An Underappreciated Exchange in the Bohr–Einstein Debate

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The Bohr–Einstein debate is one of the more remarkable protracted intellectual exchanges in the history of physics. Its influence has been lasting: One of the few clear patterns in a 2013 survey about quantum foundations [1] was that the physicists who believed Bohr to be correct were apt to say that Einstein had been wrong. The exchanges began when Bohr and Einstein first met in 1920, continued at the Solvay conferences of the following decade, reached a dramatic crescendo with the EPR paradox in 1935, and continued thereafter [2]. Not every episode in this long story has been investigated equally [3]. In particular, one late statement attributed to Bohr has received much more intense examination than Einstein’s equally pithy reply.

It is often said that Bohr declared [4],

There is no quantum world. There is only an abstract quantum physical description. It is wrong to think that the task of physics is to find out how nature is. Physics concerns what we can say about nature.

Philosophers of science have read this and marveled at the decadent, positivistic indulgence, at the almost solipsistic temperament! They see this and maintain that for Bohr, the quantum is the closing of the book of nature. The great pursuit of objective truth is — so it would seem — all but abandoned, replaced by mere instrumentalism, by the reduction of physics to a mental device for adequate predictions.

The philosophy-of-science literature has considered this particular Bohr-ism in some depth (see [5, 6], for example), while it has mostly neglected Einstein’s direct response to it. The reason for this disparity must remain a matter of conjecture, but one plausible contributing factor is that the exchange was not put in print until well after the heyday of the debate. In any event, we now turn to Einstein’s reply so that we may begin filling this lacuna. Einstein riposted,

There is no quantum world. There is only an abstract quantum physical description.

One can almost hear the soft and softly-accented voice of the flawed but kindly man, displaced in an unfathomably harsh world. There is no quantum world — of course, Einstein has been insistent that quantum mechanics is incomplete. The stochasticity of detector clicks is not the spontaneity of the Old One, but only our ignorance of the true physical configuration. There is only an abstract quantum physical description — for it is not the world that is quantum, but only our approximate and unfinished description of it. And, having thus reminded us of what he feels so keenly, the separation between the “laws” of physics and the laws of nature, Einstein strikes a note that is a little chiding, a little mournful:

It is wrong to think that the task of physics is to find out how nature is. Physics concerns what we can say about nature.
Physics is a human activity, a collective enterprise by a species equipped with shortcomings he knew only too well. Einstein, who could be quite critical of how physicists picked their topics of concern [7], reiterates that dissatisfaction here. Physics concerns — Einstein is not the man to use that turn of phrase with wholehearted approval. We may be content today with a successful but incomplete theory; we should not remain so forever.

Quotations are often shared without careful regard for their origins, but the attribution of these lines to Bohr and to Einstein are equally solid [5]. It is mildly inconvenient that the passages from Bohr and Einstein are verbally identical, but this difficulty pales into insignificance against the interplay of the contrasting visions they express.

[1] M. Schlosshauer, J. Kofler and A. Zeilinger, “A Snapshot of Foundational Attitudes Toward Quantum Mechanics,” Studies in History and Philosophy of Modern Physics 44 (2013), 222–30, arXiv:1301.1069.
[2] N. Bohr, “Discussions with Einstein on Epistemological Problems in Quantum Physics,” in Albert Einstein: Philosopher-Scientist, edited by P. A. Schilpp (Cambridge University Press, 1949).
[3] C. Chevalley, “Why do we find Bohr obscure?,” in Epistemological and Experimental Perspectives on Quantum Physics, edited by D. Greenberger, W. L. Reiter and A. Zeilinger (Springer, 1999).
[4] A. Petersen, “The Philosophy of Niels Bohr,” Bulletin of the Atomic Scientists 19 (1963), 8.
[5] N. D. Mermin, “What’s Wrong With This Quantum World?,“ Physics Today 57 (2004), 10.
[6] C. A. Fuchs, “Copenhagen Interpretation Delenda Est?,” arXiv:1809.05147 (2018).
[7] “Read the Uplifting Letter That Albert Einstein Sent to Marie Curie During a Time of Personal Crisis (1911),” Open Culture (18 December 2017).