of modern atomic theory, Feser is not disputing atomic theory in general, just its explanatory power. Feser is not "anti-science" in rejecting that atoms are there, but rather, he is rejecting the status we assign to atoms in modern atomic theory.

response, that is to impose Aristotelianism as constitutive of reality, instead of a description of reality one chooses to use. But what is reality, really?

The problem here is that Feser presupposes an Aristotelian manner of thinking. If Aristotelianism is true, then “mechanism” does not make sense. If Aristotelian categories are valid, then atomism requires it to function. However, this only make sense if someone concedes the legitimacy of the Aristotelian enterprise to begin with, but that is precisely what is under dispute!

To assert that something S is presupposed in order for another thing T to make sense is to make an epistemological argument. In order for the argument to be valid, the assertion must be made that that something S is properly basic. In order for something to qualify as “properly basic,” it must be something that is required to make sense of things. If the “properly basic” status of S is disputed, then the only way to test it is by comparing the two systems of thought. The system of thought generated by the two (or more) competing axioms are compared as to their explanatory power and correspondence to reality. If one system has greater explanatory power or correspondence to reality than the other, then it is more likely that its axioms are truly properly basic. This partakes in some manner of the logical form of *modus tollens* (If *p*, *q*; ~*q*, therefore ~*p*), where *p* indicates the axioms being tested.

In this light, Feser’s arguments here are fallacious, for he assumes Aristotelianism and therefore argues that it is necessary for Aristotelianism to be true because it makes sense of the world. The fallacy is the fallacy of affirming the consequent, whereby the argument is made that if Aristotelianism is true (if it presupposed), then these understandings of science is true. Since these understandings of science are true, therefore Aristotelianism is true (If *p*, *q*; *q*; therefore *p*)

That this is the case can be seen most clearly in the quote below:

> From the Aristotelian point of view, the difficulties notoriously facing modern origins of life research stem, not merely from any gap in current empirical knowledge, but from the irreducibility of even the simplest organic substances to purely inorganic phenomena. The intractability of the qualia problem stems from the irreducibility of sentient forms of life to merely vegetative forms of life. The difficulties facing materialist theories of the propositional attitudes stem from the irreducibility of the rational or human form of life to the merely sentient forms of life. In other words, the difficulties in question are essentially confirmation of the traditional Aristotelian position. … (p. 41)

The syllogism can be constructed as follows, which is in the form of affirming the consequent:

- P1) "If Aristotelianism is true, then there is irreducibility of animal life to vegetative life, and irreducibility of rational life to animal life."

- P2) "This irreducibility seems to be true as seen in the failure of modern science to account for the origins of life and rationality
- C) Therefore, the traditional Aristotelian position is true.

Instead of comparing the two systems, Feser argues that, based upon Aristotelian categories, science cannot make sense without it. However, it could be, and it is the case that science does make sense based upon its **own** categories. Feser's case for Aristotelianism thus starts out on the wrong foot.

Concerning ontology, whatever reality really is, on the empirical level reality is investigated through the scientific method. It is not modern atomic theory that has to conform to one's ontology (e.g. Aristotelianism), but modern ontology that has to conform to modern atomic theory. Feser is neither an idealist nor a Kantian, so his ontology must conform to what we have learned about reality.

In this instance, the answer to the argument from limitation is simple: Atoms are made up of the subatomic particles: Protons, Neutrons and Electrons. All of them ultimately are made up of quarks. The process by which quarks make subatomic particles make atoms which make things does not imply a reduction of all substance to quarks, for we can say that substances emerged out of more basic matter. Form is an emergent quality, not a basic quality. It emerges through the interaction of atoms with each other, and complexity in their interactions creates form.

The response to Feser's second argument, the argument from change, is to assert that qualities like color are emergent qualities not primary qualities. There is no substantial change in the banana because the banana did not change, only various chemicals in the banana have been altered as the fruit ripened. There was no change from green-ness to yellow-ness, but rather there was substantial change in certain chemicals in the banana, while there is no change in the banana itself, and the secondary quality of "green-ness" changes to "yellow-ness" due to the chemical changes that have taken place in the banana. One does not have to postulate prime matter, because based on modern scientific theory, there is no need for this idea at all.

Feser continues later with his view on matter, dismissing the reality of atoms inside things. Rather, for Feser atoms only appear when the things are broken apart, otherwise they are in things only "virtually," as stated:

> By contrast, the hydrogen and oxygen in water are virtual or potential rather than actual. … That it is in the water *only* virtually or potentially rather than actually is the reason you cannot burn the hydrogen in water, which you could do with actual hydrogen. (p. 313)
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> In general, the particles of which any true physical substance is composed exist within it virtually or potentially rather than actually. For example, if a stone is a true substance, then while the innumerable atoms that make it up are real, they exist

> within it virtually or potentially rather than actually. What *actually* exists is just the one thing, the stone itself. (pp. 313-314)
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> This echoes the Aristotelian position that parts exist in a substance virtually or potentially rather than actually. (p. 317)
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> Indeed, there is a sense in which these ordinary objects are *more* fundamental than the particles that make them up, insofar as the particles exist in them only virtually, only relative to the wholes of which they are parts. (p. 330)

Using an electron microscope, we can see individual atoms. It should be evident therefore that the idea that atoms of molecules like water, or even the various atoms in stone, are only there "virtually" and not actually, is false. Here, we can see the controlling philosophy of Aristotelianism taking precedence over actual science, and thus it is harmful to science and to our understanding of the truth about reality.

