Color-blindness of direction-selective units in the zebrafish optic tectum

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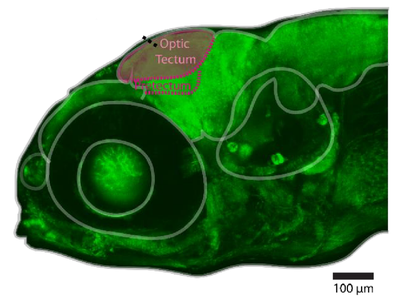
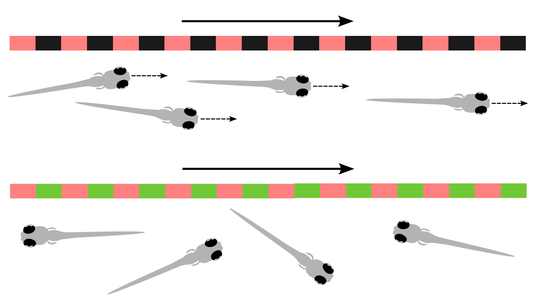


Introduction

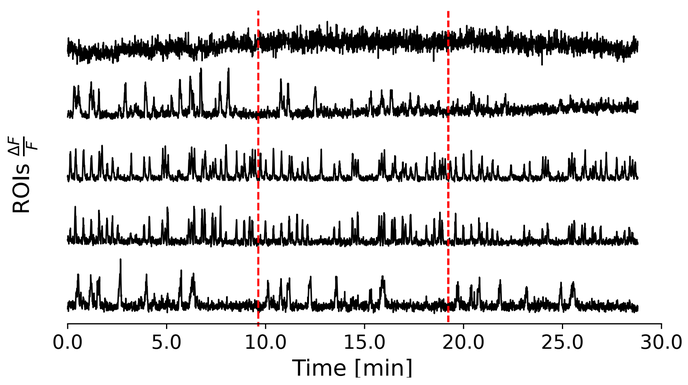
Color has a big influence on motion vision in zebrafish. Orger and Baier (2004) used the optomotor response to show that motion blindness can be induced to a grating of different colors in zebrafish.



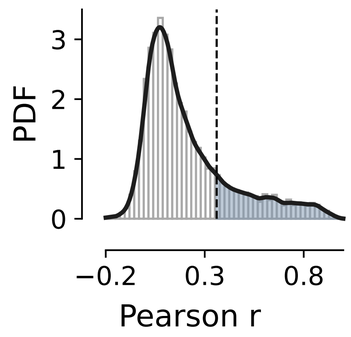
But little is known about the cortical structures conveing the „color-motion“ perception. We investigated the activity of direction-selective units in the optic tectum of zebrafish in response to gratings of various color contrasts using a combination of two-photon microscopy and calcium imaging.

Preprocessing:

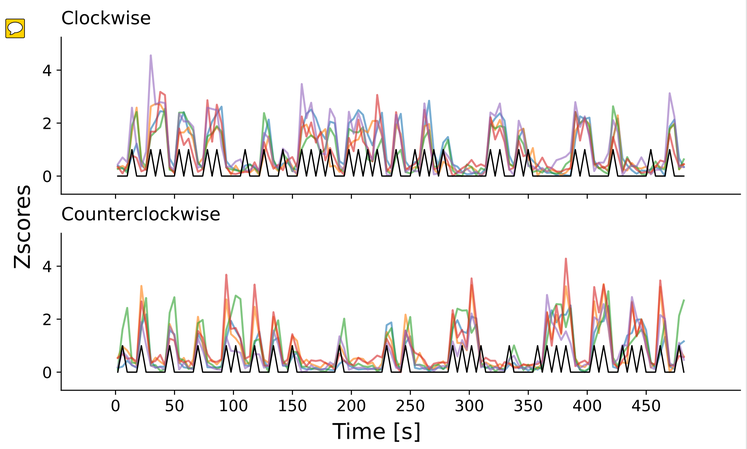
1. Region of Interests (ROI): corrosponds to neurons with genetically indueced calcium indicators. The lumiance F of the calcium imaging is calculated from the change of luminance normalized to the average luminance $F = \frac{\Delta F}{\langle F \rangle}$.



