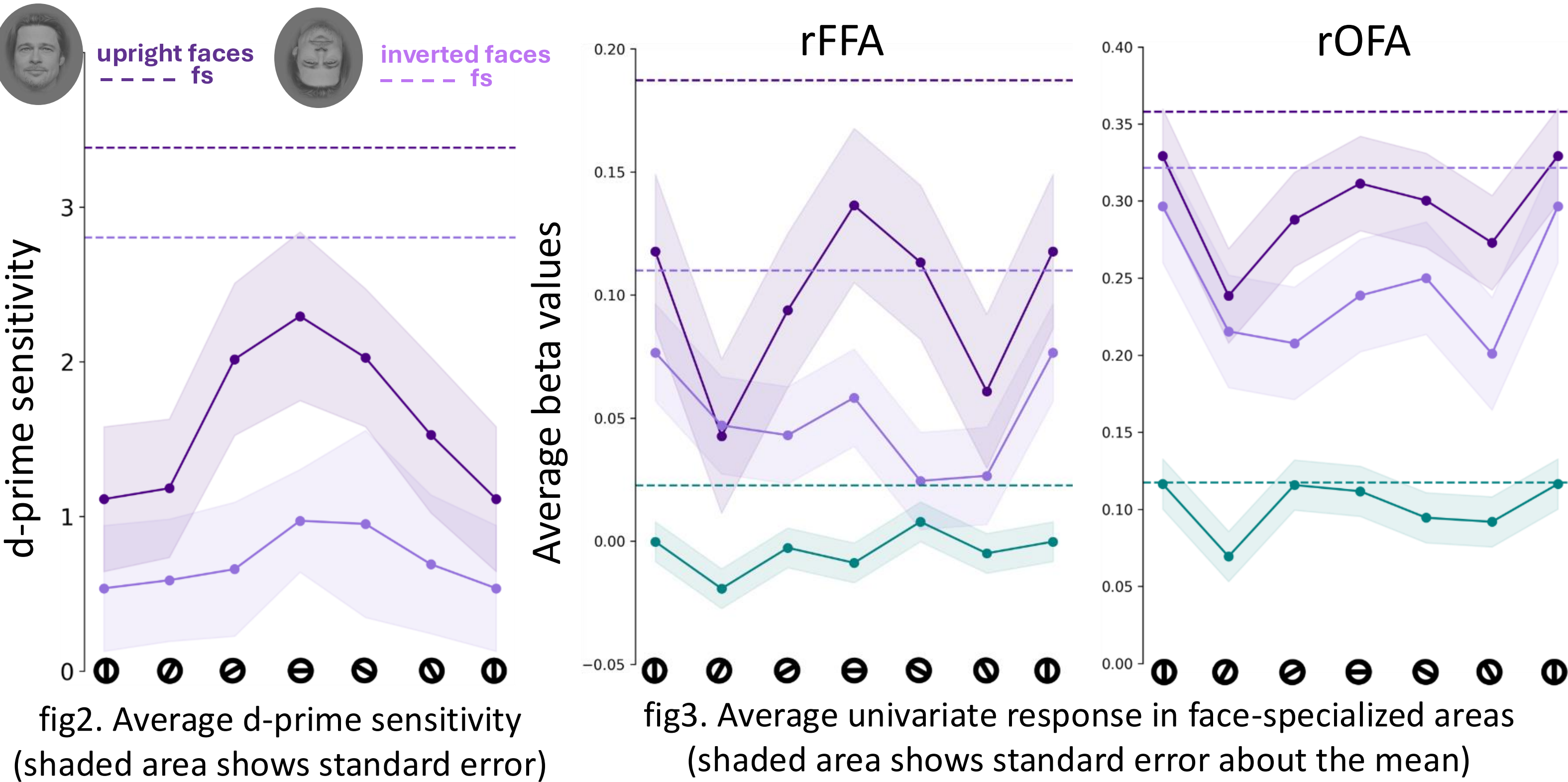


Introduction

- Human observers identify faces best based on horizontal cues. This horizontal tuning is severely disrupted when the face is inverted.¹⁻²
- Previous neuroimaging results have shown this horizontal tuning for upright face processing in fusiform face area (FFA).³
- Primary visual cortex (V1) is thought to interact recurrently with high-level visual areas to refine visual representations.⁴⁻⁵
- Orientation selectivity being a core property of V1 cells, our aim was to investigate whether high-level face-specialized mechanisms influence orientation-selective coding in V1.