Undermining science – The issue of senses: On color

Feser's privileging of Aristotelianism poses even more problems especially when we deal with the senses and things known through the senses The example used by Feser is the issue of color, where he states:

> The atomist maintains that when the banana goes from being green to being yellow, the only change that occurs in the banana itself is a change in the arrangement of atoms and their impact on the sense organs. Neither the greenness nor the yellowness we see is really there in the banana in the first place, but only in the conscious experience of the perceiver. … But in fact this neither reduces qualitative change to local motion nor eliminates it, but merely relocates it. For example, the qualitative change from green to yellow is now, in effect, located in the conscious perceiver himself rather than in the banana. It is a transition from the perceiver's experiencing greenish qualia to his experiencing yellowish qualia. (p. 210)
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> The starting point of the argument is the observation that the appearance of qualities like color varies from observer to observer. The same object will look bright red or dull red depending on the lighting; a color blind person might not be able to tell it apart from a green object; another person's color experiences could in theory be inverted relative to my own; and so on. The best explanation of these facts, the argument concludes, is that color is not really there in the objects themselves but only in the mind of the observer.
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> But there are several problems with this argument, which Putnam (1999, pp. 38-41) has usefully summarized (where Putnam is reiterating points that go back to writers like J.L. Austin (1962) and P.F. Strawson (1979)). First, the argument rests

> on a simplistic characterization of the commonsense understanding of color. Common sense allows that the same color can look different under different circumstances, just as it allows that a round object can appear oval under certain circumstances. Hence the commonsense thesis that color is mind-independent is not undermined by the fact that an object will look bright red in some contexts and dull red in others. Furthermore, color blindness no more casts down on the supposition that color is mind-independent than hallucination casts doubt on the reality of physical objects. In both cases, the defender of common sense can note that a perceiver's faculties are simply *malfunctioning*, and thus not presenting objective reality as it really is. Meanwhile the inverted spectrum scenario presupposes that the physical facts about both external objects and the brain could be exactly as they are while the way colors look is different. It presupposes, in other words, that color can float entirely free of the way things really are in the material world. But that is exactly what the commonsense view denies, so that to appeal in this context to the alleged possibility of color inversion is to beg the question. (pp. 342-3)

According to Feser's first point about color, the "mechanist" view of color as a secondary quality reduces color to something subject not objective. However, is that how science really understands color and secondary qualities?

Why do we see color? As explained by science, light waves of certain wavelength (in the visible light spectrum) possess certain colors. In the object being seen, some light is absorbed by the surface of that object due to the photons with that energy level being absorbed by electrons in the atoms in the molecules on an area on the surface of the object. The light waves that are not absorbed are reflected from the object, and the wavelength of these light waves have a certain color. When we observe that object with our eyes, the light waves reflected from the object enter our eyes and our minds read the color of the object from the wavelength of light that has entered our eyes.

The reason for this brief excursus through the science of optics is to correct what seems to be confusion on the part of Feser. Contrary to Feser, color changes are not changes in the perceiver only. In the case of a banana being ripened, the cells of the banana have ripened, and this ripening came about through a cascading set of chemical changes within the banana cell. Part of this ripening process is the changing of molecules on the surface of the banana, causing the electrons of the atoms in the molecules on the surface of the banana to start reflecting yellow light and not green light. Certainly, in the philosophy of mind, the question of how the color is translated into what we know as "green" and "yellow" is asked, but that is not the issue in question here.

When it comes to secondary qualities like color, the term "secondary" is not synonymous with "imaginary" or "false" or "not real." Rather, the term "secondary" means that these qualities are derived qualities that come into being due to the interaction of objects with subjects. It is subjective in that sense. For imagine if an alien organism has the ability to see infrared radiation as well, the banana would not appear to that organism purely "green" or purely "yellow," but probably tinted with shades of red. Since for that alien

organism the banana does not appear "green" or "yellow," does it mean that the banana suddenly lose its "attribute" of being "green" or "yellow"? The asking of this question should manifest to us why color is said to be a secondary quality not a primary quality. Or take another example in a spaceship that is travelling at a significant fraction of the speed of light. All incoming light at the front of the spaceship would be blue-shifted. At a certain speed, anyone looking out of the front of that spaceship would see infrared radiation as visible light. Do these celestial bodies in front of the spaceship change their color "attribute" at all? Again, the question itself make no sense since it ignores how color is perceived in subjects.

In science therefore, to state something is a secondary quality is not to say these things do not truly exist except in the mind. All secondary qualities do exist, but they are emergent qualities not fundamental qualities.

Feser's second argument is that color does not change depending on the person and that issues such as color-blindness in some individuals does not affect the mind-independence status of color. That is true, but that is not the argument put forward by science. The issue is not one of mind-independence, but of whether color is a primary quality. Furthermore, the problem here is the privileging of yellowish light from the Sun over all other lights. What happens if Earth orbits a blue giant start, or a red dwarf star? The "color" of those objects will then be different, would it not?

The example of color serves to illustrate how Aristotelianism distorts the science to prop up its view that there are no such things as secondary qualities, but qualities such as color are primary and they partake of what a thing is.

Undermining science – The issue of senses: On corporeality and the subject

In order to play down the objectivity of science to make way for secondary qualities like color to not be secondary but primary, Feser undermines the objectivity of science, as follows:

> A further problem with the imagined Cartesian dualist response …. Is that it begs the question against the Aristotelian insofar as it assumes that the perceptual and cognitive states of subjects of experience can entirely float free of the body. From the Aristotelian point of view, that is not the case, even given that the human intellect is incorporeal. For one thing, perceptual experience is corporeal, presupposing sense organs and brain activity. For another thing, even cognition requires, in the ordinary case, brain activity as a necessary condition, even if it is not a sufficient condition. … If we were entirely incorporeal, we would essentially be angels, having our knowledge in a single act and without relying on perceptual experience. The Cartesian notion of *res cogitans* is really the notion of an angelic intellect, not a human one. Hence, from the Aristotelian point of view, to establish that there is a succession of perceptual and cognitive states in the subject of

> experience just is to establish that that subject is corporeal and thus that the way in which it manifests actuality and potentiality is in part by being a composite of form and matter. (p. 93)

The first step Feser takes is to make knowledge, even scientific knowledge, dependent on the senses, as opposed to the senses being an *instrument* for knowing, by arguing that all knowledge is perceptual requiring a corporeal subject. But, does the mind require the senses to function? Is corporeality necessary for thinking? Feser argued that corporeality is necessary for human thinking and learning, whereas non-corporeal thinking is angelic and having "knowledge in a single act and without relying on perceptual experience."

The first flaw here is the assumption that perceptual experience is corporeal. According to Feser, to perceive something one must have a body. But in the Aristotelian scheme, humans are hylomorphic (where the soul is the form and the body the matter). Since for the Christian, during the period between the first death and Christ coming back, the souls of believers will be with God while the body remains in the grave (c.f. Phil. 1:21, 1 Cor. 15:23), how is this possible if humans are hylomorphic? In this glorified but not fully recreated existence, can the soul perceive God's love for him? It would seem for the Christian that the answer should be yes. And if that is true, then Feser's assumption here is false, for the Christian soul that is non-corporeal following the first death can indeed have perceptual experiences.

