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Physics and metaphysics in Leibniz

Abstract

This paper explores the relationship between physics and metaphysics in Leibniz. It argues that, for Leibniz, this relationship has two complementary aspects. On the one hand, Leibniz conceived the mathematical and mechanical explanation of natural phenomena as an autonomous enterprise in which there is no place for metaphysical entities such as substantial forms. On the other hand, he held that a proper account of the nature of bodies must go beyond this kind of inquiry. In order to achieve a deeper understanding of the physical world, it is necessary to reach its metaphysical foundations and appeal to metaphysical principles. The crucial point is, however, that these are *meta*-physical principles. They provide the *metaphysical grounding* of physics, the *philosophical foundations* of mechanism, as opposed to being the object of physics proper or being extended to physics itself. The paper concludes that Leibniz's proposal combined the ancient, medieval, and Renaissance tradition of the unity and systematicity of knowledge with a new understanding of the autonomy of science. In so doing, it paved the way to a modern conception of natural science in a manner which is different (but, arguably, philosophically richer) than that of other great architects of modern science such as Descartes, Galileo, and Newton.

The distinction between metaphysical and physical explanations

The *Confessio naturae contra Atheistas* of 1668-69 (A VI, 1, 489).

First incipient theorization of a distinction between 'science' (taken in a modern sense) and philosophy.

The young Leibniz presents here metaphysics and the new quantitative, mechanical physics as two different kinds of explanation.

- On the one hand, he fully embraces the new mathematically based science, or (as it was still called) 'philosophy of nature', for the explanation of natural phenomena.
- On the other hand, he maintains that the new mechanical physics does not answer more fundamental questions about the ultimate principles of reality. A further level of explanation is needed in order to account properly for the features of the physical world of which we have experience. According to him, in physical notions there are implicit principles which cannot be reduced to extension and motion. There must be in bodies a principle of unity and activity.
- The metaphysical notions expressing such a principle, however, should not enter into the explanations of physics proper, since physics proper is only concerned with the mathematical treatment of natural phenomena which can and should be explained mechanically.

This position about the relationship between physics and metaphysics remains constant throughout Leibniz's ensuing intellectual career.

In sum, Leibniz's insight is twofold.

- On the one hand, the mathematical and mechanical explanation of natural phenomena is an autonomous enterprise. In such explanations, there is no place for substantial forms.
- Yet, on the other hand, our understanding of bodies, or, more precisely, our understanding of their nature, is not exhausted by this kind of inquiry. On the contrary, in order to achieve a deeper understanding of the physical world, it is necessary to reach its metaphysical foundations and appeal to metaphysical principles.

The crucial point is, however, that these are *meta*-physical principles. They provide the *metaphysical grounding* of physics, the *philosophical foundations* of mechanism, as opposed to being the object of physics proper or being extended to physics itself.

Later texts

Objections

1. Leibniz's principle of equivalence between full cause and entire effect.
2. Leibniz's defence of the use of final causes in physics.
3. Life sciences as part of natural philosophy / the centrality of the notion of organism.
4. Leibniz's theory of derivative forces.

Reply: a one-world view

Leibniz holds a one-world (as opposed to a two-world) view. The phenomena studied by physics (or the sensible, extended bodies studied by biology) express what is ultimately real. Physics and metaphysics are about what is, *ultimately*, the same reality.

A comparison with Galileo, Newton, and Descartes

Galileo and Newton do not worry about providing metaphysical roots.

Leibniz agrees with Descartes on the need for metaphysical roots of physics.

However:

- for Descartes, the bodies studied by physics just *are* the (extended) *substances* of his metaphysics. There is no deeper level of the nature of bodies which physics cannot reach, or which is not its proper object of study
- for Leibniz, physics proper studies phenomena, that is, the world as it appears to us. Although phenomena are manifestations of substances, substances are not its proper object.