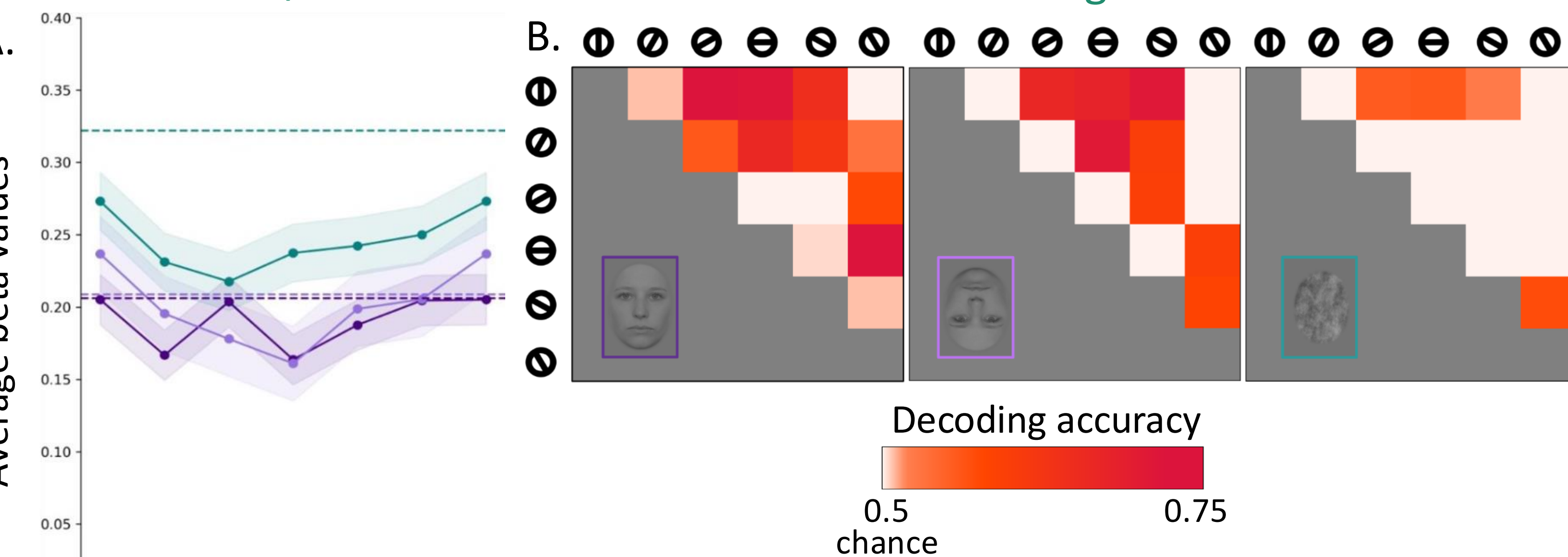
Orientation tuning for faces in the brain and behavior



- Identity recognition is tuned to the horizontal range of upright face information. Such tuning is disrupted by inversion.
- Face-specialized areas show higher responses to cardinal orientations, with FFA tuned to the horizontal range.