Feser's second assumption is that cognition requires brain activity. But that confuses correlation with causation. If as we have argued that the non-corporeal soul can have perceptual experiences, then certainly cognition does not require brain activity as a necessary condition.

Since that is the case, it is not true from a Christian perspective that the senses are needed for the mind to function. The "Cartesian notion of *res cogitans*" is therefore not an angelic way of knowing and the fact that there is a succession of perceptual and cognitive states does not imply anything about the thinking subject or the nature of things.

It must be pointed out here that Feser’s position is a form of materialism which includes heavenly substances. Souls in Feser’s scheme do not exist where there is no substance present. Humans have a human substance (physical body), angels have angelic substance (angelic spiritual body?), and God has divine substance (divine spiritual substance?). Feser’s Neo-Aristotelianism is not as anti-materialistic as one might initially have thought.

Undermining science – Mind-independence and subjectivity in science

> Now, the empiriological description of nature is essentially what Sellars calls the “scientific image” of the world, as opposed to the “manifest image” of common

> sense and ordinary experience. Since the subclass of "empirioschematic" sciences make use of concepts that are widely regarded as merely regulative rather than corresponding to anything in mind-independent reality, there is a tendency to identify the scientific image, strictly construed, with the emperiometric description of the world, specifically – that is to say, with a mathematicised conception of nature of the kind toward which the "mechanical world picture" tended, and that has become definitive of modern physics. That is not to say that those who take the scientific image to exhaust reality would all hold that everything real can be reduced to entities within the ontology of physics. Some would say instead that everything real need only supervene on the latter. Either way, though, for those who take the scientific image to be an exhaustive picture of reality, the ontology of physics "wears the trousers," as it were.
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> … The basic idea of this "absolute conception" is to construct a description of the world that is entirely free of any explicit or implicit reference to the point of view of any particular observer, or any particular type of observer. As Nagel emphasizes, the conception in question regards anything that depends on the point of view of particular observers as "subjective," and thus it takes itself to be by contrast an entirely "objective" description. … The distinction between primary and secondary qualities became the standard way of expressing the idea, with secondary qualities regarded as reflecting the observer's subjective point of view and primary qualities alone constituting the truly objective features of reality. (p. 133)
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> Part of what this chapter has been concerned to show is that the manifest image, the world as it appears from the "subjective" point of view of the conscious subject, cannot coherently be eliminated and replaced entirely by the "objective" or "absolute" perspective of the scientific image. For the latter presupposes the former, in two fundamental respects. First, abandoning the manifest image while trying to maintain the scientific image is tantamount to attempting to keep the apex of the "arch of knowledge" aloft while destroying its feet and legs. As Colin McGinn writes, the scientific image "purchases [its] absoluteness at the cost of removing itself from the perceptual standpoint" (1983, p. 127). Hence, "to abandon the subjective view is to abandon the possibility of experience of the world" (p. 127), and thus to abandon the evidence of observation and experiment on the basis of which the claims of the scientific image are supposed to be justified. It is also to abandon the reasoning processes that take us from that empirical evidence up to the scientific image and then back down from it to testable predictions. For the subjective view includes the cognitive (as well as the perceptual) states and processes of the scientist. (p. 134)
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> In short, an "objective" description is itself an extension of the "subjective" point of view, and the scientific image is itself merely a component of the manifest image. (p. 135)

Feser's last way of undermining the objectivity of science deals with the practice of science. The practice of science does involve human beings, and humans with regards

to both their practices and theory choices are not objective. However, the shift from seeing science as this absolutely objective enterprise that scientists are involved in to something that focuses on the subjectivity of scientists is in my opinion a swing from one extreme to the other extreme.

Thomas Kuhn in dealing with the history of science took note of the changes in paradigms that have taken place in science. He had noted how paradigms are by nature resistant to change until a crisis occur due to one too many breakdowns with the older paradigm. While this idea of "crisis" was overplayed by Kuhn in his early formulations of his philosophy of science, there is a sense in which crises do precipitate major changes, even if not all major changes come about through crises. Kuhn's historicist focus however does not necessarily imply any form of relativism, for the simple reason that scientists are genuinely searching for the objective truth. The problem with paradigms is not that they are "socially constructed," but rather the reason why different paradigms emerge is because of the finitude of human knowing even as it grasps after objective reality. This is seen in the problem of induction that pervades science, such that science while grasping after truth can never fully attain it.

Having said this, it is because there *is* a grasping after objective truth that science does to some degree *approximate* the truth, and scientific laws approximate the laws of nature. That is why, while Newton's Laws of Gravitation are superseded by Einstein's General Theory of Relativity, Newton's formulas can still be used in most cases where the effect of gravity on the curvature of space-time is not significant. Science is not absolute objective truth, but it does approximate it to some degree.

It is because of this that Feser's view concerning science is disturbing. For the purpose of making secondary qualities primary, Feser undermines the objectivity of science in such a manner that the subjectivity of scientists must be considered in science itself. The issue with regards to science is whether there is something beyond the practice of science, and I will assert that there are in fact laws of nature that science as a discipline grasps after, albeit imperfectly. Since science grasps after the laws of nature, the subjective striving of scientists should be seen as an *artifact* of the discipline of science, not as *part* of the subject of science, just as in the previous section we see that the senses are *instruments* of science, not components of science. For Feser, science needs to encompass the practice of scientists in understanding their observations, instead of focusing on the imperfect practice of scientists in attempting to understand the objective truths of nature. For Feser, perceptions inform science, while I would suggest it is nature that informs science, with perception being the instrument of knowing. In other words, Feser in my opinion confuses the **process** of science with the subject of science.

Science seeks to understand how the natural world works. It seeks to understand objectively how the world is run. Thus for example, it is either true or false that penicillin kills dangerous bacteria, and we can test that hypothesis out. The subjectivity of the scientist, while ever present, does not add or subtract from the **fact** that penicillin does in fact kill harmful (non-antibiotic resistant) bacteria. In the laws of motion, Newton's First Law is either true or false, and the subjectivity of the scientist does not color its **truth**.

From these two examples, it should be seen that the subject of science itself is not focused on the process of observation and explaining observation, but about the facts of how the world actually works.

When it comes to complex theories and meta-theories, meta-narratives of science, then subjectivity plays an ever-increasing role since human judgment is used in theory choice and construction. This is why scientific theories can be totally false, but this is not to deny their aspirations towards the objective truth, for human error does not disprove scientific truth.

