

Contextual modulations at low and high levels of visual perception: functional (in)dependence and influence of low contrast

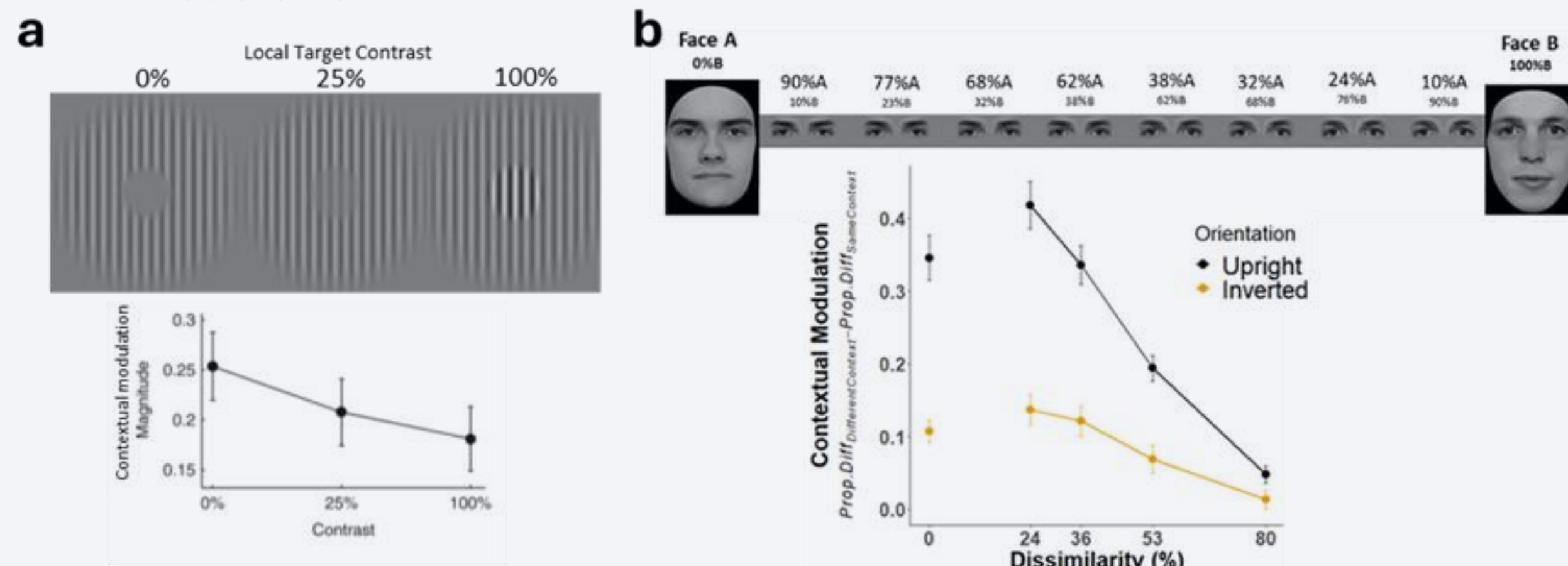
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Background

- Spatial context modulates perception at low- and high levels of visual processing
- Contextual modulations (CM) for faces presumed to rely on high-level, specialized mechanisms, with little contribution of low-level contextual mechanisms.
- Magnitude of both low- and high-level CM depends on local input strength:
 - Low-level CM: target contrast^[1,2].
 - High-level CM: facial feature dissimilarity. The more dissimilar the facial features are, the weaker the contextual modulation^[3,4].

