Review of: "A New Approach Towards Quantum Foundations and Some Consequences"

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Potential competing interests: No potential competing interests to declare.

The paper by Prof. Helland provides an interesting perspective for deriving the probabilistic formalism of quantum mechanics from statistics-related ideas. The paper should be useful, especially for people who regard quantum theory as a statistical model that can find applications beyond its original scope.
Here are my questions and remarks.

1. There are functions and transformations. It is not completely clear how these two concepts came into existence, what distinguishes them, etc.

2. The argument that non-commuting variables come from a single entity is interesting and invites more elaboration. What is the precise role of group theory here?

3. When discussing maximal variables, it might be more straightforward to recall the known lemma: two commuting operators can be represented as functions of a third operator. And if they do not have degenerate eigenvalues, each one is a bijective function of another. Somehow, the discussion touched upon this lemma several times, but it is not stressed explicitly.

4. The formulation of Theorem 1 is not completely clear. Group theoretical tools come without statistical motivations (which I would expect to see).

5. What specific points in Theorem 1 ensured that the operators are Hermitian? Why, e.g., are they not just real and symmetric?

6. The author writes "The set of eigenvalues of the operator A^θ is identical to the set of possible values of θ." Is this an independent assumption (postulate)?

7. The author writes "This version of quantum theory implies a restriction of the superposition principle." How does this relate to the superselection principle?

8. More precisely, how does the likelihood principle enter into the derivation of quantum mechanics? Is there a quantum version of Birnbaum's theorem?

9. Is appealing to a superior being necessary? What are the relations between "rational" and "superior"?

10. Within statistics, the likelihood principle and the Dutch book argument belong to different realms (likelihoodism and Bayesianism). So their combination in this setting requires explanations.

11. What is the likelihood effect?

12. As for the derivation of the Luders rule, I did not get the full argument. Our results show that the distinction between the Luders rule and von Neumann's rule is situational and depends on the concrete measurement set-up. A.E. Allahverdyan, R. Balian, T.M. Nieuwenhuizen, A sub-ensemble theory of ideal quantum measurement processes, Ann. Phys. 376, 324-352 (2017).

13. In the text, I several times met ([Born...]) instead of the equation number.

14. There is a derivation of Born's rule from statistical decision theory (D. Wallace). It seems close to the one outlined here.