Feser's conflation of process with subject has resulted in his attempt to insert subjectivity into the subject of science, instead of keeping it to the practice of science. The laws of nature are mind-independent, and Feser's arguments to undermine science's objective referent so that he can prop up his Neo-Aristotelianism should be rejected.

On science – The modern versus the Neo-Aristotelian conception of scientific laws

> The standard view of laws of nature regards them as universal regularities, ordered in something like a pyramidal structure, and where at least the laws at the apex of the pyramid are ontologically fundamental in the sense that they don't presuppose anything else (except God, for proponents of the standard view who are theists). They are universal in the sense that they hold everywhere and always. … When we reach the laws at the top of the pyramid, we have (if you'll pardon the mixed metaphor) reached metaphysical bedrock. (For the atheist, anyway. Again, the theist who is committed to this picture of laws would say that God is the cause of the laws. Even for such theists, though, there is *nothing in the natural world* that is more basic than the laws.) (p. 177)
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> There is another way to understand laws of nature, however, which is most famously associated with Nancy Cartwright and first set out in the essay collected in her influential book *How the Laws of Physics Lie* (1983). On Cartwright's view, each of the tenets of the standard view is false. First, laws are not universal regularities. Or to be more precise, if interpreted as universal regularities, laws turn out not to be strictly true; whereas if they are interpreted in a way that makes them come out true, they are no longer strictly universal. … Laws are true only *ceteris paribus*, only when certain conditions obtain. In that case though, they correctly describe the behavior of the entities they govern only under those particular conditions, and are not true of the entities universally. (p. 178)
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> A second way Cartwright departs from the standard view is by denying that laws are ontologically fundamental. What are fundamental to the entities studied by physics and the other sciences are rather their *natures* and *capacities* (Cartwright 1999, pp. 59-73, 78-90). By virtue of these natures and capacities, entities "try" or

> "tent" to behave in certain distinctive ways (1999, pp. 28-29), and the tendencies of one entity can combine with those of another to produce a joint effect. (p. 178)
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> Such an arrangement constitutes what Cartwright calls a "nomological machine" (1999, chapter 3). Laws are essentially descriptions of the regularities characteristic of a certain kind of nomological machine. … (p. 179)
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> The third way Cartwright's position differs from the standard view is that she takes laws to form a "patchwork" rather than a pyramid (1999, chapter 1). There are the laws describing the behavior of this nomological machine and the laws describing the behavior of that one, but we have no reason to believe that anything unites them all. In particular, we have no reason to believe that laws are arranged in a hierarchy or that there is some one most basic law or set of laws from which all the others follow. (p. 179)
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> … there is nothing in the actual findings of modern science that favors the standard view over hers. Empirically speaking, the rival views are evenly matched at best, with the choice between them essentially philosophical rather than scientific. (p. 179)

We finally arrive at Feser's vision of science. As an alternative to the "mechanical" view of science and the world, Edward Feser sets forth an alternative vision whereby science is *merely descriptive* of systems *not* of things. Things rather are, as Aristotle sees them, with their own natures and capacities (borrowing from Nancy Cartwright's view), and thus **things** rather than **laws** are fundamental. Lastly, laws are disparate not connected together, since they are not fundamental for reality but merely descriptive of systems. Feser further asserts that the difference between these two models of reality are empirically indistinguishable, and therefore science does not and cannot disprove his alternate ontology.

On a surface level, the two models seem indistinguishable empirically. However, I would assert that it can be proven that Feser's alternate model is unable to justify science and the workings of science, and I will do so by looking at each of the three Cartwright tenets that Feser embraces.

The first tenet is a rejection of the universality of scientific laws. Feser asserts universality to be false because things in real life do not follow scientific laws, as the laws only apply in ideal situations which are not found in this life. In a sense, it is true that the real is different from the ideal, but it is a leap of logic to assert that therefore laws are not universal. The fact of the matter is that under certain situations, we can approximate the ideal. For example, under high temperature and low pressure situations, all gases approximate the Ideal Gas Law, regardless of whether it is chlorine, argon, or carbon dioxide gas. In chemistry, the stochiometric ratio of the reaction of sulfuric acid with sodium hydroxide is always 1:2, and this applies to the reaction of any diprotic base with a monoacidic base. Newton's First Law can be easily proved in space where friction is

negligible if not absent. In other words, the distinction between the real and the ideal does not in any way invalidate the application of scientific laws.

But, Feser will object, that only proves that the laws work only under certain conditions, does it not? No, for the beauty of science is that in non-ideal scenarios, the other variables can be factored into the equation and applied then. For example, the Van der Waal equation with variables *a* and *b* work for real gases. In mechanics, the force of friction can be measured and taken into account. In chemistry, impurities in chemicals can be ascertained and factored into chemical reactions. In other words, scientific laws do not apply only under "certain conditions." The simple form of the law can be seen only under ideal conditions, but the laws do apply under *all* conditions.

Compounding the problem with Cartwright's first tenet, a rejection of the universality of laws breaks the practice of science. If laws are not universal but particular, then science and technology would grind to a halt. Why should anyone think that the application of a certain temperature in an industrial plant would result in fractional distillation of petroleum? Rather, if universality is rejected, each industrial application must be investigated anew since what works for one "substance" (e.g. alcohol and water) may not work for another "substance" (i.e. petroleum). We cannot assume that gravity on other planets would necessarily follow either Newton's Law of Gravitational Attraction or Einstein's General Theory of Relativity either. Therefore, while Cartwright's first tenet cannot be disproved empirically, it vitiates the practice of science altogether. For science to be science, laws must be both universal and at least approximately true.

Cartwright's second tenet places things as being fundamental not laws. The problem with this new take on Aristotle is that it can be proven that laws are more fundamental than things. The ability to transform one element to another through radioactive decay, through bombarding things with energetic particles (e.g neutrons, alpha particles, other atomic nuclei), or through nuclear fission and fusion, have proven that atoms are in fact real and fundamental and that Aristotelian "substances" are at best an emergent quality. The creation of anti-matter, and the ability to destroy matter by combining that matter with anti-matter to form pure energy, are not mere hypotheses but actual experimental science. On this second tenet therefore, science has indeed disproved Cartwright's new take on Aristotle.