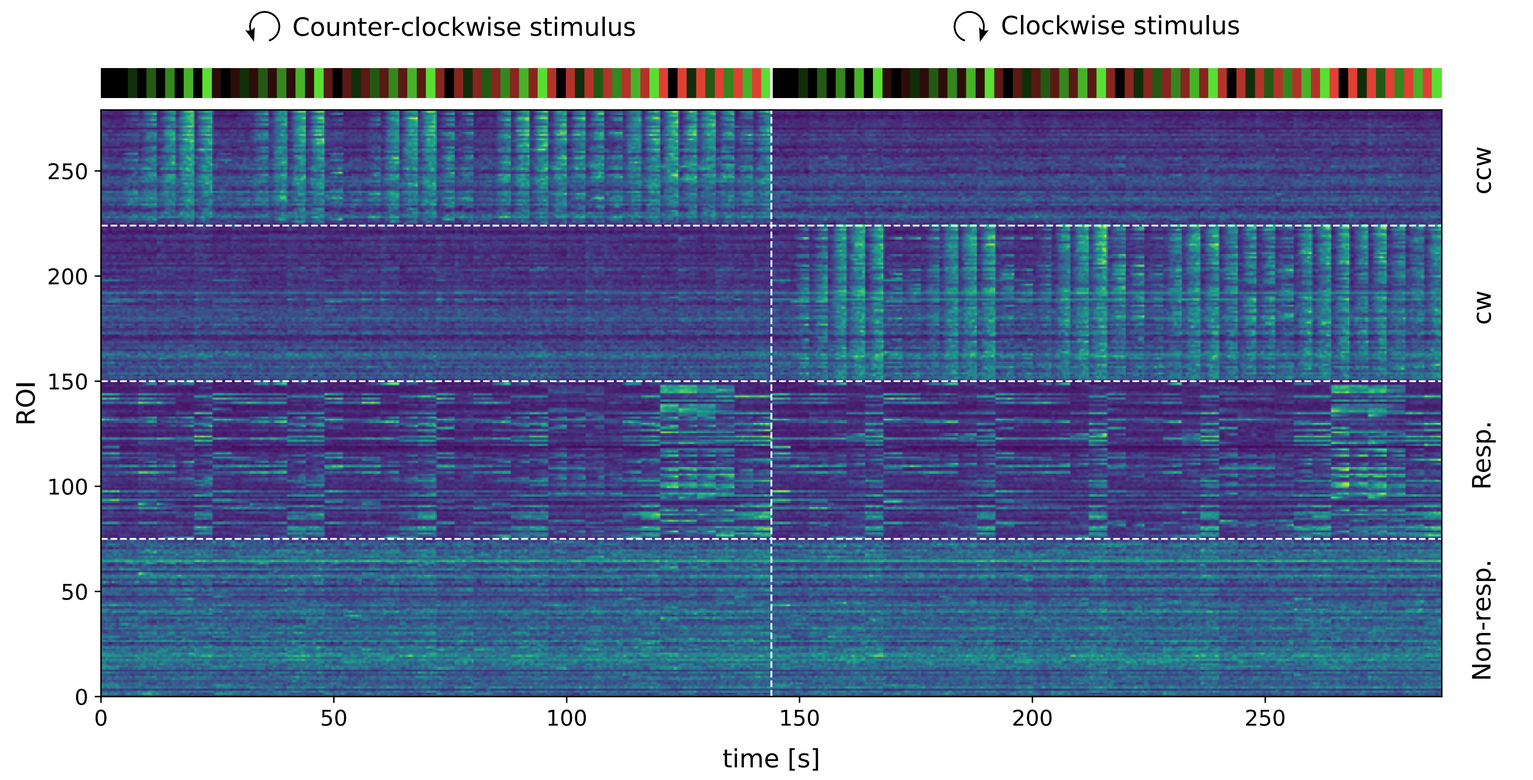
2. Active ROIs: Strongly autocorrelated ROIs across stimulus repeats are „respoding“.

