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Reading in conditions of low contrast; the adaptability of binocular fixation behaviours

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Abstract

How does the visual system adapt to reduced contrast? Participants read a row of white numbers against a static background that changed from black to white, from left to right. There was pervasive binocular disparity between the fixation points of the left and right eye as legibility decreased. Overall, the lines of sight crossed more frequently in front of the stimulus plane (“crossed fixation disparities”) than behind (“uncrossed fixation disparities”). The proportion of crossed fixation disparities increased systematically with reading difficulty. Absolute size of fixation disparity changed differentially in the two disparity types when contrast reduced, implicating different subsystems. We claim that hemisphericity provides the most insightful understanding of these behaviours. The viewer has flexible control of (a) advantaged contralateral projections from retina to cortex, (b) the size of the perceptual window, and (c) binocular fusion. Thus, an apparent failure of the eyes to fixate precisely conjointly is revealed as an adaptation of embodied cognition.