QUANTUM MECHANICS AND THE OPEN FUTURE

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ABSTRACT

Consider the proposition "There will be a sea-battle tomorrow". Aristotle argued that this is neither definitely true nor definitely false *today*, since he believed that the truth of a statement consists of its correspondence with some definite reality, and he took it as self-evident that what is in the future is not yet real. Aristotle, in other words, believed that the future is *ontologically open*. By contrast, many other thinkers, ancient and modern, believe in *fatalism*, the notion that the future is *ontologically closed* (i.e., already real and definite today), and that there is a fact of the matter today about tomorrow's sea battle (even if today we cannot know that fact). Many people believe that fatalism is supported by Einstein's theory of relativity, since according to the usual interpretation of relativity there is no viewpoint-independent way to distinguish a global past, present, and future. Others have suggested that quantum mechanics introduces an irreducible ontological indeterminacy and thus allows for an open future; however, this seems to come into conflict with relativity theory, and no one has found a clear way to make precise the intuition that quantum indeterminacy supports ontological openness. In this paper, I argue that the notion of fatalism can be made precise if we think of it as a claim that the future has a Boolean property structure. However, if this is correct, then it may be the case that by the "no-go" theorems of quantum mechanics the future must be at least partially open in the precise sense that there cannot be a fact of the matter at a given time about some events at later times. This is because the "no-go" theorems, in essence, show that in many cases one gets the wrong answer if one assumes that physical systems possess a definite reality before we interact with them. Technically, they show that quantum mechanical systems are "non-Boolean". If fatalism means that the future has a Boolean structure, then it might be possible to construct a "no-go" quantum mechanical argument to show that the future must be open in the sense that it must be, in part at least, non-Boolean. It should also be possible to quantify the degree of "openness" of the future, just as we can quantify other measures of uncertainty in quantum mechanics. I will conclude by briefly considering ways of reconciling the openness of the future with relativity; the basis of my proposal will be to argue that we need to abandon the Newtonian notion that the division between a closed past and an open future must necessarily be tied to hyperplanes of constant time coordinate.