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People fail to learn probabilistic XOR rules even in a small feature space

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Abstract

People are known for their ability to learn probabilistic rewarding rules of the environment. However, the rules tested in most studies consisted of one feature dimension or a linear combination of multiple features. It is unclear how well people can learn non-linear combinatory rules where each single dimension is noninformative. In an adapted matching-pennies game, we asked participants to predict whether their opponent would choose head or tail next trial. Though the feature space for possible rules was small, including only two binary dimensions (i.e., the two players' current choices), participants had striking failures in learning the probabilistic XOR rules (e.g., the opponent would have a probability of 0.8 to choose head if the two players had matching pennies and tail for unmatching pennies). The failure persisted in a series of experiments, even when the feature space was made explicit, after 320 trials of learning, and for different cover stories.