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Unexpected visual events elicit faster and more accurate behavioural responses

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Abstract

Predictive coding theories argue that recent experience establishes expectations that generate prediction errors when violated. Neural correlates of prediction errors have been widely reported, but their perceptual consequences remain unknown. We had observers perform a dual-report task on the orientation of briefly presented gratings within predictable or random sequences. Observers first made a speeded response to categorize grating orientation (clockwise or counterclockwise from vertical), then reproduced the orientation without time pressure by rotating a bar. This allowed us to separately assess response speed and accuracy for the same stimulus. Critically, on half the trials, the target orientation was unexpected, due to the spatiotemporal structure established by the preceding gratings. Observers responded faster and more accurately to gratings that were unexpected. These findings reveal the behavioural consequences of prediction error and indicate that unexpected events are prioritized by the visual system both in terms of processing speed and representational fidelity.