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The Evolution of Natural Cause:
A journey from Aristotle to Newton

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Aristotle was interested in making sense of natural objects themselves through taxonomy and philosophy; Newton was focused on investigating the behavior and interactions of natural objects in the physical world by the means of experimental philosophy.

In his own words, the restrictions that Newton utilizes are embodied in his Rules of Reasoning in Philosophy, found in the Principia.

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There is a clear distinction between the goals of Aristotle and Newton's investigations into the universe.

It was necessary for Newton to build upon Aristotelian nature, by narrowing the scope of the Four Causes, in order to examine a world where it was possible to experimentally determine how nature behaves. Aristotelian nature concerns itself with funneling the universe into a taxonomic structure capable of exhaustively explaining all 'Why ?'s that may arise in the study of nature. Aristotle uses his Four Causes as a tool of inquiry to expose the history, actions, and nature of things while answering the aforementioned question. Though many state that Newton openly rejected Aristotelian thought, a filtered sample of Aristotle's Causes can be found in Newton's *Philosophiæ Naturalis Principia Mathematica*, in the context of Newton's Rules of Reasoning in Philosophy. Newton's Principia laid the foundation for experimental philosophy, the scientific method, and modern physics by examining mechanical interactions in the physical world through the obscured eyes of Aristotle.

Aristotle's Four Causes are dependent on his taxonomy of nature, so an understanding of the taxonomic structure in Aristotle's Physics is necessary to examine the path between Aristotelian and Newtonian nature. At the top, there is a division between things that exist by nature (physis) and things that are products of art (techne), or man-made things. The distinction between the two arises from their origins, but also from the way in which they behave over time and space. Things of nature have innate principles of motion (kinesis) and rest (stasis) by which their state inherently evolves over time (metabole). Techne lacks this metabole; however, it is clear that techne still has kinesis and stasis from simple observation of the behaviors of man-made objects. The kinesis and stasis that is observed in techne can be attributed to the substances of which the techne is composed, assuming that all techne can be decomposed into some set of natural materials (prote hyle). Thus, the prote hyle (material substrate) brought about by the same sort of decomposition of any thing can be seen as the

essence or nature of that thing. Though, one can imagine applying the aforementioned decomposition to natural materials, dividing them down to further isolate the essence (ousia qua substance) of natural materials. If executed exhaustively, this decomposition would boil down to the few kernels of natural essence (atomos) that compose the universe; the form of the universe would then be attributed to the state and arrangement of conglomerations of these atomos. Further, the behavior of the universe could then be attributed to the superposition of the nature and arrangement of atomos in space and time. Or, as Carl Sagan puts it, “The beauty of a living thing is not the atoms that go into it, but the way those atoms are put together.” [Cosmos: A Personal Voyage, Episode 5 (1990)] Thus, nature may also be identified in the form (eidos) or temporal form (morphe) of a thing. This can be found in the first chapter of Physics, “This then is one account of 'nature', namely that it is the material substratum persisting through changes in things which evidence a principle of motion or change. But another account is that 'nature' is identified with the eidos of something, with its morphe by definition.”

From the identifiers of nature, Aristotle was able to construct a method for determining the cause of an object: the Four Causes. Of the three identifiers – hyle (matter), eidos (form, logos), and morphe (teleological shape), the latter two have a metabole. By definition, eidos and morphe rely on kinesis and stasis to exhibit themselves. So, kinesis and stasis must also be taken into account when examining the causes of natural things. [It is important to recognize that Aristotelian kinesis encompasses change in three facets: quantity, quality, and space.] The construction of the Four Causes from here seems purely logical; each cause is attributed to each identifier with the addition of kinesis. Aristotle's Four Causes are: The material cause, concerning the natural substances of which a thing is composed (hyle); the formal cause, concerning the essence of the form of which a thing has (eidos); the efficient

cause, concerning the external influence on the kinesis of an object; and the final cause, concerning the purpose for which a thing exists (morphe). From chapter 3 of Aristotle's Physics, “All the causes now mentioned call into four familiar divisions. The letters are the causes of syllables... the parts causes of the whole... , in the sense of 'that from which' (*hyle*). In each of these pairs, the initial item is a cause in the sense of substratum, the other item in the sense of the essential character – the whole, or combination or form (*eidōs*). Just so, the seed and the doctor and the advisor, and generally the maker, are all propelling factors originating from change or cessation (*kinesis*) and finally there are causes in the sense of the end or the good which things tend to; for 'that for the sake of which' (morphe)... “. The Four Causes provided Aristotle with a way to determine why natural objects exist and behave in the ways that they do.

Aristotle was interested in making sense of natural objects themselves through taxonomy and philosophy; Newton was focused on investigating the behavior and interactions of natural objects in the physical world by the means of experimental philosophy. In utilizing experimental philosophy, Newton restricts his view of the universe to one that concerns hypotheses and observations obtained through physical experiment and induction. This restriction promotes the search for simple yet wholly true causes, allows for abstraction and generalization of those causes, and removes the need to refute hypotheses generated by thought experiment or imagination.

In his own words, the restrictions that Newton utilizes are embodied in his Rules of Reasoning in Philosophy, found in the Principia. The first rule narrows the space of possible causes for natural things by establishing an ever-rising lower bound on the simplicity and accuracy of the accepted cause, “We are to admit no more causes of natural things than such as are both true and sufficient to explain their appearances.” The second rule reduces the space of

individual phenomenon by grouping similar natural phenomenon and assigning the group one cause, “Therefore to the same natural effects we must, as far as possible, assign the same causes.” The third reduces the space of individual bodies by grouping bodies with similar properties and behaviors together, “The qualities of Bodies, which admit neither intensification nor remission of degrees, and which are found to belong to all bodies within the reach of our experiments, are to be esteemed the universal qualities of all bodies whatsoever.” Lastly, the fourth rule lays the groundwork for experimental philosophy and removes the need to refute hypotheses with no experimental standing, “In experimental philosophy we are to look upon the propositions inferred by general induction from phenomena as accurately or very nearly true, notwithstanding any contrary hypotheses that may be imagined till such time as other phenomena occur by which they may either be made more accurate or liable to exception.” To show that Newton still utilized Aristotelian Causality, proof that Aristotle's Four Causes still has meaning through this 'Newtonian lens' is required.

The Newtonian lens shifts the definitions of *eidos* and *morphe* into the purely physical realm by invoking the Rules of Reasoning. The meanings of *hyle* and *kinesis* in a Newtonian context remain as they were in Aristotle's Physics; simply put, *hyle* and *kinesis* are already purely physical. *Eidos* is reinterpreted as the purely physical form of an object, neglecting the notion that the form of an object is related to its intended function or ideological identity. Rules one and three provide reason to drop the excess classification involved with Aristotle's *eidos*: to simplify the causes of natural effects. *Morphe* loses its teleological sense entirely, as notions like *telos* only complicate the analysis of bodies in the physical world. Though, *morphe* in the sense of dynamics in *eidos* is still present in the Newtonian world.

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investigations into the universe. Newton's propensity to create vast generalizations (ie. laws) across large magnitudes of bodies in the universe, rather than generating informative structures around particular bodies, exemplifies the fundamental difference between the Aristotelian and Newtonian viewpoints. It was this fundamental difference that allowed Newton to create useful models of bodies in the universe and led him to Newtonian Mechanics. However, Newton still utilized Aristotelian causality in the form of the essence of the Four Causes: hyle, eidos, kinesis, and morphe.