

Review of: "A Phenomenological Approach to Quantum Mechanics"

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The paper addresses some deep questions to which no one really knows the answers. I include myself in that. I don't begin to know whether the author is right or wrong. More than that, I am not even sure what "right" or "wrong" would mean in this context. And must it necessarily be either one or the other? Could one not manage to be both right and wrong in such a context? Or neither right nor wrong? —But enough of that. The paper is clearly written, carefully argued, and highly stimulating and generally thought-provoking. Were this a conventional journal, I would have no hesitation in recommending publication.

A few points occur to me. Not criticisms or objections. Observations, rather. Or maybe questions. They are all to do with certain key ideas which the author regards as well-known and requiring no explanation, but which I personally find rather opaque.

The concept of "direct experience," for example. I know this phrase is used all the time, in the philosophical literature and elsewhere. But since it plays a critical role in the author's reasoning, I think it is worth paying a little attention to what the phrase actually means.

To be sure, we are all having experiences all the time. But what is the basis for picking out a certain subset of these experiences and labelling them "direct"? Can the author point to an experience which is merely indirect? What is the function of the qualification "direct"? Is it merely decorative? Or does it carry some semantic weight?

Suppose I am talking to a friend. What exactly is it that is experienced directly in a case like this? Would the expression on my friend's face count as something I experience directly? Or should one argue that, since the experience is mediated by the light reflected off my friend's face and incident on my retina, therefore it must count as indirect? But in the latter case, what would it be that is directly experienced? —Is one to say that I have a direct experience of events in my retina? Or action potentials in my cerebral cortex?

Again, the author talks of the "quantum world." Like "direct experience," this phrase is widely used in the literature. But what does it mean exactly? How does the quantum world differ from the ordinary world? Does it in fact differ? Is this talk of another world just a way of talking? Or what?

Quantum uncertainties apply to macroscopic objects too. For instance, the interferometer at LIGO is plenty big enough to see. Yet the measurement of the difference in the lengths of the two arms needs to be so precise that quantum

mechanics starts to matter (see, for example, Ganapathy et al^[1]). Again, it is possible to make naked eye observations of a single atom in a trap (see, for example, Nadlinger^[2]). Of course, it is true that quantum mechanics reveals many new and surprising facts about the world. But it's not clear to me why we shouldn't regard them as facts about the ordinary world: the one in front of our noses.

The author says that, unlike the situation with classical physics, “[the] concrete nature of the world appears to vanish as we enter the quantum domain.” This isn't clear to me. Consider, for example, three friends at a snooker table. Alice is playing a shot and is completely engrossed in judging by eye exactly how hard to hit the ball, and in what direction. Bob is engrossed in calculating these parameters using Newton's laws of motion. Caroline is engrossed in calculating the same parameters using Schrödinger's equations. I'll agree that the three friends are having very different experiences. But it is not clear to me that they differ in point of concreteness. In particular, I don't see why the experience of doing a calculation in classical mechanics should be considered somehow more concrete than the experience of doing a calculation in quantum mechanics.

Let me conclude by saying that I am not just trying to be difficult here. I have been puzzling over the meaning of quantum mechanics for more years than I care to count. Of course, I know where the author is coming from. I have been through many of the same thought processes myself. It is just that I have come to think that, if we are not going to be arguing endlessly about the interpretation of quantum mechanics until the end of civilization, we need to break out of the rut. Not that I know how to break out of the rut. The above comments are a few observations which may (or may not) be of some help in doing so.

References

1. [^]D. Ganapathy, W. Jia, M. Nakano, V. Xu, et al. (2023). *Broadband Quantum Enhancement of the LIGO Detectors with Frequency-Dependent Squeezing*. *Phys. Rev. X*, vol. 13 (4). doi:10.1103/physrevx.13.041021.
2. [^]David Nadlinger. (2018). *Single atom in an ion trap*.