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Manuscripts and Documents on the History of Physics: A Historical Materialist Textbook by Boris Hessen. Verum Factum, 2022

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LARGELY UNNOTICED, A TRUE GEM was given to all Marxists and philosophers and historians of science last year. September saw the publication of a long-lost textbook by the Soviet physicist and historian of science Boris Hessen. As the opening volume of the *Verum Factum* book series, Manuscripts and Documents on the *History of Physics: A Historical Materialist Textbook* launches a series that has set the spreading of insights and inquiries into the political dimension of scientific practices and knowledge production as its goal.[1] It brings together different contributions to political epistemology[2] in an open-access format.

Pietro Daniel Omodeo's and Sean Winkler's edition of Hessen's textbook offers not only a complete transcription of the Russian original, but also, and this is probably more decisive for most international scholars, an English translation of the most relevant parts. In addition, the material is introduced by four articles that contextualize and highlight the significance of Hessen's work, thus making the edition an accessible introduction into his views on the relations between science and society.

1. The volume is freely accessible on the website of Verum Factum: https://verumfactum.eu/volumes/manuscripts-and-documents-on-the-history-of-physics/.
2. As used in (Omodeo 2019).

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In the first article, Rose-Luise Winkler (2022) provides a sketch of the circumstances of Hessen's life and work within which he wrote the textbook. The reason the nearly 700-pages manuscript had to finally wait 86 years for its publication is that in 1936, when the proofs were ready for printing, he was arrested and sentenced to death—a victim of the Stalinist purges. The manuscript was only rediscovered in 2004.

Sean Winkler (2022) embeds Hessen's thought within the philosophical disputes between 'mechanists' and 'dialecticians' that occurred in the Soviet Union at that time in the second article. According to his characterization, Hessen's views in all his works are "emblematic of the Deborinite approach to dialectical materialism" (Winkler 2022, 45), thus locating him among the latter.[3] Hessen must thus be seen as following an "anti-reductionist natural philosophy" (ibid., 46). Moreover, the article includes a discussion of Hessen's arguments in favour of contemporary developments in physics, namely quantum mechanics and general relativity.

The way Hessen's ideas have been received and circulated internationally is presented by the detailed investigation in the article by Gerardo Ienna (2022). They were first taken up by leftist historians of science in Britain, from where they continually reached scholars all over the world. The overview ends by going through the relatively large number of new editions and translations of Hessen's work that appeared in recent decades. Hence, it becomes clear that his textbook arrives at a time where a renewed interest into his analyses can be experienced.

One possible reason for this is given by Pietro Daniel Omodeo (2022) in the last introductory article. While contemporary science studies has the advantage of conceptualizing science as a contingent cultural phenomenon, rather than approaching objective truth, it nonetheless fails to grasp the larger narrative of modern science. According to Omodeo, this is illustrated by the attacks against the concept of the Scientific Revolution. Instead of dismissing it, the "Scientific Revolution should be understood as the cultural expression of specific relations of power and a specific historical arrangement of society at a global level" (ibid., 176). Such a point of view has the potential to inaugurate and guide a reflection on the role and function of science even today. In this light, he argues, Hessen's analyses can be seen as an "antidote" (ibid.,175) against the problems faced in science studies nowadays.

3. After the Russian Revolution of 1917, Abram Deborin was the leading figure of the 'dialecticians,' who argued against the possibility of reducing nature to mechanical causal explanations and insisted that the laws of dialectics are inherent to nature.

To understand this appraisal, we must first of all turn to the claims Hessen made. Up to now, he has mostly been famous for his paper "The Social and Economic Roots of Newton's *Principia*"—originally a talk he delivered at the Second International Conferences for the History of Science in London in 1931. A new translation has been offered by Freudenthal and McLaughlin recently.[4] Following a materialist conception of history, Hessen (2009) argues that scientific progress cannot not be understood as the accumulated result of individual flashes of genius but must rather be grasped against the background of specific social relations in place. In consequence, he posits a close connection between science on the one hand, and technological and economic development on the other.