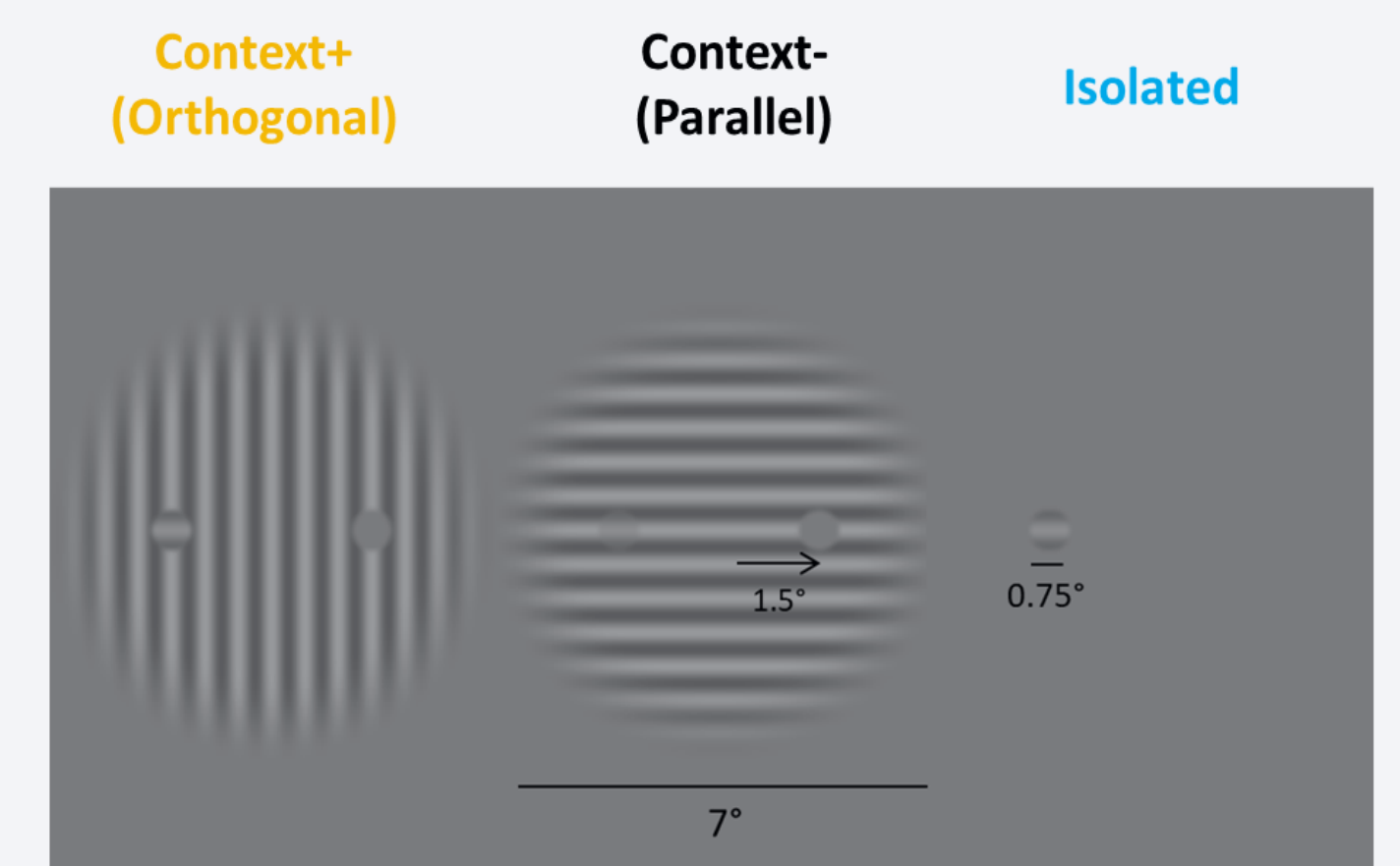


Research question: Are CM for faces partly accounted for by low-level and V1-based mechanisms? → Is individual susceptibility to CM at low and high processing levels functionally related?

Methods

Low level task :

- Contrast detection (psy staircase) with 3 contexts
- Which side did the target appear ? Left or Right ?



High level task :

