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Tracking temporal regularities

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Our perception does not depend exclusively on the immediate sensory input. We exploit the statistical regularities in the environment, leading, e.g., to attractive perceptual choice history biases in a stable world, yet the conditions and mechanisms facilitating this flexible use of prior information to predict the future are unclear. Here we use a standard perceptual decision-making task and manipulate transitional probabilities between successive stimulus orientations to address two questions in parallel. First, at the individual differences level, we investigate the relationship between non-clinical autistic traits and history bias adjustment to the temporal statistics of the environment. It has been suggested that individuals with autism spectrum disorders (ASD) are impaired in the integration of immediate sensory evidence and long-term statistics; reduced reliance on prior choices in ASD may thus result from a failure to learn and exploit statistical regularities. Indeed, we find reduced adjustment of choice history biases in individuals with particularly high autistic traits. Second, at the general population level, we investigate the mechanism underlying these history biases by capitalizing on noise-driven fluctuations in the orientation statistics of the stimuli. Using a reverse correlation analysis, we evaluate stimulus-independent bias and stimulus-dependent sensitivity to predicted orientations. We find that both mechanisms coexist, whereby there is increased bias to respond in line with the predicted orientation and suppressed sensitivity to information inconsistent with the prediction. Together, the current study sheds new light on the mechanisms underlying history biases in perceptual decision-making and their reduced expression in individuals with particularly high autistic traits.

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