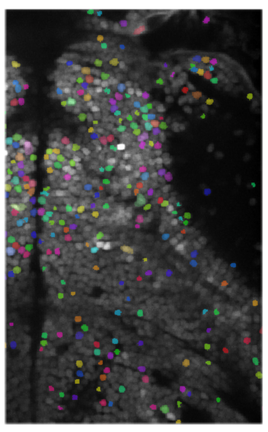


3. Direction selective ROIs: ROIs that correlated with a direction regressor (clockwise (CW) or counterclockwise (CCW)).

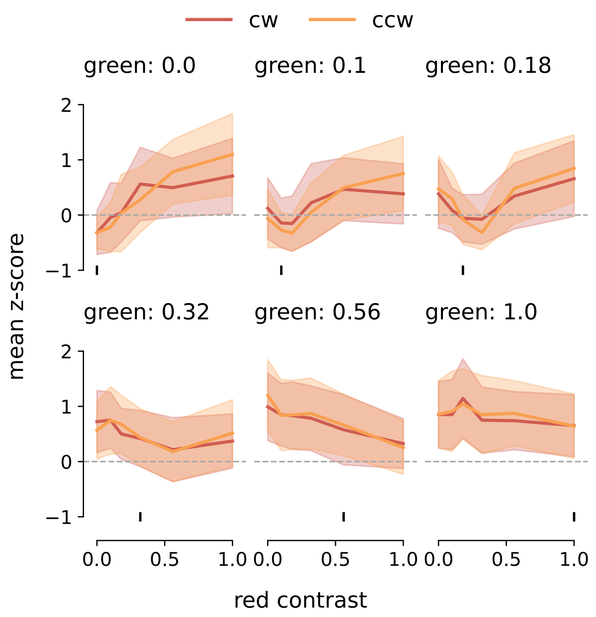


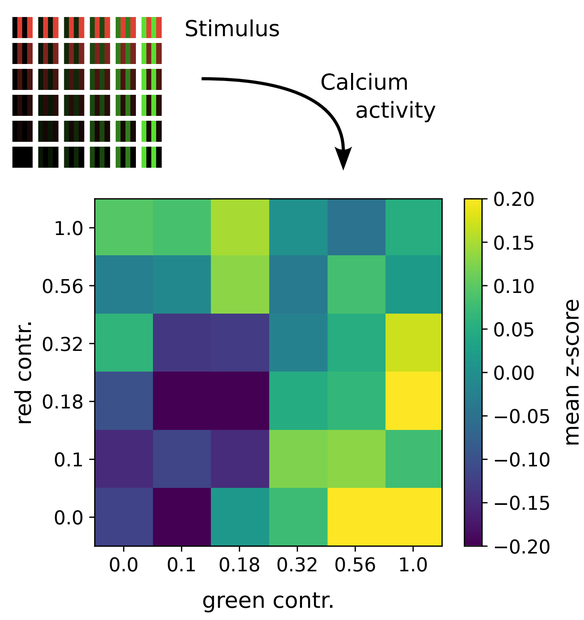
2-photon calcium imaging





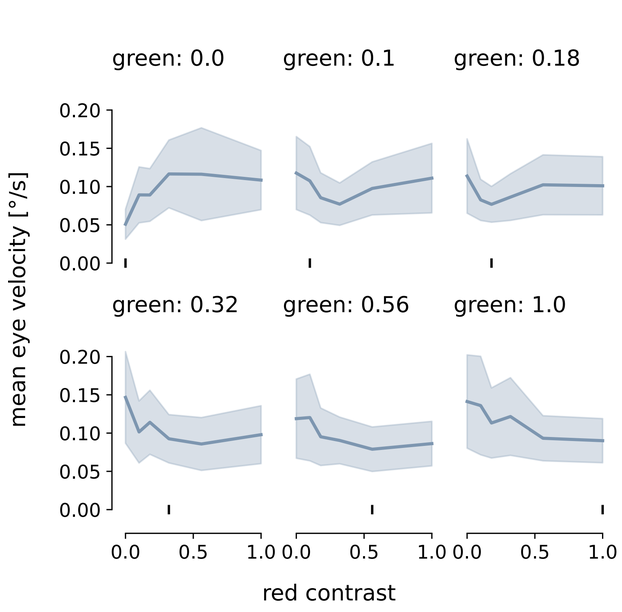
ROIs on right optic tectum

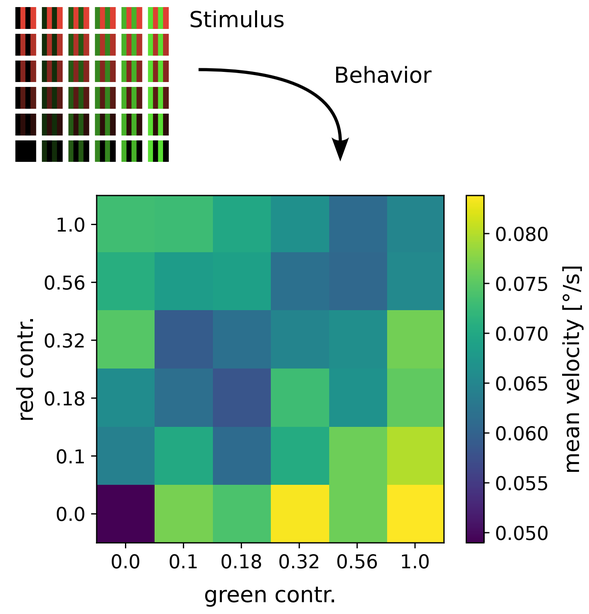




- Both directions CW and CCW responded equally
- Points of zero acromatic contrast may correspond to lowest calcium activity.
- A slight shift in the troughs of activity could be explained by a higher intensity of green compared to red.

Behavior





- The behavioral response (OKR) reflect the pattern shown in calcium activity.

Conclusion

- We observed that the optic tectum of the zebrafish encodes for color directed motion stimuli.
- The optic tectum is motion blind for various contrast levels