

Bohr's Quantum Philosophy

Roberto Angeloni (2013) *Unity and Continuity in Niels Bohr's Philosophy of Physics*. Leo S. Olschki, Florence, ISBN: 978-88-222-6282-0, 212 pp, 27.00€ (paperback)

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The Danish pioneer of atomic theory, Niels Bohr, is generally and with good reason considered the chief architect of the conceptual foundation of quantum mechanics. His famous but also enigmatic principle of complementarity, which dates from 1927, became the much-discussed backbone of what in the 1950s was called the Copenhagen interpretation of quantum mechanics (or sometimes the orthodox interpretation). Given this role, it is understandable that his thoughts concerning the quantum world and its relationship to the classical world have attracted intense interest among philosophers and historians of science—much more so than among physicists.

Roberto Angeloni's book is part of a long historical tradition with roots back to the 1960s. His ultimate aim is no less than establishing "the real philosophy of Niels Bohr" (p. 198), which he finds in the two thematic concepts of unity and continuity. The book, published in the Italian series *Biblioteca di Nuncius*, is clearly structured and written except that the English language is far from perfect. It consists essentially of three inter-related parts, one dealing with Bohr's philosophy of physics, another with the historical and cultural roots of this philosophy, and a third part which analyses Bohr's semi-classical atomic model from the 1910s. As far as the last part is concerned, Angeloni offers a detailed and competent reconstruction of the 1913 theory, but not one that goes beyond or differs much from what earlier writers (such as John Heilbron, Thomas Kuhn, and Sandro Petruccioli) have suggested. In agreement with Petruccioli, he stresses the continuity inherent in the correspondence principle and its significance for Bohr's later thoughts. Angeloni's Bohr is not a revolutionary thinker but one of a deeply evolutionary inclination.

Angeloni shares with some other authors the belief that one can find in Bohr's earliest work on atomic theory a kind of research programme that gradually unfolded until it reached its culmination in the principle of complementarity. In this respect, he follows Imre Lakatos' methodology quite closely if by no means uncritically. His aim is "to explain the origin of Bohr's fundamental belief in continuity and harmony through an

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historical analysis of his cultural and scientific background” (p. 2) and to do so by means of what he calls a post-Lakatosian methodology. To make up for the deficiencies in Lakatos’ rationalist account of how Bohr’s ideas evolved, Angeloni turns to Gerald Holton’s thematic approach to the history of science and ideas. This approach includes metaphysics as a fully legitimate source for scientific theories, which Lakatos’ methodology does not. Angeloni reconsiders in great detail a question which was much discussed two or three decades ago, namely the historical and philosophical roots of Bohr’s basic ideas of quantum physics. Did Bohr need external inspiration from a philosopher or some other cultural source? If he did, who was his spiritual father?

More than half of the book is concerned with these questions and the answers that previous authors have come up with, including candidates as diverse as Søren Kierkegaard, William James and Harald Høffding—not to mention Immanuel Kant. Angeloni’s discussion of this issue, belonging perhaps more to history of ideas than history of science, is learned, lengthy and repetitive. In fact, he relies very much—and one may even say too much—on scholars such as Jan Faye, David Favrholt, Henry Folse, and John Honner. Indeed, his own favourite source is the very same as Faye’s, namely the Danish philosopher Høffding whom Angeloni credits as the founder of a philosophy of continuity and unity which deeply influenced young Bohr. Høffding, he suggests, even anticipated Bohr’s conception of the quantum of action. Realizing that these and other suggestions lack solid documentary support Angeloni argues, like other scholars in the tradition have done, by means of circumstantial evidence and likely connections. In this endeavour, he finds it necessary to cover substantial parts of the history of philosophy and the ways in which philosophical doctrines permeated to and were received in Denmark. For example, he deals in some detail with Leibniz’s natural philosophy and also with Schelling’s *Naturphilosophie* in order to relate Bohr’s thoughts to much earlier metaphysical ideas concerning continuity and unity. Without suggesting a direct connection, he argues that Bohr’s view of quantum theory is somehow analogous to the holism of the Romantic scientist-philosophers and that the latter may provide insight into the first. As to the more direct impact on Bohr’s thinking, Angeloni largely duplicates what Faye and others have written about the cultural environment in which Bohr grew up, including the influence of the so-called Ekliptika Circle, an academic discussion group founded in 1905.

The discussion in *Unity and Continuity* of the conceptual origin of Bohr’s quantum philosophy is comprehensive and detailed, but it seems to me that much of it is irrelevant with regard to the main question of how Bohr arrived at his ideas concerning the quantum atom. To my mind, the wealth of details about the historical development of philosophical ideas and the views of young Bohr’s acquaintances tend to blur the question rather than clarify it. Having read Angeloni’s book, I remain sceptical that Høffding or someone else really deserves the honour of having inspired Bohr substantially. There is much of interest in the book relating to the history of ideas generally, and also to the tradition of Bohr scholarship specifically, but it casts no new light on the origin and meaning of Bohr’s quantum philosophy.

Compliance with ethical standards

Conflict of interest There is no conflict of interest in this review (HK).