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Kernel

Hegel holds that forces, energies, and other highly abstract concepts of physics, if used for a unification of natural laws without the guidance of philosophy, accidentally render science a new variety of metaphysics.

— Posch 2004 p. 14

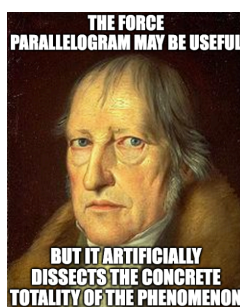


Figure 1: Meme

Parallelogram Law of Vector Addition

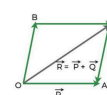


Figure 2: Dissecting the concrete totality of the planetary motion

Dramatis Personae

- Newton (1643-1727)
- Hegel (1770-1831)
- Kepler
- Galileo
- Goethe
- Kant
- Petry

¹Thomas Posch, „Hegel's Criticism of Newton's Physics: A Reconsideration“, 2004.

Glossary

Terms as used in this paper

“sense of nature” “a method of contemplating nature which conserves natural phenomena as totalities instead of decomposing them into parts which are then made sort of atoms of the phenomena” (p. 4). It is a synthetic way of grasping the essence of the phenomenon.

Unified dynamical laws (UDL) Refer to abstract concepts and unify various “realms” of phenomena. According to Hegel, it is more than just the application of mathematics to physics, and encourages reductionism, which is harmful to philosophy. Hegel observed that “Newton set the laws of forces in the place of the laws of phenomena” (p. 11). UDLs depend on boundary conditions.

phenomenological Law (PL) The Kepler-Galileo type. They refer to *classes* of phenomena. Less fundamental than dynamical laws (though not according to Hegel).

The scientists’ task, according to Hegel the formulation of PLs.

The relation between maths and physics

the mechanistic worldview Hegel considers this harmful to philosophy. “It is one of the basic features of the mechanistic worldview to be based upon an immediate (i.e unreflected) application of mathematics to scientific inquiry”

“theories of everything”

self-determination of the Notion some Hegelian concept:

Hegel’s philosophy of Nature

unified dynamical laws

reductionism “putting everything on the same level” (p. 10). The mechanistic worldview is an example thereof.

Realms of reality in Hegel’s metaphysics, there are “primitive” realms and “higher” realms. A.k.a ‘ontological hierarchies’.

Kant’s critique of traditional metaphysics (p. 10)²

“mathesim excolere, quatenus ea ad philosophiam spectat” to cultivate mathematics, insofar as it pertains to philosophy

Hegel’s dialectical method / conception of nature allows one to *prove* the laws of motion of natural bodies (p. 8)

moments (Hegel)

Galileo’s Law (p. 11)

“The encyclopaedic system” (p. 9)

Hegel’s distinction between “the empirical” and “the Notion”

post-scholastic (p. 1)

Outline

- we attempt a non-Hegelian rephrasing of Hegel’s criticisms of Newton
- is Hegel’s anti-Newtonian philosophy of nature a *rational and self consistent* theory?

²What is this?

I. Hegel's Sense of Nature (Some basic features of H's criticism of Newton)

- Hegel thought Newton treated analysis adequately from a philosophical point of view.
- Newtonianism spread much quicker through England and France than Germany.³
- Hegel's ambition was not just to be a better philosopher but, overshooting the mark, he also tries to be a smarter physicist than Newton, and this doesn't help his case.
- Although he does get his criticism of centrifugal force right
- Sense of Nature.

II. Hegel and Newton differ on the relation between mathematics and physics.

Ila Newton (pp. 5-6)

- replace aristotelian ontology, but add a new one.
- Petry emphasized that Newton was not aware of the metaphysical contents of the Principia
- Newton does not *adequately reflect* on the role of mathematics in physics.

Ilb. Hegel (pp. 6-9)

- Hegel believed physical theorems cannot be *proved* mathematically. Hegel warns against assigning any ontological value to mathematical concepts like vector components.

III. Why Hegel Hated Dynamical Laws (The metaphysical background of Hegel's views of the relation between mathematics and physics) (pp. 9-14)

- Hegel's *anti-reductionism* helps us understand why he believes we cannot prove theorems of physics mathematically. (although we *can* prove them using his dialectical method, apparently)
- Hegel believes Newton unintentionally favours reductionism by his view on the relationship between physics and mathematics.
- Hegel believes the introduction of UDLs to be **semi-philosophy**; the way UDLs unify different realms of phenomena appears to Hegel dangerously mechanistic.
- Hegel does not like abstract concepts in UDLs like gravity, entropy, probability, etc.
- Reconstruction: How would Hegel view *energy*?
 - Equating different kinds of energy overlooks qualitative differences between different kinds of energy⁴