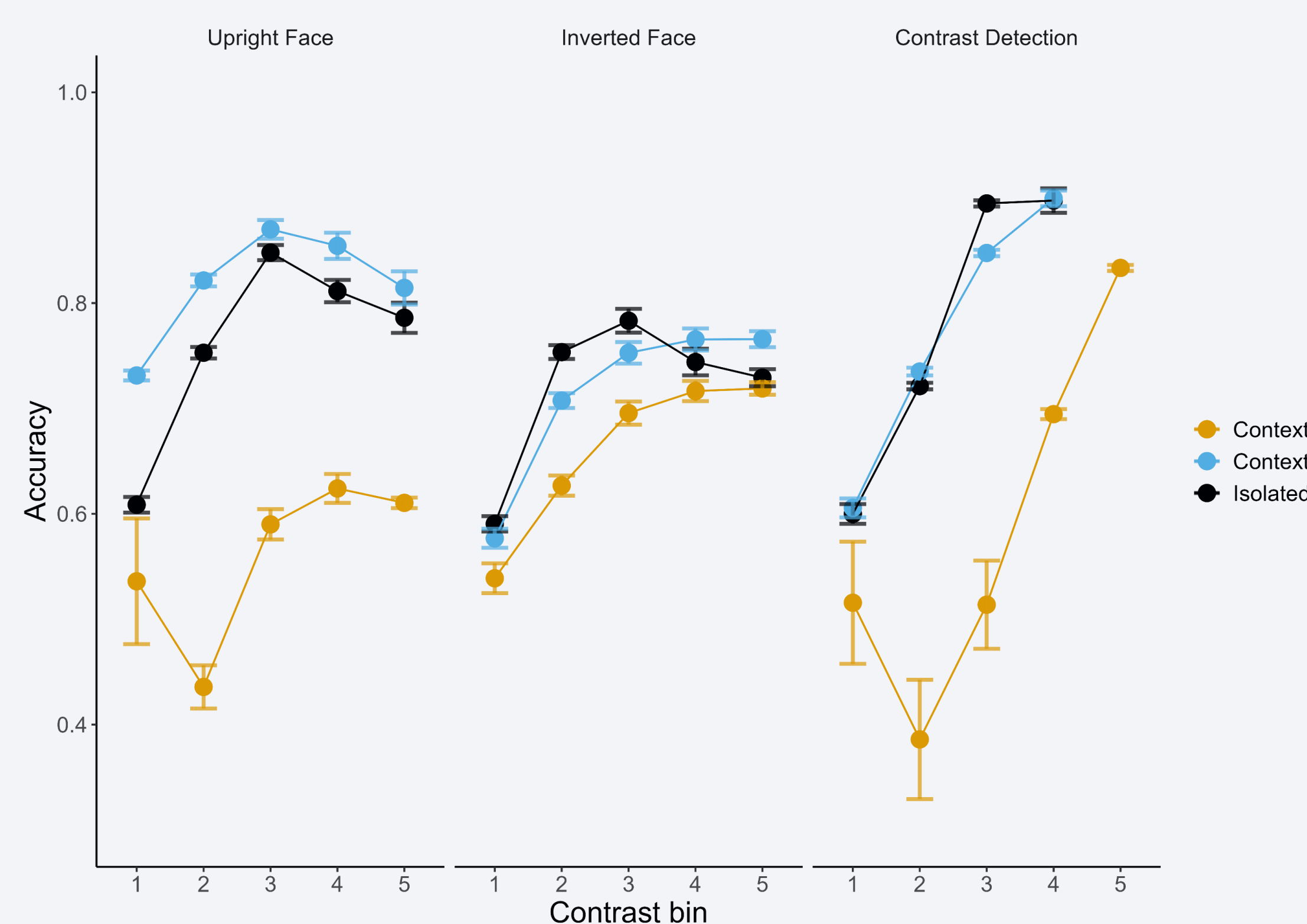
- Delayed matching paradigm (psy staircase)
- 2 orientations (upright/inverted)
- Is the eye region strictly identical or not ?



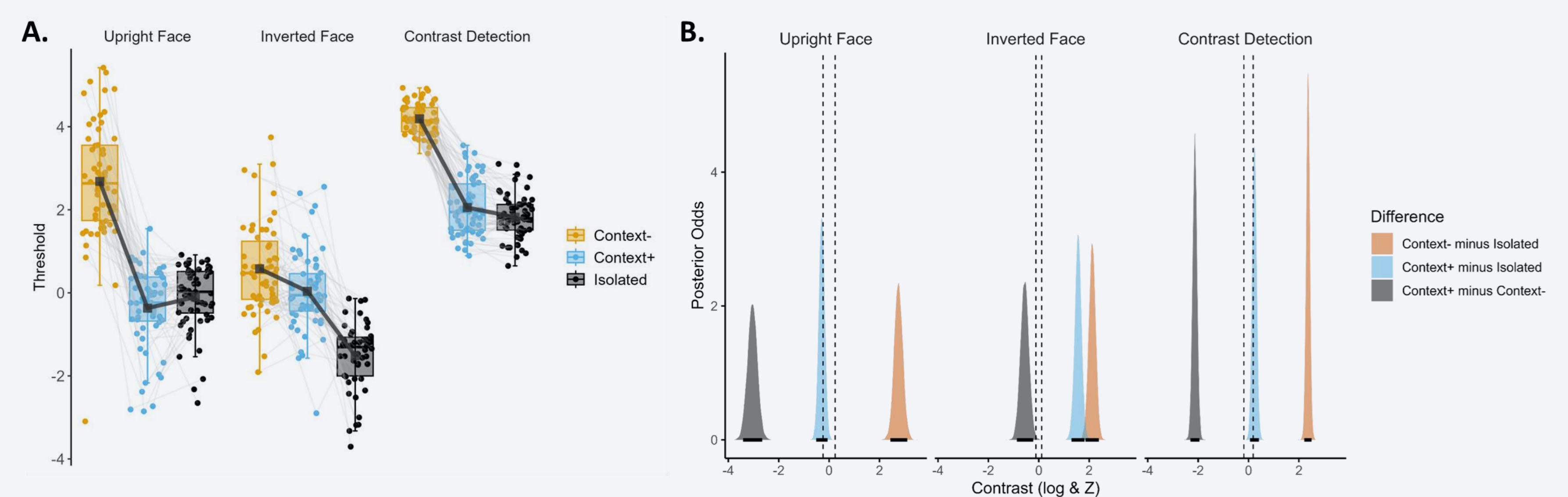
Participants (n=60) performed tasks.

