The effect of practice with inverted faces on behavioural and ERP horizontal bias

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Background

Information for face identity is carried by contours in a narrow orientation band centred around horizontal.[1,2]

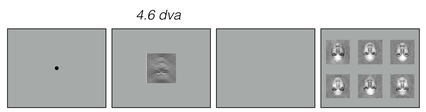
Horizontal bias, a measure of the strength of the selective use of horizontal structure, is associated with the identification accuracy of unfamiliar[2] and familiar[3] upright faces, and trained inverted faces.[4]

The N170 for upright faces is driven by horizontal structure[5,6], but the N250 amplitude is related to horizontal bias.[5]

Are face-related ERPs related to the orientation structure of *inverted* faces, and how does the relation depend on learning?

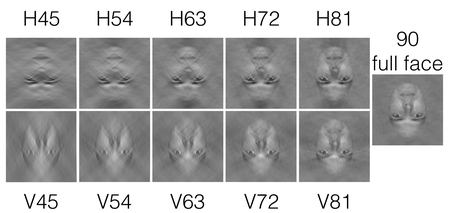
Methods

Task: 1-of-6 inverted face identification task.



DV: response accuracy & EEG

IV: Filter orientation (Horizontal/Vertical)
Bandwidth (±45, 54, 63, 72, 81, or 90°)
Training (pre/post)



n: 11 young adults (M = 21.9, SD = 2.8, 4 female)

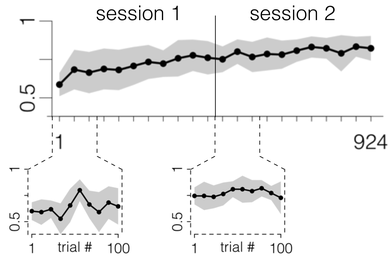
Day 1: identify filtered + full faces (42 trials/condition)
Day 2: identify unfiltered (full) faces (462 trials)
Day 3: identify unfiltered (full) faces (462 trials)
Day 4: identify filtered + full faces (42 trials/condition)

EEG was collected on days 1 & 4

EGI 256 channel, *Cz* ref., bandpass filtered (1-30 Hz)

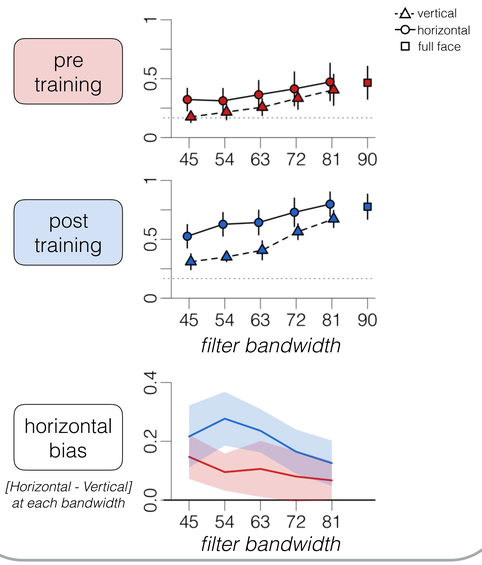
Behaviour

1. Training improved response accuracy to unfiltered, inverted faces.

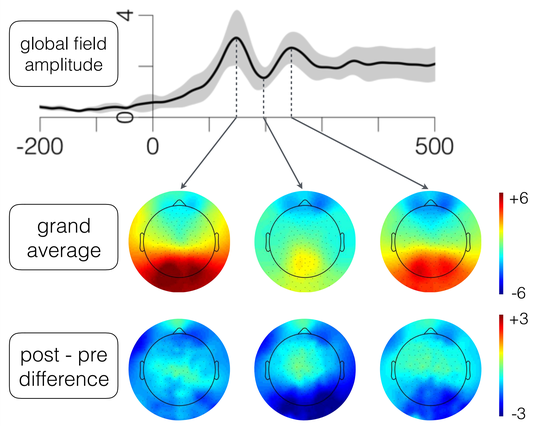


**shaded regions & error bars are always 95% confidence intervals*

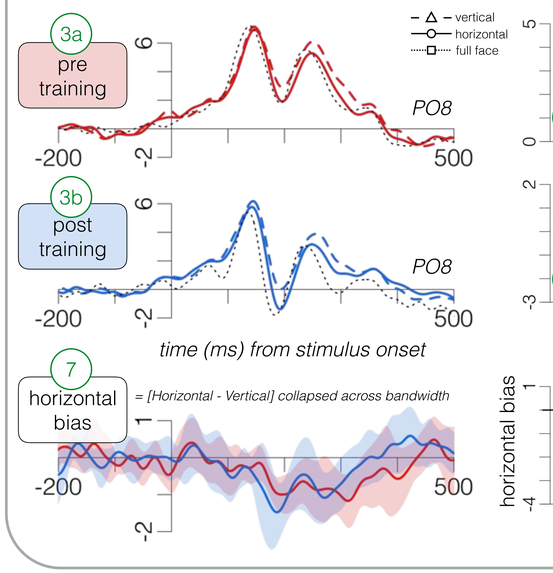
2. Training strengthened horizontal bias (i.e., higher accuracy for H than V).

