Review of "Logic Meets Wigner's Friend (and their Friends)", by Alexandru Baltag and Sonja Smets (*International Journal of Theoretical Physics* 63:97, pp. 1–27, 2024)

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This article considers the famous 'Wigner's Friend' thought experiment in the foundations of quantum mechanics [7], and later extensions, in particular the Frauchiger–Renner paradox [2]. I won't repeat the details of these thought experiments here (in any case, the details of Wigner's Friend should be familiar); instead, I'll just note that in the latter of these two papers, they are presented as no-go theorems in the form of the following inconsistent triad:

Q: The universal validity of quantum theory.

C: Consistency between agents about their predictions of measurement outcomes.

S: Unique outcomes of measurements.

Now, it's evident that not all approaches to the foundations of quantum mechanics are going to feel the force of such thought experiments to the same degree. For example, Everettians will (obviously) deny **S**; QBists can also sidestep apparent problems here by denying that the quantum state is representational (see e.g. [3]).[1]

Be that as it may, it's still an interesting exercise to think through how other approaches to the foundations of quantum mechanics would tackle

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[1]This isn't to imply that these approaches don't have their own problems to contend with—e.g., intersubjectivity in QBism (on which see e.g. [6]).

these (apparent) paradoxes. The article under consideration here considers how to address these paradoxes within the framework of the 'relational quantum mechanics' pioneered by Rovelli [5], the core tenet of which is that systems only possess quantum states *relative* to other quantum systems. The key proposal from this article is to define a relational notion of an 'admissible observer':

> [A] system A is an "admissible observer" with respect to [another background observer] O and [a given history] h if and only if it is always possible that (as far as the background observer O can know) that [*sic*] none of the information carried by A will be fully erased from the universe at any given moment of the given history h. (p. 4)

Relativising the notion of an observer in this way is an interesting move—but it's not obvious that it needs to be wedded to relational quantum mechanics, which is committed (as noted above) to the relativity of the quantum state itself.[2] But setting that aside, it does seem that the notion of an admissible observer helps advocates of relational quantum mechanics to make sense of the above pardoxes, as the authors spell out in great detail in a number of case studies in §3.2. As the authors explain in their conclusion, the upshot is this:

> This context-dependent and observer-dependent approach gives us a pragmatic-epistemic solution to Wigner Friend's-type paradoxes: there are no absolute, universally acceptable observers, but only (communities of) admissible observers relative to some background observer and background timeframe or protocol. Every system is an admissible observer to itself, but not every system is an admissible observer to every other system. (p. 25)

In sum, then: this is an interesting article, which develops resources which should help proponents of relational quantum mechanics to engage with and tackle Wigner's Friend-type scenarios. However, (i) it's not obvious that the tools developed here can't be appropriated by other approaches too, (ii) one has to acknowledge (something which I haven't mentioned in

[2]And once liberated from relational quantum mechanics, this notion of a relative, admissible observer could be appropriated by e.g. proponents of the Everett interpretation in their engagement with these 'paradoxes' (where, e.g., Wigner's friend will be an admissible observer relative to Wigner, but not vice versa.) As Alexandru Baltag has stressed to me, this shouldn't be understood to be a problem for the notion of an admissible observer; rather, it should be taken to be an advantage.

this review up to this point) the quite serious problems faced by relational quantum mechanics (such as (a) making sense of interaction events—see [1]—and (b) the charge of radical relativism raised in [4]), and (iii) one should also acknowledge that these paradoxes might look less troubling from the point of view of other approaches to the foundations of quantum mechanics, such as the Everett interpretation or QBism.

Acknowledgements

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References

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