Blutner, Reinhard; beim Graben, Peter
Quantum cognition and bounded rationality. (English) Zbl 1359.81012
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Summary: We consider several puzzles of bounded rationality. These include the Allais- and Ellsberg paradox, the disjunction effect, and related puzzles. We argue that the present account of quantum cognition – taking quantum probabilities rather than classical probabilities – can give a more systematic description of these puzzles than the alternate treatments in the traditional frameworks of bounded rationality. Unfortunately, the quantum probabilistic treatment does not always provide a deeper understanding and a true explanation of these puzzles. One reason is that quantum approaches introduce additional parameters which possibly can be fitted to empirical data but which do not necessarily explain them. Hence, the phenomenological research has to be augmented by responding to deeper foundational issues. In this article, we make the general distinction between foundational and phenomenological research programs, explaining the foundational issue of quantum cognition from the perspective of operational realism. This framework is motivated by assuming partial Boolean algebras (describing particular perspectives). They are combined into a uniform system (i.e. orthomodular lattice) via a mechanism preventing the simultaneous realization of perspectives. Gleason’s theorem then automatically leads to a distinction between probabilities that are defined by pure states and probabilities arising from the statistical mixture of pure states. This formal distinction relates to the conceptual distinction between risk and ignorance. Another outcome identifies quantum aspects in dynamic macro-systems using the framework of symbolic dynamics. Finally, we discuss several ideas that are useful for justifying complementarity in cognitive systems.

MSC:
81P05 General and philosophical questions in quantum theory
81P10 Logical foundations of quantum mechanics; quantum logic (quantum-theoretic aspects)
81P16 Quantum state spaces, operational and probabilistic concepts
03G12 Quantum logic
06C15 Complemented lattices, orthocomplemented lattices and posets
37B10 Symbolic dynamics
00A79 Physics

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Full Text: DOI

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