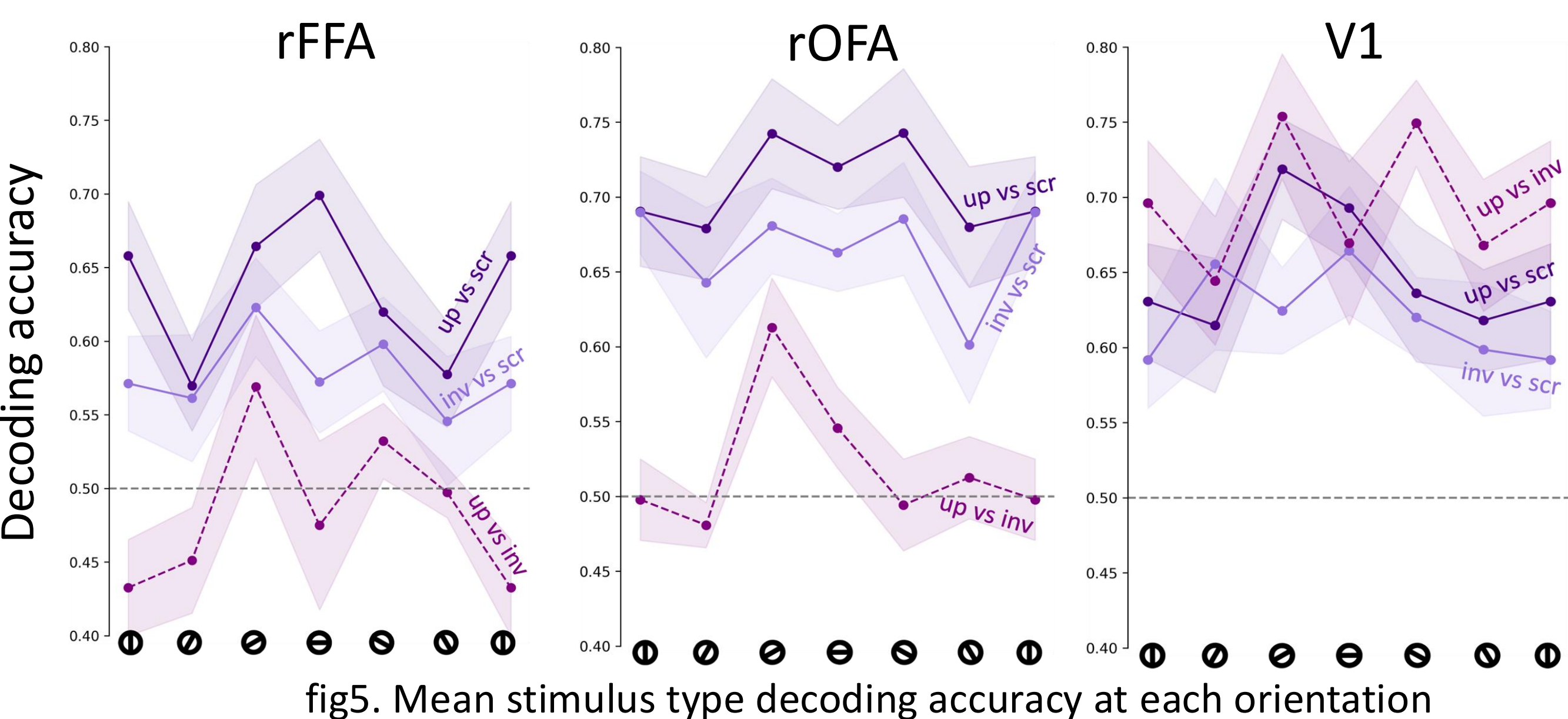
Sharpening in V1?

Univariate response in V1



- V1 exhibits suppressed responses at the horizontal range for faces.
- Despite this suppression in the horizontal range, orientation decoding is best at cardinal orientations for faces.
- Orientation selectivity decreases in sharpness for scrambled images.

Decoding stimulus type from voxel patterns



- Upright faces are classified against scrambled more reliably around the horizontal range in all ROIs.

Conclusions

- Orientation selectivity in V1 is modulated by stimulus type.
- Face representations in V1 are sharper in the horizontal range than other orientations.
- Despite the lack of direct top-down sharpening from face-selective areas, these preliminary findings suggest that V1 orientation selectivity is influenced by higher-level natural statistics of the human face.

Methods

- 3T fMRI neuroimaging** (orthogonal task; n = 10) with unfamiliar faces (upright, inverted, scrambled).
- Psychophysics** (identity matching task; n = 10) with faces of famous male celebrities (upright, inverted).

Orientation-filtered stimuli were generated by applying a wrapped Gaussian filter (std = 15°) at specific orientations (0° - 180° in steps of 30°) to the Fourier-transformed image.