On Cartwright's third tenet, that is debatable. Scientists have not yet discovered a unifying theory of everything, and it is uncertain if they ever will. However, the problem with the third tenet is not that there are certain disparate sets of laws, but rather Cartwright's denial of all hierarchy goes against our understanding of how the various scientific disciplines connect to each other.

The convergence of scientific disciplines in the natural science is seen in for example biochemistry, whereby biology and chemistry are integrated. The biochemical pathway of glycolysis for example show how chemistry underlies biological nutrition, and thus chemistry is more fundamental than biology. When one looks into molecular structure in bond length, angles of chemical bonds, valence electrons and dipole movement, it can

be seen that physics is more fundamental than chemistry. All of these prove that there is some hierarchy among scientific disciplines and scientific laws. Along with the rejection of second tenet, the scientific picture of atoms and laws of nature appears more credible than the Neo-Aristotelian version of substances being fundamental. A deeper understanding of science here thus falsifies Cartwright's third tenet.

As it can be seen, on the surface, it seems that Cartwright's and Feser's model of ontology and science is empirically indistinguishable from the modern ("mechanist") model. But a deeper understanding of science falsifies that model. One can reinterpret certain scientific laws in line with this Neo-Aristotelian model, but the model cannot and does not work for actual scientific practice and understanding. Cartwright's and Feser's model of science and scientific laws are therefore to be rejected as contrary to how science actually works, and what things actually are.

Next, we will look at issues in science, with some discussions of philosophy.

Scientific issues: On the issue of relative motion

> For another thing, McGinn argues, there are difficulties with the thesis itself, never mind the argument for it First of all, on analysis it appears to be incoherent. Consider a universe with just two objects, A and B. Suppose that from A's frame of reference, A is stationary and B is moving toward A, whereas from B's frame of reference, B is stationary and A is moving toward B. According to the relationalist, there is no fact of the matter about which is really moving. Relative to A, B is moving and A is not, and relative to B, A is moving and B is not, and that is all that can be said. But remember that local motion is change with respect to place or location. For B to move, then, is for it to be at location L1 at one moment and at a different location L2 at the next. Now, since B is indeed moving from A's frame of reference, the locations L1 and L2 that B is at at each movement must be different locations. But since B is not moving from B's frame of reference, the locations L1 and L2 that B is at at each moment must not be different locations. So L1 and L2 are both identical and not identical. But that is absurd. (p. 213)
>
> Second, McGinn argues that the relativity of motion becomes implausible once we factor in considerations other than motion. If we are only considering only their motion, we could say either that the sun is at rest and that the earth is moving relative to the earth, or that the earth is at rest and the sun is moving relative to the earth. However, when we factor in the different masses of the sun and the earth, this is no longer the case. … The motions considered in the abstract may be symmetrical, but the causal factors are not, so that there is a fact of the matter about which is really moving relative to which. (p. 214)

A major paradigmatic shift in science has been the shift from an absolute frame of reference to a relative frame of reference. This is especially evident when one considers

the theories of relativity. Depending on the frame of reference, an object can be considered to be in motion, or be stationary. Superficially, we take the Earth to be stationary when calculating motion on Earth, although we understand the Earth to be in motion around the Sun. But relative frames of reference mean more than considering something to be a stationary point of reference. It means that the frame of reference can be swapped such that if one object X is seen as stationary, the other, Y, is seen as in motion. But if Y is seen as stationary, then X is seen to be in motion. Therefore, the very concept of "motion" is relative. It is here that Feser, moving on to deal with particular scientific issues, cites McGinn's argument and disputes this common scientific understanding of motion.

McGinn's argument seems valid enough. If B is seen as moving, which is true from A's perspective, it moves from point L1 to point L2. However, if B is seen as stationary (B's perspective) and A is moving, then surely B is at point L1 and remains at point L1, never moving to point L2. Such an argument however misunderstands how relative frames of reference works. In relative frames of reference, there is no such thing as absolute points of space, and it is this error that McGinn commits.

To perceive the nature of the error, let us place a marker at point L1 and a marker at point L2, and name them M1 and M2 respectively. In A's frame of reference, B is moving towards A and it moves from L1 to L2. Thus, B would have moved past M1 and M2, as M1 and M2 are both stationary in A's frame of reference. Consider however what would be the case in B's frame of reference. If B is considered stationary, then A is moving towards B. The markers M1 and M2 would also move towards B, since they are in the same situation as A. Since M1 and M2 supposedly mark L1 and L2 respectively, then it could be said that L1 and L2 move towards B. In other words, in B's point of reference, to the extent that points L1 and L2 are supposed to be points in space, they "move" towards B if B is taken to be the frame of reference. This is seen in the diagram (Figure 1) below:

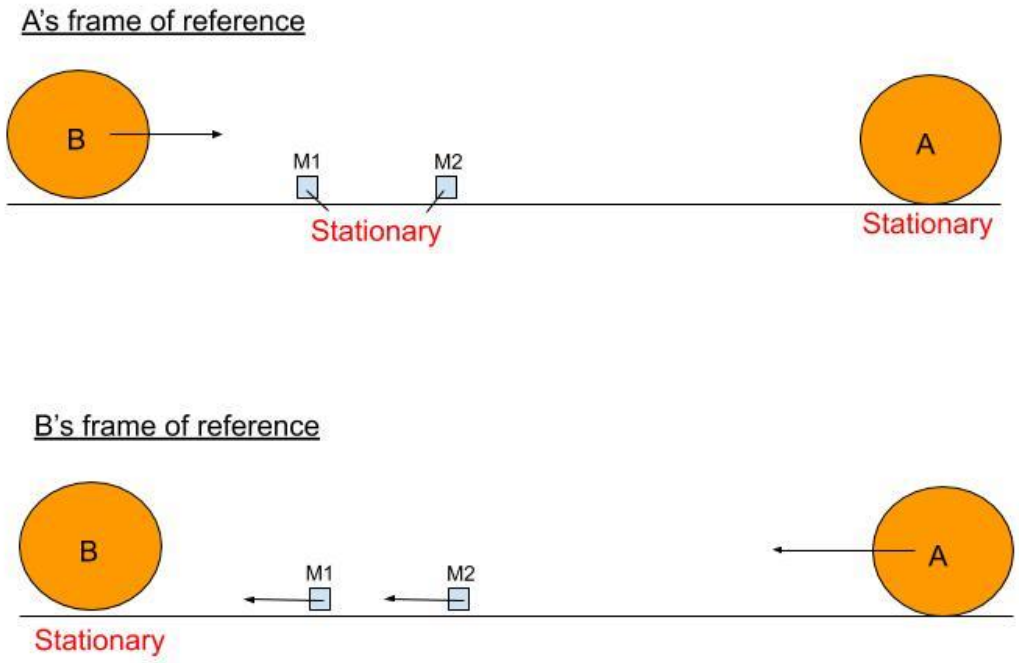

Figure 1: Relative frames of motion

McGinn's error therefore is in assuming that L1 and L2 mean anything at all in relative frames of motion. The entire concept of frames of reference is precisely to assert that just as there is no such thing as a fixed frame to consider motion, so there is no fixed frame to consider location. L1 and L2 only make sense in A's frame of reference, not in B's.

