

JAN FAYE: *Niels Bohr: His Heritage and Legacy. An Anti-Realist View of Quantum Mechanics*. Dordrecht, Boston, London: Kluwer Academic Publishers, 1991. xx, 263 pp.

This book is a penetrating effort to demonstrate the importance of Danish philosopher Harald Høffding's philosophy of nature and science for the physicist Niels Bohr. Based on two earlier studies which appeared in the *Danish Yearbook of Philosophy* for 1979 and in *SHIPS* in 1988, this book gives extensive evidence for Høffding's influence on Bohr by pointing to the following kinds of links between the two thinkers:

- indirect biographical links: e.g., via the friendship of Bohr's father Christian Bohr with Høffding's: both were professors at the University of Copenhagen and members of the Royal Danish Academy of Sciences and Letters, and furthermore, the physiologist and the philosopher regularly met at each other's houses to discuss matters of scientific and philosophical importance such as, for instance, the methodology of biology; and in particular, the conflict between the mechanical and the theological explanation of life (cf. 12ff.);
- direct biographical links: after enrolling at the University of Copenhagen in 1903 Bohr took part in a course on 'propaedeutic philosophy' taught by Høffding. Furthermore, on the basis of their correspondence and some other sources, the author argues that Bohr also attended some of Høffding's more advanced courses and showed a continuing deep interest in philosophical problems even after specializing in physics (cf. chapter 2);
- circumstantial evidence, such as, for instance, the later reminiscences of other members of the so-called 'Ekliptika circle' in which Niels and his brother Harald as well as several other students gathered from 1905 on to discuss issues like 'the psychology of the free will' and other topics picked up from Høffding's lectures (cf. 24ff.);
- specific similarities and homologies in their thinking (see later).

It is actually quite remarkable that some of the other philosophers and writers to whom the later Bohr sometimes referred, are also fairly closely linked to Høffding's: the pragmatist philosopher William James, for instance, whose remarks on the "stream of thought" in *Principles of Psychology* the later Bohr so much admired and who had already used the term 'complementary' in this text in 1891 to describe differences between the conscious and the subconscious self, remained in contact with Høffding since the latter's visit to America. Søren Kierkegaard and Poul Martin Møller were a part of the common background shared by both Høffding and Bohr, and so it is not too surprising that we can retrace some elements of their philosophizing in Bohr's physics and that Bohr repeatedly praised these thinkers and asked his students to read their texts. As a side remark, it should also be kept in mind that Bohr always was very polite in his remarks about other people's work, so not too much can be inferred on the basis of Bohr's occasional and most often unspecific evaluations. Instead it is much more interesting to look at traces of his cultural background in his actual research practice.

Somehow, Faye cannot but downplay the influences of thinkers other than Høffding for Bohr's work, since he so much wants to prove the unequalled importance of Høffding to Bohr. Ehrenfest's role in the formation of the principle of correspondence, for instance, is not even mentioned (cf. chapter V, 113ff.), and Kierkegaard's influence is minimized against earlier claims by Max Jammer and Gerald Holton about his importance for the conceptualization of the structure of the hydrogen atom in 1913 (cf. p. 36f.). Unfortunately, Bohr's own statements about these influences are fairly unclear and unspecific, but the task of the historian of science then is to point out *what* precisely it was that was useful, and *how* it migrated from the frame of thinking of one person to another. To me, Faye's thesis: "what Bohr knew about philosophers and philosophical problems came to him through Høffding" (p. 35) is an overstatement of the point. Bohr was immersed in the Danish culture, which

was constitutive for all of these thinkers, along with a big grain of eclecticism (cf. p. 233); to single out *one* of the ingredients of this diffuse but nevertheless decisive cultural frame as 'the' source of Bohr's philosophical thinking seems to me to be misleading. Actually, Poul Martin Møller's novel about the adventures of a Danish student, in which he masterfully plays with the problem of making a cut between subject and object must have been a better, whittier and sharper illustration of what Bohr had in mind when he pondered about the measurement problem than any philosophical treatise could have been.

My endless enquiries make it impossible for me to achieve anything. Furthermore, I get to think about my own thoughts of the situation in which I find myself. I even think that I think of it, and divide myself into an infinite retrogressive sequence of 'I's who consider each other. I do not know at which 'I' to stop as the actual, and in the moment I stop at one, there is indeed again an 'I' which stops at it. I become confused and feel a dizziness as if I were looking down into a bottomless abyss, and my ponderings result finally in a terrible headache. (Cited in Faye's translation, p. 154.)

The Danish student's reflection about his thinking disturbs this thinking in the same sense in which a physical measurement disturbs the measured system.

The main part of the book under review is devoted to explicit similarities and homologies between Høffding's and Bohr's thinking. Høffding's philosophy of mind and psychology of free will, for instance, is arguably homologous to Bohr's philosophy of quantum mechanics, in that both touch the question of whether or not the phenomena exist independently of our observation in the sense illustrated by Møller's novel. Høffding's notion of truth (not a correspondence theory but rather a coherence theory by demanding that as many ideas as possible should be connected in a lawful way) reappears in Bohr's concept of the goal of quantum mechanical laws. Other common strands in Høffding's and Bohr's thinking are (cf. p. 136): their epistemological (not ontological) defence of the external world, a similar criterion of reality as causal connectibility, a non-picturing theory of knowledge, and a blurred distinction between subject and object. Both believed in the existence of 'irrational' elements of cognition wherever the subject interacts with the object, and they both looked for "complementary modes of descriptions" as the way out of paradoxes in the fields of psychology and ethics (Høffding) and quantum mechanics (Bohr) respectively. Faye coins the term 'objective anti-realism' to denote this philosophical position somehow in the middleground between idealism and realism (cf. 216ff.). This placement of Bohr's philosophy of nature conflicts with Henry Folse's and Dugald Murdoch's efforts to claim Bohr for the realist camp, but Faye's arguments against Folse (see 204ff.) are convincing, because (for good reasons!) Bohr did *not* assume atomic objects to have inherent states possessed independently of any relations to other objects.

To the reviewer, the most original part of the book deals with the impact of Einstein's criticism of the Copenhagen interpretation in 1935 on Bohr's interpretation of quantum mechanics (p. 174ff.). According to Faye, the EPR paper forced Bohr to rethink his position, to change his terminology and to shift his emphasis from an epistemic to a more linguistic argumentation. Indeed, after 1935 Bohr more and more stressed the fact that "the results of the observations must be expressed in unambiguous language with suitable application of the terminology of classical physics" (Bohr, as quoted by Faye on p. 189).

It is a pity that the book under review does not have a separate bibliography and that often Bohr's writings are not quoted according to their first appearance but rather from anthologies such as *Atomic Physics and Human Knowledge* (1958), which makes it hard to see from which period of Bohr's thinking certain quotes are made. That the notes are endnotes and not footnotes does not make the reading of the book easier, and unfortunately English

style is sometimes as opaque as Bohr's originals are, although a native speaker (Susan Dew) has made sure that the English prose of the author is at least grammatically correct. All in all, this book is certainly no easy reading, but specialists will find the work invested in reading it rewarding.

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