

Chapter 10

“Shut Up and Calculate”

One of the biggest dangers in presenting quantum unknowns might be *sophism*; a wasteful exercise in fruitless scholasticism and mysticism [589]; on a par with magic [588, p. 631]. Thereby the current quantum mechanical formalism is presented as incomprehensible [211, p. 129] and, as Jaynes put it, as [291], “*a peculiar mixture describing in part realities of Nature, in part incomplete human information about Nature – all scrambled up by Heisenberg and Bohr into an omelette that nobody has seen how to unscramble.*” Even Einstein conceded to Schrödinger, “. . . *the main point was, so to speak, buried by the erudition.*”¹ – and that was about his own co-authored “EPR”-paper [196] which he did not write, and was unhappy with the way it turned out [285, p. 175]!

What is even more discomfoting, in this author’s opinion, is the reaction: whereas quantum sophism presents the theory as a sort of deep “*hocus pocus*” [522], there is an alternative perception of quantum mechanics as a sort of shallow “*nothing-burger*;” thereby disallowing or at least discouraging semantical questions about the meaning, as well as about the epistemology and ontology of the quantum formalism. In this way quantum theory is reduced to an almost trivial execution of functional analysis.

The latter approach has a long tradition. Already in 1989 Mermin stated [362, 363] “*If I were forced to sum up in one sentence what the Copenhagen interpretation says to me, it would be ‘Shut up and calculate!’*” Well in line with this witticism are articles entitled “*Quantum theory needs no ‘Interpretation’*” [228],” or “*Interpretations of quantum theory: A map of madness* [93],” or assurances that “*Quantum theory is a well-defined local theory with a clear interpretation. No “measurement problem” or any other foundational matters are waiting to be settled* [201].” Dirac suggested “*not be bothered with them too much*” [175].

¹German original [550, p. 537]: “. . . *die Hauptsache ist sozusagen durch Gelehrsamkeit verschüttet.*”

Indeed, already Sommerfeld had warned his students not to get into these issues, and Feynman [211, p. 129] predicted the “*perpetual torment that results from [[the question]], ‘But how can it be like that?’ which is a reflection of uncontrolled but utterly vain desire to see [[quantum mechanics]] in terms of an analogy with something familiar.*” Therefore he advised his audience, “*Do not keep saying to yourself, if you can possibly avoid it, ‘But how can it be like that?’ because you will get ‘down the drain’, into a blind alley from which nobody has yet escaped.*”

But heresy has continued. Clauser [of the Clauser–Horne–Shimony–Holt (CHSH) inequalities [145]], in a noteworthy paper [144], pointed out the dogmatism of “*evangelical theoreticians . . . their ecumenical leadership, and especially given Bohr’s strong leadership, the net legacy of their arguments is that the overwhelming majority of the physics community accepted Bohr’s “Copenhagen” interpretation as gospel, and totally rejected Einstein’s viewpoint.*” At some point Clauser got thrown out of the office by the impatient Feynman (who often liked to market himself as “cool”). “*A very powerful . . . stigma began to develop within the physics community towards anyone who sacrilegiously was critical of quantum theory’s fundamentals. . . . The net impact of this stigma was that any physicist who openly criticized or even seriously questioned these foundations (or predictions) was immediately branded as a ‘quack.’*” Clauser continues by noticing, “*To be sure, there remained alive a minority of the theory’s founders (notably Einstein, Schrödinger, and de Broglie) who were still critical of the theory’s foundations. These men were obviously not quacks. Indeed, they all had Nobel Prizes! Instead, gossip among physicists branded these men ‘senile.’*”

As time passed by, another, more optimistic phase of the perception of quantum foundations followed, which, however, might not have sufficiently and critically reflected the previous evangelical theoreticians’ orthodoxy. On the contrary, quantum mechanics has been marketed to the public and to policy makers alike as a hocus-pocus type capacity [522].

This author believes [504] that interpretation is to the formalism what a scaffolding in architecture and building construction is to the completed building. Very often the scaffolding has to be erected because it is an indispensable part of the building process. Once the completed building is in place, the scaffolding is torn down and the opus stands in its own full glory. No need for auxiliary scaffold any more. But beware of those technicians who claim to be able to erect skyscrapers without any of those poles and planks!

In addition, when it comes to claims of applicability of the formalism, and its ontological commitments, the suppression of semantic content in favour of mere syntax makes us vulnerable: in many ways the formalism could be extended to domains in which it cannot be applied safely and properly. Thereby, the resulting certifications, alleged capacities and predictions could be wrong. Hence, if it comes to utilize the formalism, interpretation serves not only as scaffolding, but also provides guiding principles and precautionary methods of evaluation and application.

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