Feser's next paragraph deals with gravitational rotation, which is the realm of the general theory of relativity. From my albeit rather limited of the topic, it is false to assert that rotation of the earth around the sun disproves relative frames of motion. First of all, the earth does not technically revolve around the sun. Rather, it revolves around the center of gravity of the entire solar system. The sun "wobbles" so to speak since it makes up most but not all of the mass of the solar system. This shows that it is not the sun as an object that is considered stationary, but rather motion under the force of gravity follows the curvature of space-time. Since space-time curvature is asymmetrical in the case of the solar system, so we do say that the earth revolves around the sun and not the other way around.

Relative frames of motion are apparent however when the space-time curvature is symmetrical, as in the case of a binary star system with stars of equal masses. In this case, it is true that star C revolves around star D, and star D revolves around star C, and

also that both stars revolve around their common center of gravity, as seen in the figure (Figure 2) below:

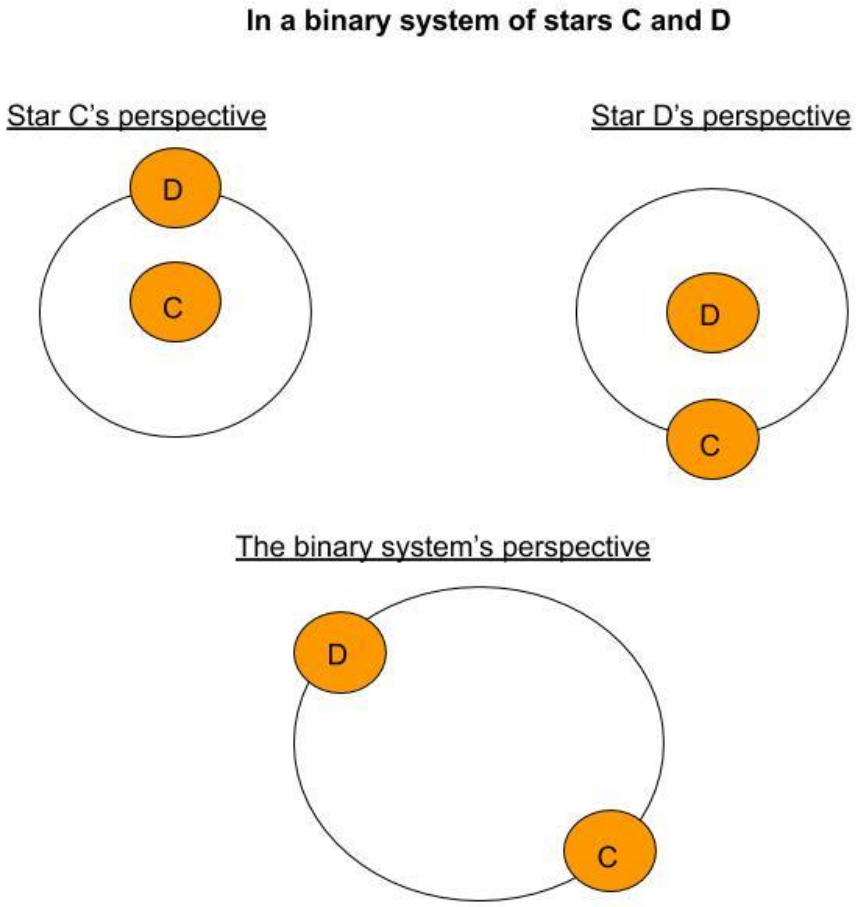

Figure 2: Relative stellar perspectives

As it can be seen, where space-time curvature is symmetrical, relative frames of motion are present. The fact that the earth revolves around the sun, and not the sun revolves around the earth, is due to the asymmetrical nature of the space-time curvature caused by the sun, and therefore this example is not a valid one in disproving relative frames of motion.

Having examined the arguments put forward by McGinn and repeated by Feser, it is evident that their arguments against relative frames of reference betrays an ignorance of the science involved. While one can legitimately ask whether an absolute point of reference with regards to space, motion, or even time is or should be present, it is fallacious to claim that relative frames of references make no sense and are self-contradictory. They are certainly counter-intuitive, but self-contradictory nonsense they are not.

Philosophical issue – Time and tenselessness

> In any event, the new tenseless theory concedes that the old theory fails, but denies that this gives any support to the A-theory. According to the new theory, though the meaning of a tensed sentence is not captured by a tenseless sentence, its truth conditions are nevertheless captured by the latter. (p. 241)
>
> However, this approach too faces grave problems (Craig 200a, Chapter 3; Craig 2001, pp. 119-29). One such problem is logical. Supposed that Bob and Fred each utter a token or instance of the sentence “Socrates drank hemlock.” Let’s label Bob’s utterance of the sentence B, and Fred’s utterance of the sentence F. According to the new tenseless theory, B is logically equivalent to the sentence “Socrates is drinking hemlock earlier than B,” which gives B’s truth conditions. Similarly, F is logically equivalent to the sentence “Socrates is drinking hemlock earlier than F,” which gives G’s truth conditions. Now, B and F are also logically equivalent to each other. In other words, what Bob says when he says “Socrates drank hemlock” is true if and only if what Fred says when he says “Socrates drank hemlock” is also true. So, the sentences “Socrates is drinking hemlock earlier than B” and “Socrates is drinking hemlock earlier than F,” since they are logically equivalent to B and F respectively, should be logically equivalent to each other as well. However, they are not logically equivalent, because it could have turned out that Bob uttered his sentence while Fred did not, or vice versa. So, the new tenseless theory’s analysis fails. (p. 241)

Feser next moves on to the issue of time. There are a lot of philosophical issues with time however, even more so than scientific issues, so they need to be addressed before the science is dealt with.