More specifically, his paper contains three theses that are based on the figure of Newton and his *Principia*. First, Hessen explains the emergence of classical mechanics as a response to the technological demands placed in the fields of trade and transport, as well as the military and mining industry by the advent of the epoch of merchant capitalism and manufacture. Secondly and somewhat conversely, he relates the absence of certain physical discoveries, specifically the law of conservation of energy, to a lack of technical application thereof—the steam engine in this case. Thirdly, he argues that ideological distortions in science, such as Newton's introduction of God into his world picture, can ultimately be traced back to the class positioning in political struggles of that time.

The theses about the development of early modern science that Hessen presented in this article differ significantly from his usual research focus. This has led some scholars to consider his analysis of Newton as rather ad hoc and superficial. His textbook proves otherwise, however. The topics it covers and the points it makes are similar, partly even identical to what he proposed in his article of 1931. Hessen's materialist history of early modern physics—the cornerstone of which he sees in the emergence of classical mechanics—can thus be seen as the result of larger project, which he probably already started in the late 1920's.

4. In their edition, Freudenthal and McLaughlin (2009) included several texts by Henryk Grossmann from around the same time, in which he makes a similar argument to Hessen, too. Thereby, they introduced the Hessen-Grossman Thesis: "Technology was developed *in order to* facilitate economic development and science developed *by means of* the study of the technology that was being applied or developed" (4, emphasis in the original). With the formulation, they stress the fact that science is not restricted to the immediate improving contribution to technology. Rather, they propose to regard technology as having provided science with its subject matter—machines.

Accordingly, the historical scope which Hessen covers in his textbook is also broadened. The three main parts deal with a number of scientists that were active during the epoch of the Scientific Revolution. Consequently, the context is no longer restricted to England, but expands to Western Europe in general. The basic argument of the first part, however, remains the same: "The remarkable flourishing of the natural sciences in the sixteenth and seventeenth centuries," according to Hessen (2022), "is due to the break-up of feudal ownership, and the development of merchant capital, international maritime transport and heavy industry (mining and metallurgy)" (4).

As in his earlier article, he summarizes the technical problems faced in economic fields that rose to importance with the unfolding of new social relations in early modern Europe and correlates them with mechanical problems of physics. Such a historical materialist approach to science, Hessen concludes, explains "why the great constellation of natural scientists, beginning with Galileo and ending with Newton, chose the problems of terrestrial and celestial mechanics as the main themes of their research" (Hessen 2022, 191).

Hence, with respect to his first thesis, Hessen's textbook does not offer us anything entirely new—some parts are literally the same. Nevertheless, the reader is provided with much more material for illustration. For instance, he brings up sources that discuss the conditions of road and river transport (Hessen 2022, 191–202), as well as quotes that testify to Galileo's interest in military affairs—including gunnery or fortification (ibid., 210–12)—or reports about the already existing complexity of mines (ibid., 214–19). The argument is also framed slightly different in the textbook. The limits of science are not addressed at all. At the same time, the third part includes a much more extensive treatment of the roles played by institutions, which had only been touched upon very slightly in the Newton paper.

There, Hessen asserted that the new scientific endeavours of the 16th and 17th centuries did not receive their original impulse from within the universities. On the contrary, they struggled against them. Instead of being integrated into the old institutions, therefore, these practices took place in specialized, professional schools or in scientific societies, situated outside the traditional university system. Hence, other than the Austrian Marxist and sociologist of science Edgar Zilsel (2003), who argued that modern science resulted from the merger of the methods of "university-scholars"

and "*humanistic literati*" with those of "superior *craftsmen*" (4), Hessen draws a rather one-sided picture of the institutional impact.

