Comparing Markov and quantum random walk models of categorization decisions

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Abstract

Quantum probability theory has successfully provided accurate descriptions of behavior in decision making, and here we apply the same principles to two category learning tasks, one using overlapping, information-integration (II) categories and the other using overlapping, rule-based (RB) categories. Since II categories lack verbalizable descriptions, unlike RB categories, we assert that an II categorization decision is characterized by quantum probability theory, whereas an RB categorization decision is governed by classical probability theory. In our experiment, participants learn to categorize stimuli as members of either category S or K during an acquisition phase, and then rate the likelihood on a scale of 0 to 5 that a stimulus belongs to one category and subsequently perform the same rating for the other category during a transfer phase. With II categories but not RB ones, the quantum model notably outperforms an analogous Markov model and the order effects on likelihood ratings are significant.