The "new tenseless theory" propped up by B-theorists in the philosophy of time asserts that the truth conditions of a converted tenseless sentence if equivalent to the truth conditions of a "normal" tensed sentence. Feser, as an advocate for a traditional understanding of time (A--theory presentism), rejects that tensed sentences can be so converted into tenseless sentences. (I am not taking a stand on A- or B-theories of time, but just to note whether Feser has proven his case.)

With regards to the "new tenseless theory," Feser asserts that if the same sentence ("Socrates drank hemlock") is said separately by Bod and Fred, their two utterances if converted into tenseless sentences would not have the same truth conditions and therefore are not equivalent to each other, thus the new tenseless theory is false. However, did Feser adequately present that theory? It does not seem to me to be the case. Feser converted Bob's utterance to "Socrates is drinking hemlock earlier than B," where "B" is the act of utterance. However, is that the correct way to render Bob's utterance into a tenseless sentence? I would suggest not.

When Bob utters "Socrates drank hemlock," he was stating that, from his vantage point at his time and space, Socrates' act of drinking hemlock was in the past. The sentence

"Socrates is drinking hemlock earlier than B" however suggests something different, in that Bob was being self-reflective in his thought and uttered something like "Socrates drank hemlock earlier than this utterance of mine." In other words, the problem with Feser's argument against the "new tenseless theory" is that he did not properly render the utterance tenseless. Rather, the proper tenseless rendering of Bob's utterance is "Socrates is drinking Hemlock earlier than December 1st, 1999," assuming Bob had uttered that sentence in the date of December 1st, 1999.

Such a way of rendering propositions tenseless would render Feser's argument moot. Whether it is adequate to render tensed sentences into tenseless sentences is a separate question which I am still mulling over, but at least on this point, Feser's argument against tenseless sentences is singularly unconvincing.

> A second problem is that the theory cannot account for sentences of which there are no tokens or instances. Consider a sentence like “There are now no tokens or instance of any sentences,” which could be true at a time when no one happens to be uttering any sentences. The new tenseless theory entails that the truth condition for this sentence would be that it is uttered at a time when there are no tokens or instance of any sentences. But of course, it never could be uttered when there are no tokens or instances of any sentences (since for someone to utter it would just be to produce a token or instance of a sentence). The new tenseless theory thus implies that the sentence could never be true. Thus, since the sentence could in fact be true, the theory is false. (pp. 241-242)

Feser’s second argument is to address the issue of self-referential statements. The rendering of tensed sentences into tenseless sentences is not necessarily easy. This is especially the case when the sentence can be rendered into a self-contradiction. This sentence "there are now no tokens or instances of any sentences" when uttered contradicts itself, as it refers to a set that includes itself. However, if it is not uttered, the sentence could be correct. Feser utilizes this interesting feature to discount the view that tensed sentences can always be rendered into tenseless sentences.

In such a scenario, the question must first be asked whether and in what situations such a sentence could be true. This particular sentence is true when no one is uttering any sentences, including this sentence. In other words, the only time this sentence could be said to be true is when it is not uttered. Therefore, if the sentence is to be translated into a tenseless statement, the scenario itself must be translated for it to make sense.

It is rather surprising that Feser did not seem to attempt a translation of the sentence unlike his previous example, so let me offer a translation here for this sentence. The offered translation is this:

> "There is at time *t* (e.g. 8am, December 1st 1999) no tokens or instances of any sentences, with this sentence at time *u*."

This translation after all is the sense of the sentence in tensed form, and therefore the tenseless form would be rendered thus.

Whether tenseless sentences are basic for one's philosophy of time, it seems rather apparent that the language of tenses should not be an issue, contra Feser. If there are problems with one's view of time, the realities of tenses (of which some languages do not have any) do not seem to be helpful in resolving the discussion.

Philosophical issue – On the spatialization of time: Events in space and time

> Events always also stay the same distance apart in space. An object located at a certain region of space exclusively occupies that region. Two physical objects cannot be in the same place at once. By contrast, an event located at a certain point in time is not the exclusive occupant of that point in time. Many events are occurring at any particular moment. (p. 275)

Moving on, are events in space analogous to events in time? Feser does not think so. For him, while two physical objects cannot be in the same place at once, many events are occurring at any particular moment. However, here again Feser does not adequately represent the issue, as I will show.

When we mention that two physical objects cannot occupy the same place at the same time, it is evidently clear that there are two factors in play - "not same place," and "not same time." Two objects can occupy the same place at different times, or they can occupy two different places at the same time. Likewise, if we move forward with the analogy, two events cannot be occurring at the same time at the same place. Two events can occur at the same time but different places, or they can occur at two different times at the same place. Notice that I have just swapped the "place" and "time" in the sentences to show that events in time are analogous to events in space, contra Feser's assertion to the contrary.

When Feser said that "many events are occurring at any particular moment," that is true but it is not the whole picture. If two objects cannot be in the same place **at once**, then we must add the same qualifier analogously and then we will note that it is false that "many events are occurring at any particular moment" **at the same place**. Feser's objection only works if the analogy is not played out in full, for once it is played out, the analogy between space and time does work.

Philosophical issue – On the “spatialization” of time: Geometry and the Cartesian plane

> A second problem is that there are serious questions about how coherent is the description of space and its occupants that results when we conflate physical space with geometry, and geometry in turn with a system of numbers. Neither points (since they lack any extension at all), nor lines (since they lack width and depth), nor planes (since they lack depth), can be said to *occupy* space. (p. 278)

Feser errs in his understanding of Cartesian geometry. No, these terms do not occupy space. By definition, they **constitute** space.