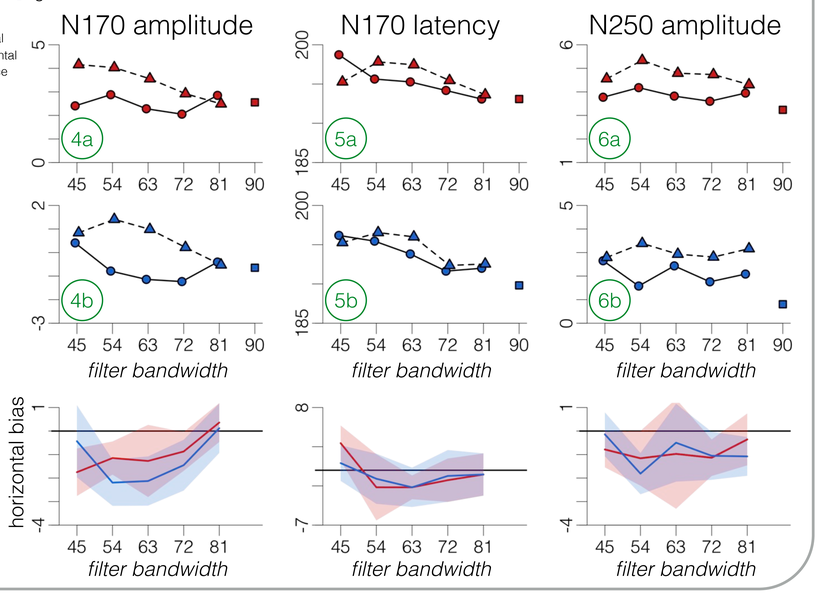


ERP Results



3. ERP components were more negative after training. Largest learning effects were in the N170 time window.
4. N170 amplitude was more negative to horizontal than vertical filtered faces. Training increased the difference.
5. N170 latency was sensitive to filter bandwidth, but not filter orientation. Training had no effect.
6. N250 amplitude was more negative to horizontal than vertical filtered faces. Training had no effect.
7. Average ERP horizontal bias was larger, and slightly earlier, after training.

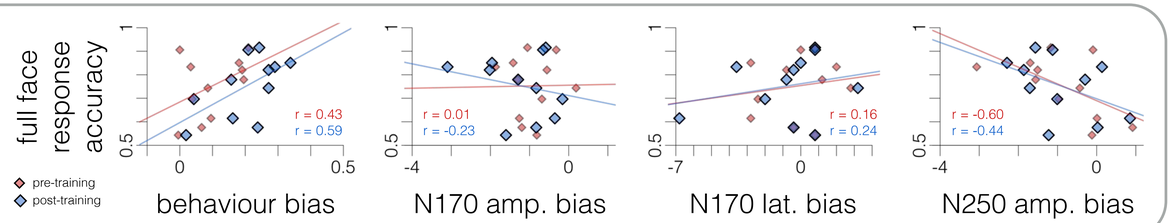




Correlations

8. Full face accuracy was best correlated with behavioural and N250 amplitude measures of horizontal bias, but not N170 amplitude/latency.

**bias = ∑(H45:81 - V45:81) / # bandwidths*



Conclusions

Practice with inverted faces improves face identification and strengthens horizontal bias.[4]

ERPs to inverted faces are more negative after training, but, like upright faces[5], they are sensitive to orientation structure before training.

Behaviour and N250 amplitude sensitivity to horizontal structure are good measures of horizontal bias.[5]

1.Goffaux & Dakin, (2010). Horizontal information drives the behavioural signatures of face processing. *Front. Psychol.*
2.Pachai et al. (2013). Sensitivity to information conveyed by horizontal contours is correlated with face identification accuracy. *Front. Psychol.*
3.Pachai et al.,(2017). Personal familiarity enhances sensitivity to horizontal structure during processing of face identity. *J. Vis.*
4.Pachai et al., (2018). The effect of training with inverted faces on the selective use of horizontal structure. *Vis. Res.*
5.Hashemi, et al., (2018). The role of horizontal facial structure on the N170 and N250. *Vis. Res.*
6.Jacques et al., (2014). Face perception is tuned to horizontal orientation in the N170 time window. *J. Vis.*