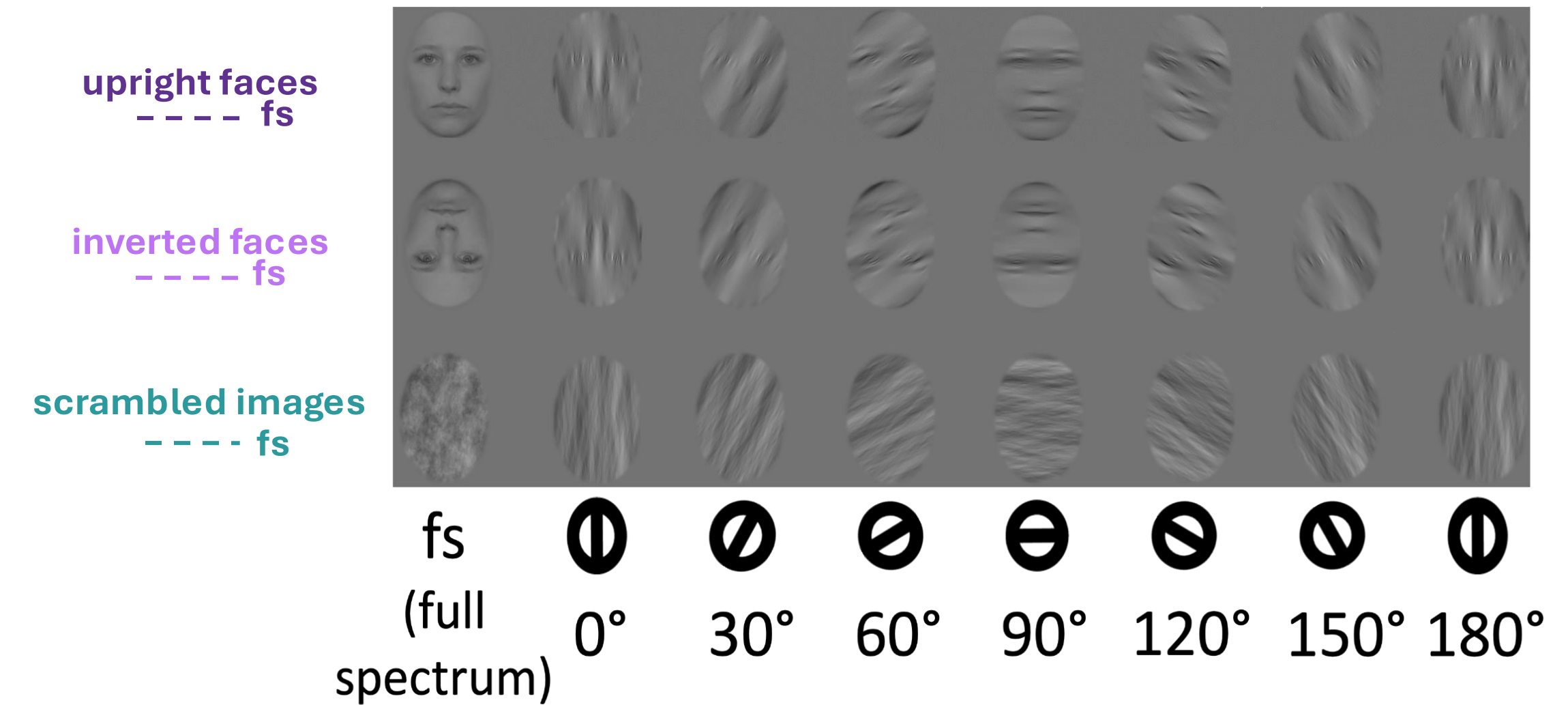


fig1. Example of orientation-filtered stimuli in the fMRI task (Stimuli in the psychophysics experiments are generated similarly, but with celebrity faces)