Philosophical issue – On the "spatialization" of time: Abstraction and mathematization

> All these puzzles disappear when we realize that the mathematics just is an abstraction rather than anything concrete. In particular, it is *abstracted from* a concrete physical reality whose nature outruns anything captured by the mathematics, rather than being exhaustively *constitutive* of concrete physical reality. (p. 279)

> The idea of space as a kind of receptable or container can be elucidated by noting what it rules out, such as the views of Descartes and Leibniz (Cf. Bittle 1941, p. 152). If space is what *contains* extended physical substance, then (contra Descartes) it cannot be identified with extended physical substance *itself*. Space qua container can either be filled or empty in a way a physical substance itself cannot be. (p. 199)

Is space and time merely mathematics? It would seem rather reductionistic to reduce things to mathematical formulae. But the problem is that this question is not actually important for whether time can be considered space-like with coordinates in space-time. For some reason, Feser seems to think that the opposing view reduces everything to mathematics. Generally for most people with some version of a scientific worldview, that reductionistic approach is not taken. Rather, if the mathematics are true, then what we are saying is that the nature of space-time must reflect the mathematics we have found that describe reality.

It is this view of reality, rather than Feser's reductive caricature, that informs scientific worldviews of reality. We do not spatialize time just because the math demands it, but rather because the math reflects the nature of reality. If reality does not spatialize time, then the math will not reflect it.

This is not to say that we must necessarily take 'time' to be just another spatial dimension, but rather that arguments against seeing 'time' as being different from 'space' cannot be argued from the fact that 'time' is 'space-like.' Whatever time is, it is space-like. It may have many dissimilarities to 'space,' but that is another argument altogether.

The reason why Feser thinks current understanding of space is insufficient is because he defines "space" in an Aristotelian manner. This is not however how "space" is defined scientifically, which is why there is nothing wrong with the spatialization of time.

Philosophical issue – On the "spatialization" of time: Definition of time, as spatial dimension?

> This suggest a further argument against any attempt to spatialize time, which is that it can never be completely carried through. Again, time is the measure of change within space. If we think if space as three-dimensional, then time is the measure of change within three-dimensional space, but if instead we say that what common sense conceive of as time is "really" just a fourth spatial dimension, then what this implies – again, for all the defender of the spatialization of time has shown – is that time ought really to be thought of as the measure of change within *four*-dimensional space. If the defender of the spatialization of time now claims that time so understood is really just a *fifth* spatial dimension, then the response will be that in that case time turns out to be the measure of change in *five*-dimensional space. And so on *ad-infinitum*. (p. 290)

We last move on to the definition of time. According to Aristotelianism it seems, time is defined as the "measure of change within space." Using this definition, Feser argued that time cannot be taken as another dimension like space. However, is that truly an acceptable definition of time?

This definition of time implies that change must happen when time progresses. In other words, if there is an instance in which change does not occur, then time cannot be said to have occurred. This is problematic on many levels. First of all, there are many examples in which change does not occur even though it cannot be said that time has not passed. Hydrogen atoms in the inter-galatic medium are perhaps the best example of something that will not be undergoing any changes for the next few hundred years (unless Christ comes again, but that is a different thing altogether). Most atoms will not undergo any form of nuclear reaction so they would be considered "timeless" as well according to this definition. Bacteria locked in ice are also "timeless" during their "time" frozen in ice, as they do not change. All such examples should be sufficient to show that time can pass without any change happening. Therefore, the Aristotelian definition of time is falsified.

Feser is also in error in understanding what "spatialization" of time in the context of modern science actually mean. It does not mean time becomes another spatial dimension (although some may give that impression). It just means that time is analogous to space in the sense of its quantifiability and ability to be manipulated (time dilation and gravitational dilation). It does not mean that time is a spatial dimension in an eternalist 4-dimensional block that we (3-dimensional beings) perceive as time. Rather, time is qualitatively different from space. It is theoretically possible that we might discover infinite

dimensions of space, yet time is still the (א +1) dimension, a separate dimension from all other spatial dimensions.

As such, it seems that there is no reason why time cannot be seen to be analogous to space. While we currently know of only one temporal dimension, there is theoretically no reason why there cannot be more than one temporal dimension either. Feser's and the Neo-Aristotelian argument on the nature of time is flawed and based upon an errant understanding of the world, and thus should be rejected, whether it is seen in philosophy, or in theology (Classical theism).

Scientific issue – Time, time dilation and the Aristotelian view of time

> In particular, that spacetime appears curved could be interpreted as evidence that it really is curved, but it could also be interpreted instead as evidence that some force is affecting our measuring devices (Kosso 1998, pp. 102-3; Rickles 2016, pp. 83-90; Sklar 1992, pp. 53-69). (p. 305)

After going through the philosophical issues concerning time, we return to the scientific issues. Here, it is really astonishing where one can end up with an *a priori* system in place. It seems that Feser thinks it is a plausible interpretation of the special theory of relativity that time dilation does not exist. Rather, in Feser's interpretation, the measurement of time is dilated, but time itself is perfectly fine. Given how everything in the material world including the human body runs on physical and chemical and biological processes that proceed in time, what Feser is advocating for here is a split between the clock and processes in time. But since the clock keeps time through mechanical or other processes (e.g. computer chip), how is that supposed to work out?

Feser's proposed interpretation is therefore unscientific. It fails to notice how the human body itself depends on the flow of time to function. The moving of muscles, the transmission of nerve signals — all of these depend on physiological processes that are similar to how clocks keep time. It is simply inconceivable that something that affects "our measuring devices" will not affect us also. If something affects "our measuring devices," then it will affect our perception and engagement with time as well. Electrical impulses will travel slower if time is slowed and so on, and one does not have to be a materialist to hold that to be true.

Conclusion

In this review, we have looked and critiqued many of Feser’s arguments. Feser’s book suffers from the major flaw in affirming the consequent, arguing that science must be understood to presuppose Aristotelianism because Aristotelian categories in science can be seen by an Aristotelian. For properly basic beliefs, what is necessary is to compare

and contrast two or more systems as to their explanatory powers and correspondence to reality. Feser has however failed to do that, instead focusing his arguments on showing how science must be understood according to Aristotelianism for someone *already* committed to Aristotelianism.

When one looks at the specific arguments, Feser's arguments are unimpressive. Feser does not seem to understand science and the workings of science, showing major errors in scientific understanding. Feser is indeed conversant with the philosophical discussions in play, but fail to see how science does in fact invalidate certain philosophical positions and how his particular brand of Neo-Aristotelianism in particular undermines the scientific enterprise, and not just the supposed "mechanism" and "atomism" that is the foil to his main argument.

In conclusion, while Feser has in fact written a great apology for Aristotelianism for the modern world, Feser has failed to actually prove the necessity of Aristotelianism in science or indeed anywhere else. Far from the revenge of Aristotle, what we see are the quivering spasms of Aristotle's corpse.