Conclusion

Heir of the past: the unity of *scientia* or knowledge and its systematicity / metaphysical grounding of physics.

Herald of the future: distinction between philosophy and 'science' (that is, in this case, the nascent quantitative physics or classical mechanics) as two different, autonomous enterprises.

Texts

A key early text

Confessio naturae contra Atheistas (1668-69):

through the admirable improvement of mathematics and the approaches which chemistry and anatomy have opened into the nature of things, it has become apparent that mechanical explanations – reasons from the figure and motion of bodies, as it were – can be given for most of the things which the ancients referred only to the Creator or to some kind (I know not what) of incorporeal forms. The result was that truly capable men for the first time began to try to save or to explain natural phenomena, or those which appear in bodies, without assuming God or taking him into their reasoning. Then, after their attempt had met with some little success, though **before they arrived at foundations and principles**, they proclaimed, as if rejoicing prematurely at their security, that they could find neither God nor the immortality of the soul by natural reason ... It seemed to me unworthy for our mind to be blinded in this matter by its own light, that is, by philosophy. I began therefore myself to undertake an investigation ... Setting aside all prejudices, therefore, and suspending the credit of Scripture and history, I set my mind to the anatomy of bodies, to see whether the sensory appearance of bodies can be explained without assuming an incorporeal cause. At the beginning I readily admitted that we must agree with those contemporary philosophers who have revived Democritus and Epicurus and whom Robert Boyle aptly calls corpuscular philosophers, such as Galileo, Bacon, Gassendi, Descartes, Hobbes, and Digby, that in explaining corporeal phenomena, we must not unnecessarily resort to God or to any other incorporeal thing, form, or quality ... but that so far as can be done, everything should be derived from the nature of body and its primary qualities – magnitude, figure, and motion. But what if I should demonstrate that the origin of these very primary qualities themselves cannot be found in the essence of body? Then indeed, I hope, these naturalists will admit that **body is not self-sufficient and cannot subsist without an incorporeal principle**. (A VI, 1, 489 / PPL 109)

Later texts

Discourse on Metaphysics (1686), § 10:

That there is something sound in the belief in substantial forms, but that these forms change nothing in the phenomena and must not be used to explain particular effects. Not only the ancients but also many able men given to deep meditation who taught theology and philosophy some centuries ago ... have introduced and maintained the substantial forms which are so widely discredited today. But they are not so far from the truth, or so ridiculous, as our modern philosophers commonly imagine. I agree that **the consideration of these forms serves no purpose in the detail of physics and that they ought not to be used to explain particular phenomena**. In this the Scholastics failed, as did the physicists of the past who imitated them, thinking that they could account for the properties of bodies by mentioning forms and qualities, without taking pains to examine the manner of their operation. This is as if one were content to say that a clock has a time-indicating property proceeding from its form, without inquiring wherein this property consists. ... But **this inadequate understanding and abuse of the forms ought not to make us reject something whose knowledge is so necessary**

in metaphysics that without it, I hold, we cannot well understand the first principles or raise the spirit to the knowledge of incorporeal natures and the wonders of God. ... **a physicist can give an explanation of his experiments, making use, now of simpler experiences already past, now of geometric and mechanical demonstrations, without needing the general considerations which belong to another sphere.** (PPL 308-309)

Leibniz to Arnauld (14 July 1686):

Approve as I may of the Schoolmen in this general and, if I may so put it, metaphysical explanation of theirs of the principles of bodies [through substantial forms], **I still subscribe fully to the corpuscular theory in the explanation of particular phenomena; in this sphere it is of no value to speak of forms or qualities. Nature must always be explained mathematically and mechanically, provided it is remembered that the very principles or laws of mechanism or of force do not depend on mathematical extension alone, but on certain metaphysical reasons.** (PW 63)

A New System of the Nature and the Communication of Substances (1695):