Hessen (2022) does not only repeat, but he also quotes more material and sources to illustrate his two-pronged observation in his textbook. The struggle of the universities against 'Cartesianism' in France (2022, 243), for instance, is used to corroborate the fact that the traditional universities—the "bulwarks of scientific reaction and scholasticism" (ibid., 237)—opposed the inclusion of the new sciences. The structure and aims of the new institutions that were formed as a result are discussed more closely in his book through the mentioning of famous examples such as the Florentine Academy del Cimento, the London Royal Society or the Paris Academy of Sciences (ibid., 254–63).

So far, Hessen's article on Newton's Principia appears as a distillate of the findings presented in his textbook. Even though the latter offers more material, it is merely more than an extension—while not a trivial, also not a completely unexpected one—of the thesis already presented there. The second part of the textbook, however, brings up something qualitatively different. Because it was aimed at students participating in history of physics courses, the mid-part represents an anthology, in which Hessen included a variety of primary sources to illustrate "the emergence and development of the main principles of dynamics" (Hessen 2022, 224).

By including a collection of key texts from the history of physics, including, among others, works by Lagrange, Galileo, Huygens, Descartes, Leibniz or Newton, Hessen aims to show that scientific theorization and concept formation do not simply follow a linear or already laid-out path. Rather, according to him, the "development of mechanics in the seventeenth century rested not only on the question of the perpetual refinement, systematization and design of its principal foundations, but also on the disputes between different schools of thought" (Hessen 2022, 225). In classical historiographies, however, Hessen mentions in the preface, "we barely find any portrayal of that intense struggle taking place between different schools of physics and the process which forged its basic principles and laws" (ibid., 188).

More than anything else, the inclusion of this part opposes receptions of Hessen in science studies that dismiss him as an economic reductionist. At the same time, the point of view that Hessen takes here might be inspiring for people beyond the field of the history and philosophy of science. Science teachers or scholars of science education might draw another

perspective from his didactic take on how to present concept formation in physics in a historical and social manner.

Unfortunately, except for the introduction, this part of the textbook has not been translated in the edition. One can of course appreciate Hessen's intention for situating the internal disputes in physics within its socio-economic and ideological context and read the primary sources that are listed in the original. Nevertheless, for scholars not well versed in Russian, it becomes difficult to judge or gain a lot from this exercise, since it remains unclear which excerpts of the texts Hessen chose and how he introduced them.

In conclusion, the edition of Hessen's textbook is first of all an invitation to reread his oeuvre. This can be done with its historical value for the field of science studies in mind—which of course it has—but there is more to it. The edition and availability of the new material offers the ideal moment to reconsider Hessen's Marxist approach to science and reassess it in the light of the current state of science studies.

For obvious reasons, Hessen's thesis about early modern sciences is outdated by our standards and can no longer count as a sufficient explanation for the mechanical nature of the newly emerging classical physics. It remains partly stuck in preconceived conceptions of history as progress characteristic of Soviet dialectical materialism with its corresponding view on scientific development as a continual rapprochement to objective truth. More fine-grained analyses into a variety of facets of the contingent nature of science as a cultural expression, along with a pluralism of the most progressive theoretical approaches of the day would need to be pursued to overcome this limitation.

Nevertheless, there are several convincing advantages inherent to Hessen's framework. For instance, we can fully agree with what the editorial collective states in the foreword, "Hessen's approach shows how historical and philosophical as well as scientific and socio-economic levels can be integrated into a complex picture of the formation of science in both ideal and material sense" (Freyberg and Omodeo 2022, 8).

Hessen provides us with a tool to connect, orient and bring together singular, but specialized in-depth case studies into a larger narrative. With its focus on the transformative potential inherent to collective human action in the form of class struggle, his approach opposes both scientism and relativism—the two false oppositional views characterizing our neoliberal world.

In this sense, the final publication of Hessen's textbook on the history of classical mechanics that this edition offers can warmly be welcomed. It is a valuable contribution to the struggle for a renewal of the socialist tradition in science studies—which has largely (and deliberately) been neglected and forgotten. Its task, to grasp what part science plays in the reproduction of capitalist relations in the present, would offer the possibility to politicize science and participate in the creation of radically different visions for the relations between science and society in the future.

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