How do respiration and pupil size align with changes in perception?

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Introduction

- **Respiration** and **pupil** reflect **internal states** of the **body** and **nervous system**.
- Both signals are coupled at rest¹, yet the dynamics of this coupling is under-studied²: some studies report only a reduced², while others suggest the absence of such coupling during cognitively demanding periods³.
- **Both** signals may **reflect changes in spontaneous perception**⁴. When viewing bistable objects, pupil dilation changes around perceptual switches⁵, while it remains unknown whether respiration aligns to such switches.
- We studied respiration-pupil interactions while participants viewed a bistable object (Necker cube).







- Pupil & respiratory dynamics around reversals
- Comparing long vs. short perception stability
- \rightarrow Perceptual reversals: 289.3 +/- 22.7

 \rightarrow Median stability duration: 4.6 +/- 0.5 s





lime around button press [s]

-Pervious cube stability long -Pervious cube stability short

Respiration phase bins

Conclusion[•]

- Pupil size decreases more prior to a switch for epochs of longer stability.
- **Respiratory phase is more coherent** for periods of longer stability.
- Overall, pupil is largest around the onset of expiration and smallest at the expiration-inspiration transition. Around reversals this dependency is reduced.

References -

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See also: Brascamp et al., eLife, 2021 | Chang et al., Psychophysiology, 2024