IV. Conclusion (p. 14-16)

Hegel philosophises about individual theorems; one must philosophise about entire scientific theories⁵

Assumptions

- Newton did not speak of dynamical laws, differential equations, or boundary conditions. But the core concepts he used are equivalent

Comments

- For Hegel, using *time* in mathematics renders it *impure*. Indeed, Newton's calculus is fundamentally time-based. Either Newton struggled with this and tried to remove time from his calculus, or he viewed time as fundamental to mathematical structure. Not sure which is true.
- Hegel refuses to accept *the introduction of dynamical laws* as a progress of science (p. 12).
- Unreflected use of mathematics in physics is likely to favour the mechanistic worldview (p. 10)

³compare Hegel's reticence with Hume's excitement despite him living a half century earlier

⁴V.E: Perhaps it posits an "identity" where "transformation" would be more apt? But also, engineers would agree that we should not overlook qualitative differences between different kinds of energy, these differences are encapsulated in things like quality (entropy)

⁵How does he do this? Why is it bad?

- Hegel believes theorems of physics cannot be proved mathematically (p. 9)
- Hegel distinguishes between *laws*⁶ and *dynamical laws*⁷.
- Hegel criticised a certain “type of law” introduced by Newton.
- Hegel believes that *the qualitative differences within the realm of nature* refute the Newtonian quest for unified dynamical laws. (p. 15)

Questions

Q. So Posch is not asking whether Newton’s theory is self-consistent and rational, he is asking whether Hegel’s anti-Newtonian philosophy of nature is rational and self-consistent? Is that correct? (p. 1)

Q. Is there a contradiction in Hegel’s opposition to the parallelogram of forces? It is forces that are dissected, not the motion itself as implied on p.4. But Hegel *also* disagrees with the use of abstract concepts like *force*. So he disagrees with its use, and then also disagrees with breaking it down on the grounds that it “violates the totality” of the phenomenon. This seems to me, like casual reasoning. In one context he considers the *force* a bad, abstract concept, and in another context he considers the *force* to be a phenomenon whose ‘totality’ must be protected.

Q. In what sense are “space and time” “moments” of particular phenomena (p. 4)?

Q. In What sense did H believe that N had adequately treated *analysis* from a philosophical point of view (p.2)?⁸ Q. What are the inconsistencies in Newton’s concept of Force (p. 1)? and Centrifugal force (p. 3) ?

Q. In what sense is Newton’s use of mathematics “direct” and unreflected? Can we think of an example of a mathematical physicist who took a more “indirect” and “reflected” use of mathematics in Physics?

Q. For Posch/Petry, what *would it have looked like* if Newton took a more “reflected” view of the role of mathematics in natural philosophy?

Q. In what sense if Newton’s view of mathematics quasi-Cartesian (p. 6)?

Q. IIb: “The physical” says Hegel “quite radically” “cannot be proved mathematically”. How radical is this, really? Surely it is equivalent to Hume’s saying that there are no necessary connections between matters of fact?⁹ Is Hegel saying something fundamentally different to Hume? If so, isn’t this a caricature of Newton’s view? Newton surely did not believe he could derive the inverse square law from pure thought alone? It seems like Hegel’s view is different from Hume, as “such proofs only prove the necessity of real proofs” (p. 7) implies that “real proofs” (necessary connections between matters of fact) really do exist for Hegel.

Q. Do vector components have ontological value?

Q. How does H. praise K and chastize N? Q. Why is the mechanistic worldview harmful to philosophy?

Q. Can we contrast Hegel’s (1770-1831) dislike for Newton’s philosophy with Hume’s (1711-1776) enthusiasm for it?

⁶How does he define these?

⁷How does he define these?

⁸Come to think of it, what did Newton believe about analysis, philosophically? Surely that time was a fundamental part of it (Fluxions and Fluents). But then, isn’t this at odds with Hegel’s belief that *pure* mathematics shouldn’t reference *time* (footnote 24)?

⁹David Hume, *An Enquiry Concerning Human Understanding* (1748), Section 4.

Q. Did Hegel view the advantage of being able to have an economy of laws (i.e unifying phenomena on the earth's surface - falling bodies - with celestial phenomena)?

Q. In what sense is gravity a “non- law” that Hegel disapproves of (p. 13)?

Q. (p.14): “In Newton's view the introduction of the concept of force helps physics to surmount the status of a scholastic doctrine”. Where / when did he express this?

A. I think something is non-phenomenological when it refers to concepts that are outside our direct experience (like Force, Energy, Momentum, etc...)

Q. Is the ostensible a priori deduction of power laws by Hegel a reference to *dimensional analysis*? (p. 13)

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