Eye position influences contrast responses in V1 of alert monkey

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Do our neurons in V1 respond differently when we look in different places? To answer this question, we have studied neuronal responses to moving bars in V1 of an alert monkey while it maintained different directions of gaze. The monkey was trained to fixate on an LED attached to the stimulus screen while the screen was placed in three positions: straight ahead or 0 deg (0 position), approximately 10 deg to the right (10R) or or to the left (10L) in the horizontal plane (h) in a constant vertical position (v). Recorded mean +/- SE eye positions in minarc were: for 0 position (h,v) = (2.5+/- 5.7, 5.3+/-3.8), for 10R position (516+/-16, -32+/-3), for 10L position (-540+/-12, 31+/-5). We have recorded contrast responses in 21 cells. Changing eye position significantly influenced the maximum amplitude of the response in 13 cells. In 4 cells where maximum responses were unchanged, responses to lower contrasts changed significantly for different eye positions. In 7/17 cells in 0 position, in 5/17 cells in 10R position and in 5/17 in 10L position, responses were larger than in other two positions.

We have fitted contrast responses r(c) with the Naka-Rushton equation: r(c) = Rmax*(c^n /(c^n + c50^n)), where Rmax is the maximum response, c - contrast, c50 - contrast at the half of Rmax, n - nonlinearity. We have analyzed only those responses with a sufficiently good fit (estimated by the RMS). In most cases changing the eye position had small influence on n, but significant influence on Rmax and c50. We have analyzed 18 contrast responses to increment and decrement bars. Rmax changed, more than 20%, in 12 cases and c50 in 14 cases. In 10 measurements both Rmax and c50 changed as the eye position changed.

Our preliminary data also suggest that the eye position could differently influence the size of the increment and decrement zones in the classical receptive field of V1 cells.

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