I had gone far into the country of the scholastics, when mathematics and modern authors drew me out again, while I was still quite young. Their beautiful way of explaining nature mechanically charmed me, and I rightly scorned the method of those who make use only of forms and faculties, from which we learn nothing. But afterwards, having tried to go more deeply into the principles of mechanics themselves in order to explain the laws of nature which are known through experience, **I realized that the consideration of mere *extended mass* is insufficient ... So it was necessary to recall and, as it were, to rehabilitate *substantial forms*, which are so much decried these days – but in a way which would make them intelligible, and which would separate the use which should be made of them from their previous misuse.** I found, then, that the nature of substantial forms consists in force, and that from this there follows something analogous to feeling and desire; and that they must therefore be understood along the lines of our notion of *souls*. But **just as the soul ought not to be used to explain in detail the workings of an animal's body, I decided that similarly these forms must not be used to solve particular problems of nature,** although they are necessary for grounding true general principles. Aristotle calls them *first entelechies*. **I call them,** perhaps more intelligibly, *primitive forces*. (WF, 11-12)

On Body and Force (May 1702):

it is empty to fly immediately, and in all cases, to the form or the primitive force in a thing when distinct and specific reasons should be given, just as **it is empty to resort to the first substance, or God, in explaining the phenomena of his creatures,** unless his means or ends are, at the same time, explained in detail ... although we say that everything in nature is to be explained mechanically, we must exempt the explanation of the laws of motion themselves, or **the principles of mechanism, which should not be derived from things merely mathematical and subject to the imagination, but from a metaphysical source,** namely, from the equality of cause and effect and from other laws of this kind, which are essential to entelechies. Indeed, as I have already

said, **physics is subordinated to arithmetic through geometry, and to metaphysics through dynamics.** (AG 254-255)

Leibniz to Nicolas Rémond (10 January 1714):

when I looked for the ultimate reasons of Mechanism and of the laws of movement themselves, **I was fully surprised to see that it was impossible to find them in Mathematics, and that it was necessary to return to Metaphysics.** This is what took me back to Entelechies, and from the material to the formal, and made me finally understand, after many corrections and advancements of my notions, that the Monads, or simple substances, are the only true substances, and material things are nothing more than phenomena, but well founded and well connected. This is that of which Plato, and even the later Academics, and also the Sceptics, have glimpsed something, but these Gentlemen, who came after Plato, did not made use of it as well as him. (GP III, 606)

Objections

On Body and Force (May 1702):

Whatever Descartes may have said, not only efficient causes, but also final causes, are to be treated in physics, just as a house would be badly explained if we were to describe only the arrangement of its parts, but not its use. ...

although we say that everything in nature is to be explained mechanically, we must exempt the explanation of the laws of motion themselves, or the principles of mechanism, which should not be derived from things merely mathematical and subject to the imagination, but from a metaphysical source, namely, from the equality of cause and effect and from other laws of this kind, which are essential to entelechies. (AG 254-255)

Tentamen anagogicum (1696):

all natural phenomena could be explained mechanically if we understood them well enough, but the principles of mechanics themselves cannot be explained geometrically, since they depend on more sublime principles, which show the wisdom of the Author in the order and perfection of his work. (GP VII, 272; transl. by Garber in *Leibniz*, 234)

in corporeal nature itself, there are, so to speak, two kingdoms which penetrate one another without confusing themselves and hindering one another: the kingdom of power, according to which everything can be explained *mechanically* by efficient causes . . . ; and also the kingdom of wisdom, according to which everything can be explained, so to speak, *architectonically* by final causes[.] (GP VII, 273, my transl.)

Leibniz to Bayle (9 January 1687):

I will add a remark of consequence for metaphysics. I have shown that force should not be estimated by the composition of speed and mass [mv], but by the future effect. Nevertheless it appears that force or power is something real from the present [moment], and [that] the future effect it is not. Hence it follows *that it will be necessary to admit in bodies something different from mass and speed, unless one wishes to deny to bodies all power of acting.* (GP III, 48)