Philosophy, mathematics, and modern physics - a dialogue

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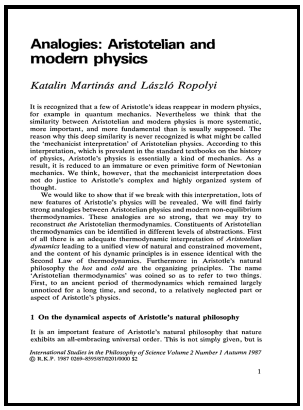

Analogies: Aristotelian and modern physics

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It is recognized that a few of Aristotle's ideas reappear in modern physics, for example in quantum mechanics. Nevertheless we think that the similarity between Aristotelian and modern physics is more systematic, more important, and more fundamental than is usually supposed. The reason why this deep similarity is never recognized is what might be called the 'mechanicist interpretation' of Aristotelian physics. According to this interpretation, which is prevalent in the standard textbooks on the history of physics, Aristotle's physics is essentially a kind of mechanics. As a result, it is reduced to an immature or even primitive form of Newtonian mechanics. We think, however, that the mechanicist interpretation does not do justice to Aristotle's complex and highly organized system of thought.

We would like to show that if we break with this interpretation, lots of new features of Aristotle's physics will be revealed. We will find fairly strong analogies between Aristotelian physics and modern non-equilibrium thermodynamics. These analogies are so strong, that we may try to reconstruct *the* Aristotelian thermodynamics. Constituents of Aristotelian thermodynamics can be identified in different levels of abstractions. First of all there is an adequate thermodynamic interpretation of *Aristotelian dynamics* leading to a unified view of natural and constrained movement, and the content of his dynamic principles is in essence identical with the Second Law of thermodynamics. Furthermore in Aristotle's natural philosophy the *hot* and *cold* are the organizing principles. The name 'Aristotelian thermodynamics' was coined so as to refer to two things. First, to an ancient period of thermodynamics which remained largely unnoticed for a long time, and second, to a relatively neglected part or aspect of Aristotle's physics.

1 On the dynamical aspects of Aristotle's natural philosophy

It is an important feature of Aristotle's natural philosophy that nature exhibits an all-embracing universal order. This is not simply given, but is

International Studies in the Philosophy of Science Volume 2 Number 1 Autumn 1987
© R.K.P. 1987 0269-8595/87/020100 $2

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Description: -
-
Mathematical physics.
Cosmology.
Physics -- Philosophy.Philosophy, mathematics, and modern physics
- a dialogue
-Philosophy, mathematics, and modern physics - a dialogue
Notes: Includes bibliographical references.
This edition was published in 1994

Filesize: 12.15 MB

Tags: #Copenhagen #Interpretation #of #Quantum #Mechanics #(Stanford #Encyclopedia #of #Philosophy)

Stoicism

He never completed this degree, but instead studied mathematics, notably with Ostilio Ricci, a mathematics teacher attached to the Tuscan court and the Florentine Accademia del Disegno. And there simply do not seem to be any other theories in the offing. For after all, they will insist, there has to be some reason, some explanation, why the world is as it is and is not some other way.

Plato

Camilleri 2017 calls Bohr the philosopher of experiment.

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In mathematical physics—a discipline he helped create—he calculated the law of free fall, conceived of an inertial principle, determined the parabolic trajectory of projectiles, and advocated the relativity of motion. For Galileo, by contrast, Copernicanism was also a commitment to a physically realizable cosmography. In an intellectualist recidivist mode, this entry will outline his investigations in physics and astronomy and exhibit, in a new way, how these all cohered in a unified inquiry.

Natural philosophy

After leaving university, Galileo worked as a private mathematics tutor around Florence and Siena and cultivated the support of leading mathematicians.

Modern philosophy

What he failed to work out—and this was probably the reason why he never published De Motu—was this positive characterization of heaviness. This is possible only if the subject uses causal and spatial-temporal concepts for describing the sensorial content, placing phenomena in causal connection in space and time, since it is the causal space-time description of our perceptions that constitutes the criterion of reality for them. Due to

these principles it is possible within, say, classical mechanics, to define a state of a system at any later time with respect to a state at any earlier time.

Modern philosophy

According to Medley 2003 , this pattern is simply a reflection of the dominant cultural dynamics of the time, affected as they were by the conquests of Alexander.

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