Zooming in on the true neural mechanisms of phenomenal consciousness

ABSTRACT:

Background
In the search for the neural basis of conscious experience, perception and report are typically confounded as neural activity is recorded while participants explicitly report what they experience.

Aims
To disentangle perception from report using eye-movement analysis techniques based on convolutional neural networks and neurodynamical analyses based on information theory.

Method
We use a bistable visual stimulus that instantiates two well-known properties of conscious perception: integration and differentiation. Observers either perceive the stimulus as one integrated unitary object or as two differentiated objects that are clearly distinct from each other.

Results
Electroencephalograpy measures of integration and differentiation closely follow perceptual experience. We observed increased information integration between anterior to posterior electrodes prior to a switch to the integrated percept, and higher information differentiation of anterior signals leading up to reporting the differentiated percept. Information integration was linked to perception and even observed in a no-report condition (perceptual transitions were inferred from eye-movements). In contrast, the link between neural differentiation and perception was observed solely in the active report condition.

Conclusions
Perception and report require distinct levels of anterior-posterior network communication and anterior information differentiation: while front to back directed information is associated with changes in the content of perception, regardless of report, frontal information differentiation was absent in no-report conditions, and therefore has a different role not directly linked to perception *per se*.

Keywords
Consciousness, perception, information theory, report

Published Work:

Canales-Johnson, A., Beerendonk, L., Chennu, S., Davidson, M. J., Ince, R. A. A., & van Gaal, S. (2023). Feedback information transfer in the human brain reflects bistable perception in the absence of report. *PLoS Biology, 21*(5), e3002120. https://doi.org/10.1371/journal.pbio.3002120

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