▸ IULIAN D. TOADER, *Distribution can be dropped.*
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Non-epistemic criteria, including pragmatic considerations, are not indispensable when choosing between rival logics; rational or epistemic adjudication is possible. This is a position that has recently been defended by Ian Rumfitt [1]. So he argues, more particularly, that classical logicians have no serious epistemic reason for dropping the distribution of conjunction over disjunction, i.e., for adopting quantum logic. I disagree with Rumfitt, and the paper explains why.

I give a formal version of the proof (henceforth, "the Proof") that distribution is false in standard quantum mechanics, making use of the rules for $\wedge$-introduction and $\wedge$-elimination, substitution and De Morgan only, all available in quantum logic. Then, I describe Rumfitt's first truth-ground semantics ($\mathcal{TG}_1$) and his criticism of the Proof: $\mathcal{TG}_1$ cannot validate the behavior of disjunction in the Proof, so a metalogical proof is needed to justify that behavior. But this proof requires classical logic, which makes the Proof rule-circular. Afterwards, I present Rumfitt's second truth-ground semantics ($\mathcal{TG}_2$) including an adjusted semantic principle for disjunction, and then his criticism: the Proof assumes that the state space of a physical system is finite-dimensional, so it must be revised. But Rumfitt argues that the revised Proof is unsound with respect to $\mathcal{TG}_2$. This is supported by the so-called Eigenstate-Eigenvalue Link (EEL), which implies that observables with a continuum spectrum, like position and momentum, have no precise values because they have no eigenstates if represented on an infinite-dimensional space. Rumfitt concludes that the classical logician doesn't have any good epistemic reason to believe that distribution can be dropped.

However, I think this conclusion is not justified. I first argue that despite dropping the assumption of finite-dimensionality, Rumfitt has not shown that the revised Proof is unsound with respect to $\mathcal{TG}_2$. For although one cannot simply reject the EEL, to allow observables to have precise values at all times, rather than only at eigenstates, one can nevertheless revise the EEL as well, by coarse-graining the infinite-dimensional state space. This allows observables with a continuous spectrum to have coarse-grained values at regions, rather than at points in that space. The revised Proof is sound with respect to a coarse-grained $\mathcal{TG}_2$. Secondly, I reconsider $\mathcal{TG}_1$ in order to argue that Rumfitt has not shown the Proof rule-circular, either. I explain rule-circularity away by showing why quantum connectives can behave classically in the metalanguage of the Proof. To explain this classical recapture, more coarse-graining is needed, of a kind that is unavoidable in quantum mechanics (since implied by no-go theorems like Kochen-Specker). Quantum connectives can behave classically not only in the metalanguage of quantum mechanics, but in all contexts where the Uncertainty Principle does not apply.

[1] Ian Rumfitt, ***The Boundary Stones of Thought. An Essay in the Philosophy of Logic***, Oxford University Press, 2015.