Correlations between orientation tuning profiles

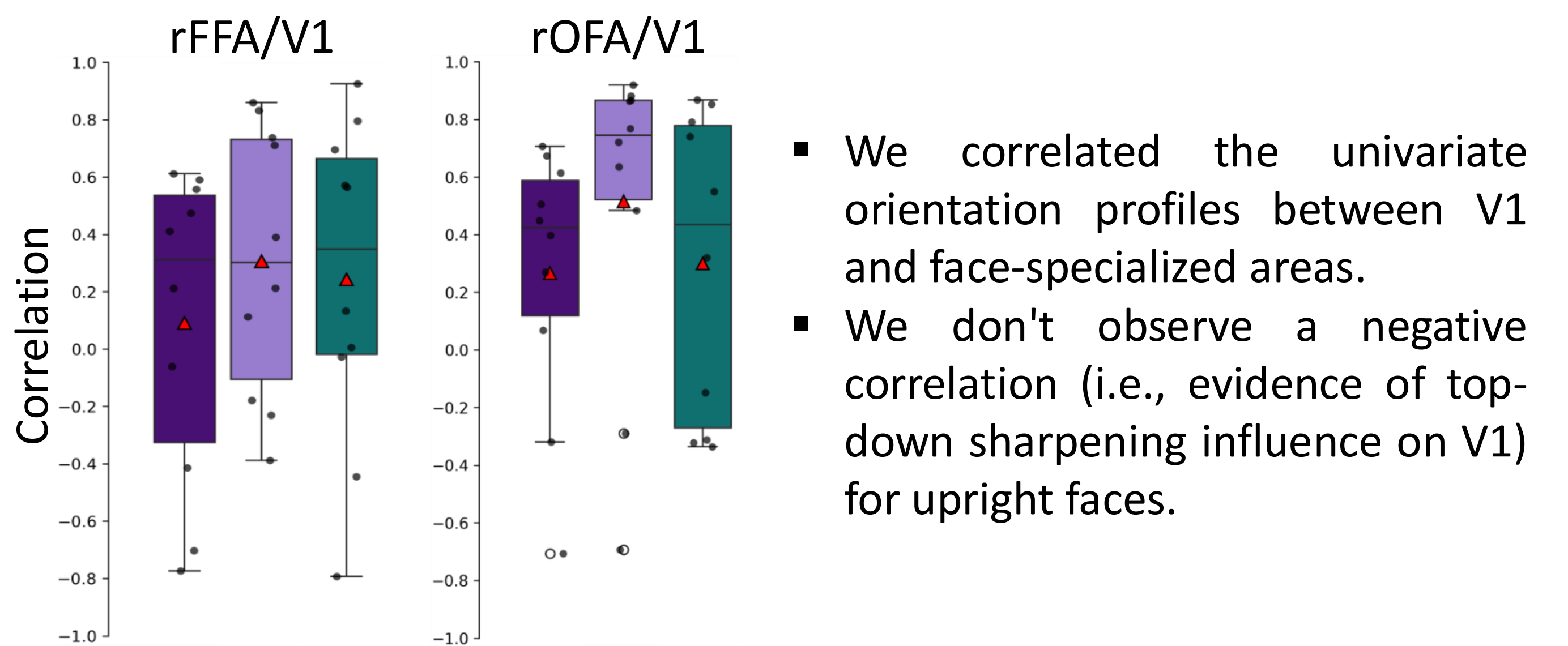


fig6. Pearson correlation between univariate orientation profiles

Brain/behavior correlations of orientation tuning profiles

Correlation of behavior and univariate orientation profiles

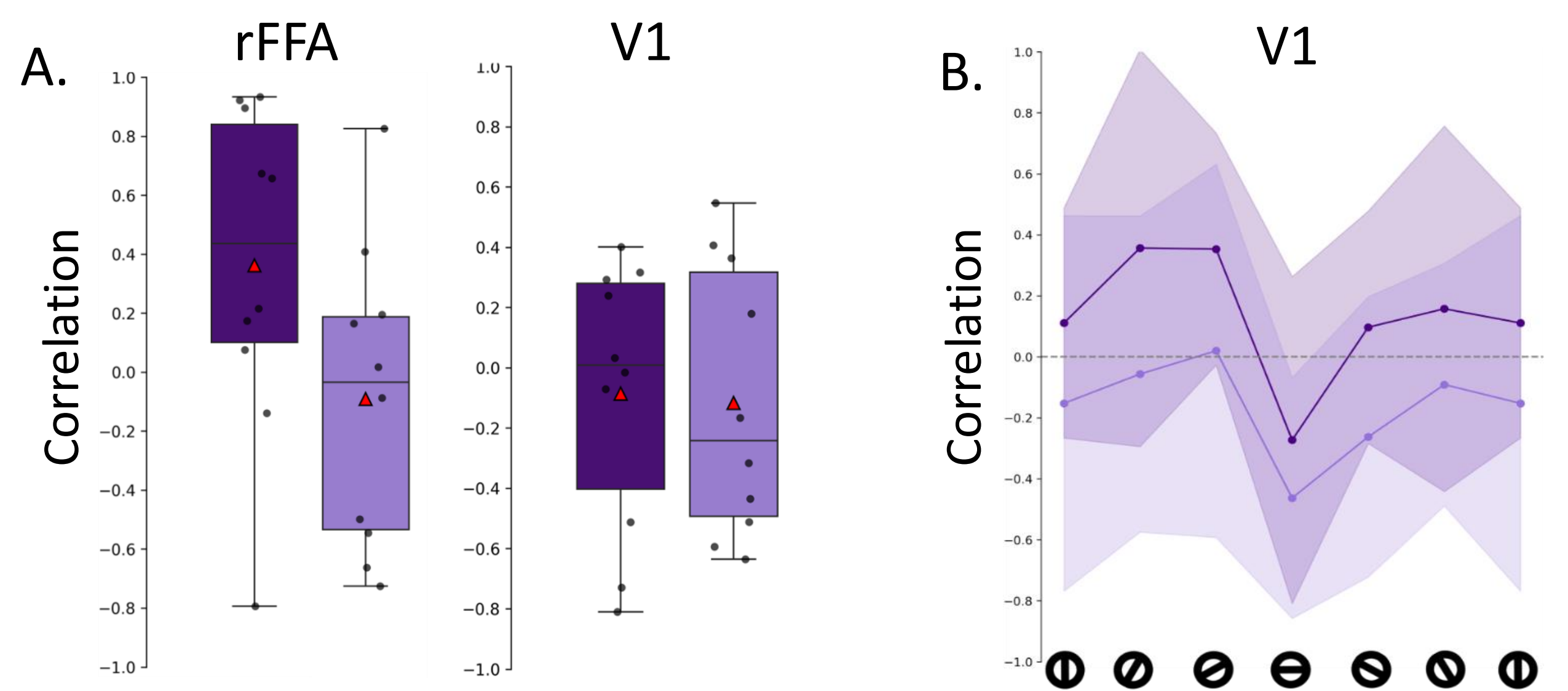


fig7. Pearson correlation between univariate and behavioral: a) orientation profiles and b) per orientation beta-values in V1

- FFA response is positively correlated with identification behavior for upright faces.