CM modulation profile & magnitude

Across tasks, CM magnitude decreases as a function of local target contrast: the higher the contrast, the weaker the difference across contextual conditions.

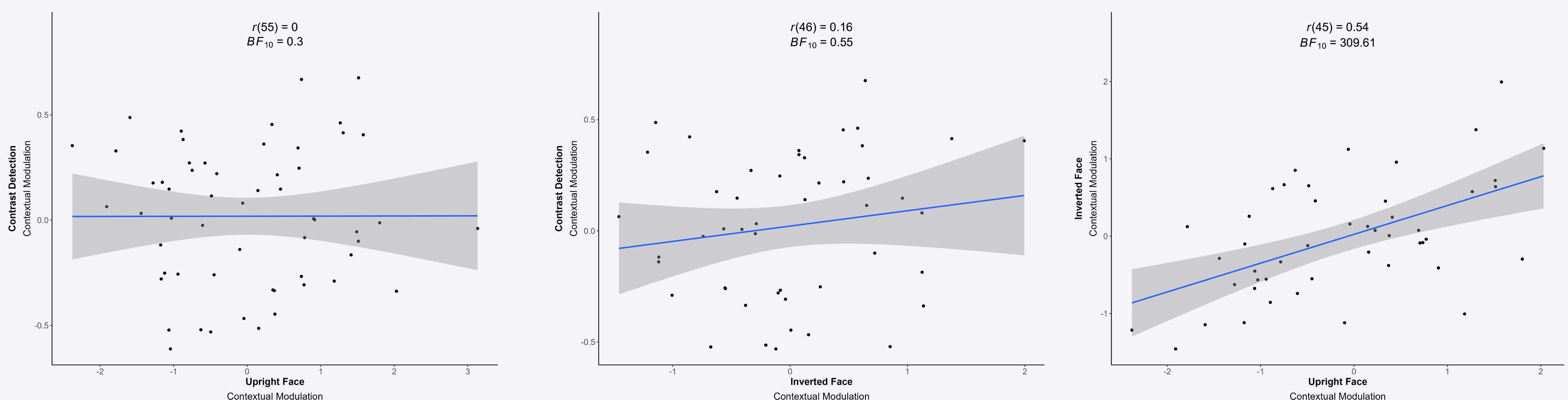


Upright face and contrast detection tasks: suppressive context (Incongruent and Parallel) interfered (i.e., elevated threshold) with local processing substantially. Inverted face: weak CM overall; both context types (Incongruent and Congruent) interfere with local processing.



- Z-scaled threshold values for each condition in the facial feature discrimination task (Upright Face, Inverted Face) and the contrast detection task.
- Posterior odds of the difference between the contextual conditions.

Correlation of CM magnitude across tasks



CM magnitude values are the product of regression of regression method for each task. Blue line indicates the regression line and shaded area covers standard error bounds.

Discussion

In line with past evidence^[3,4] :

The magnitude of CM depend on local input contrast both in low- and high-level vision .

The absence of correlation between low- and high-level CM magnitude suggest independent underlying mechanisms.

CM in inverted faces are weaker than in upright faces but rely on partially similar mechanisms.

Low- and high-level contextual modulations have similar working principles but are functionally independent.

Support for the existence of high-level mechanisms specialized for the natural statistics of the human face.

Contact

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References.

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- Angelucci et al., J. Neurosci., 2002.
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- Canoluk, Moors, Goffaux, V. PLOS ONE., 2023