Representation of face-prior precision

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Abstract:

Perception is an active inference in which perceptual priors are combined with sensory input. It is still unclear how the precision of prior expectations is represented in the human brain. Prior precision could be represented with prior content itself in sensory regions. Alternatively, there could be distinct, specialized brain regions that represent precision separately from the content of the prior. Here, we used multivariate functional resonance imaging to test whether the precision of face priors can be measured together with expected face identity in face-sensitive regions. During face anticipation, representations of expected face identity increased with prior precision in the face-sensitive anterior temporal lobe. In contrast, during face presentation, representations of face identity increased with surprise in the fusiform face area and the insula. Our findings suggest that precision of face priors is represented in higher-level face areas. These priors seem to influence the representation of face input in lower-level face regions and additional specialized brain regions which signal surprise to unexpected stimuli.

Keywords: Representational similarity analysis; fMRI; face perception; prior expectation; certainty

Introduction

Here, we used multivariate functional resonance imaging (fMRI) to test whether the precision of face expectations can be measured together with expected face-identity in these face-sensitive regions (i.e., lower-level fusiform face area (FFA) and higher-level anterior temporal lobe (aTL)).

Methods

Participants were trained to relate images of scenes and faces (n = 31). Each scene predicted three faces: one with low, one with intermediate, and one with high probability (10, 30, or 60 %).

An independent functional localizer run was recorded before the training to define face-sensitive regions of interest (FFA and aTL) (Blank, Kiebel, & von Kriegstein, 2015). We used representational similarity analysis (RSA) to test whether multivariate pattern similarity between presented and expected faces depends on the prior strength (Nili et al., 2014).

Results

Behavioral results Participants associated the three scenes and faces with the corresponding low, intermediate, and high probabilities.

Multivariate fMRI results During presentation of face images, RSA showed that face-identity specific representational similarity across faces presented in the localizer and in the test run increased with surprise in the FFA, (r = 0.1037, p = 0.0201) and the right insula (r = 0.1139, p = 0.0124). During anticipation of face images, representational similarity between presented faces in the localizer and expected faces during scene presentation in the test run depended on the strength of the face expectation in the aTL (r = 0.0697, p = 0.0277).

Discussion

This finding supports theories of predictive coding which suggest that the prior precision is co-localized with the representation of the prior itself (Egner, Monti, & Summerfield, 2010; Friston, 2005).

Acknowledgments

References

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