- V1 response at the horizontal range shows negative correlation with identity recognition.

Correlation of behavior and V1 orientation decoding

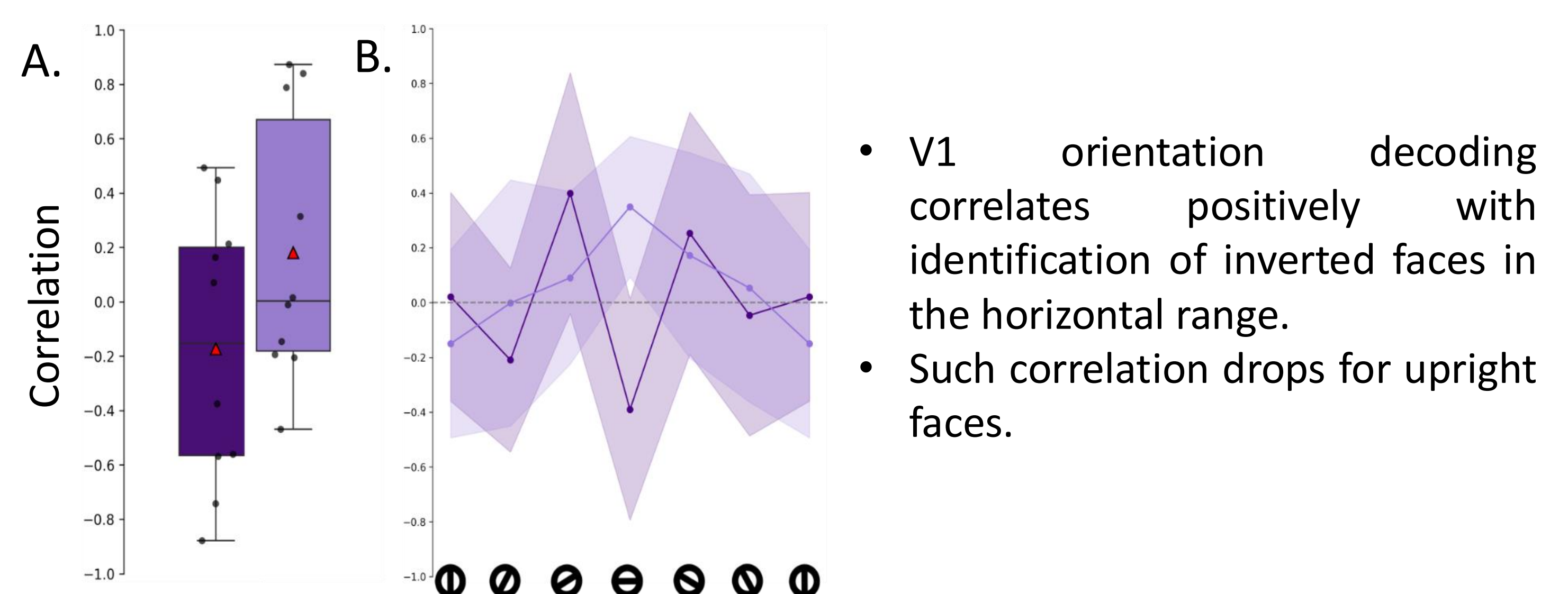


fig8. Pearson correlation between decoding and behavioral: a) orientation profiles and b) per orientation beta-values in V1

- V1 orientation decoding correlates positively with identification of inverted faces in the horizontal range.
- Such correlation drops for upright faces.