Trait anxiety moderates visual pathway contributions to the processing of clear versus ambiguous threat

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Background

• Fear expressions combined with averted gaze clearly signal where threat resides. Fear expressions coupled with direct gaze, however, are more ambiguous.

• Amygdalar responses have been found to be greater to clear threat when rapidly presented (300 ms) and to ambiguous threat for more sustained presentations (1 s; Adams et al., 2012). Similar flips have been reported as a function of anxiety (Ewbank et al., 2010).
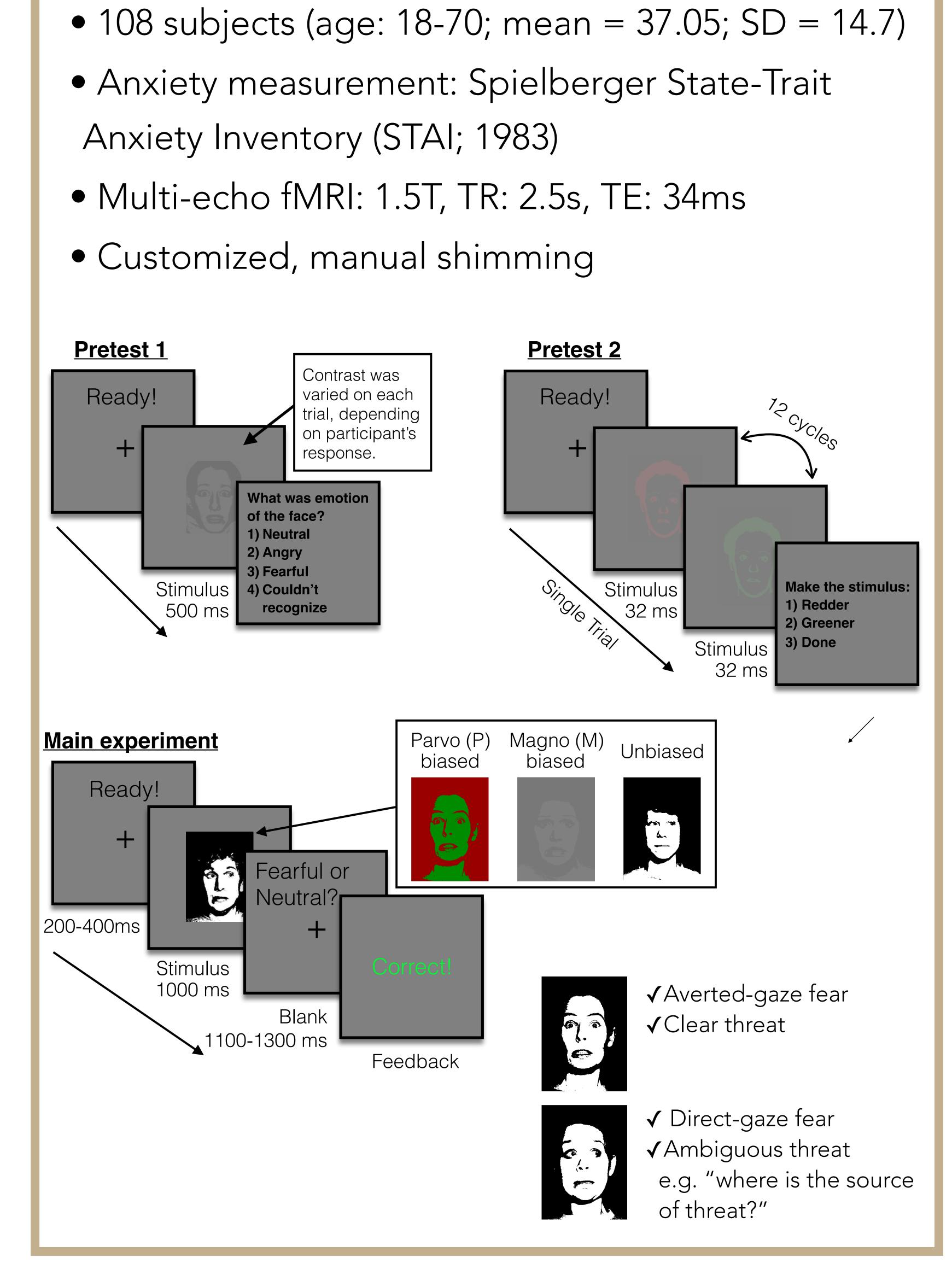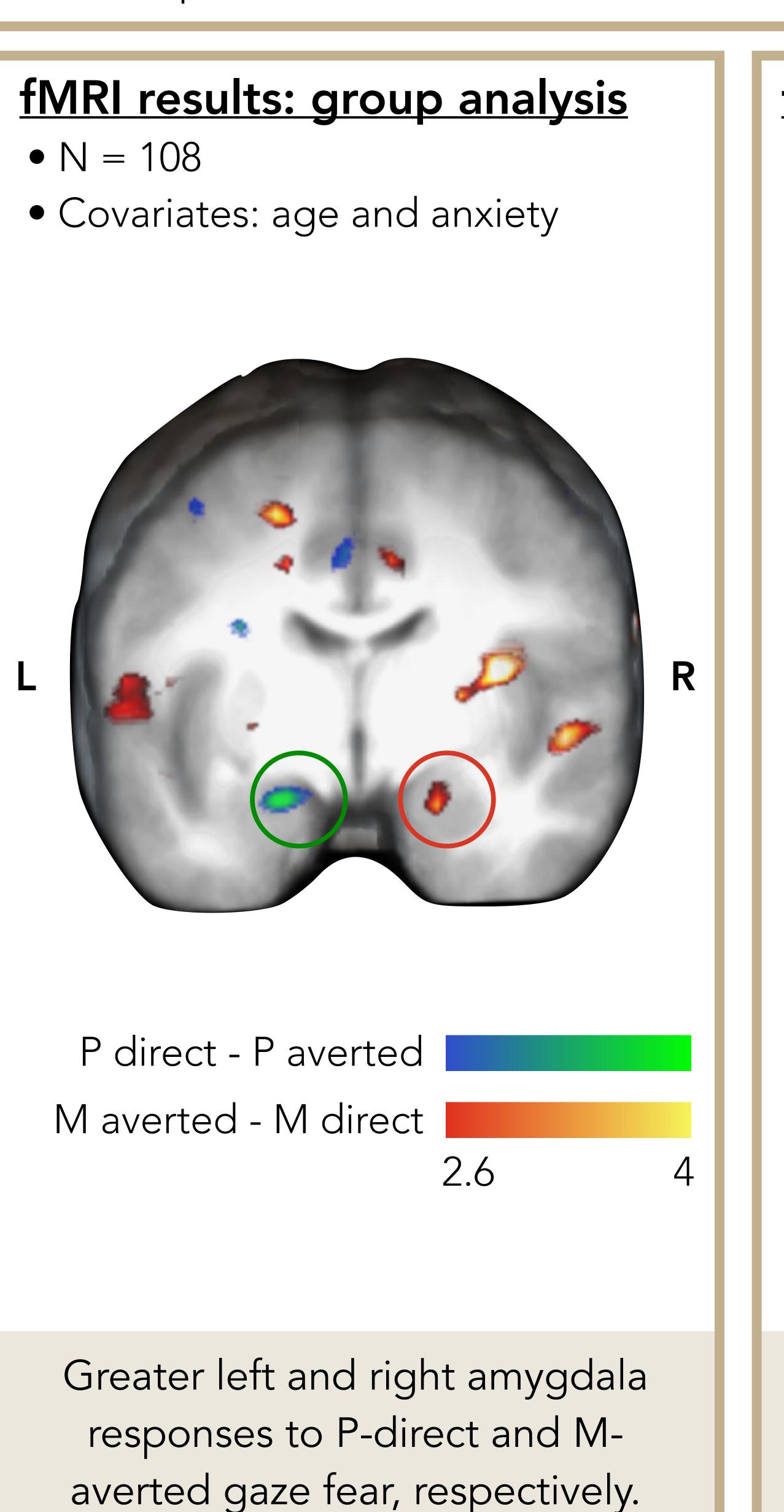
Research objectives

• Understanding differential contributions of the magnocellular (M) and parvocellular (P) pathways to processing facial threat cues.
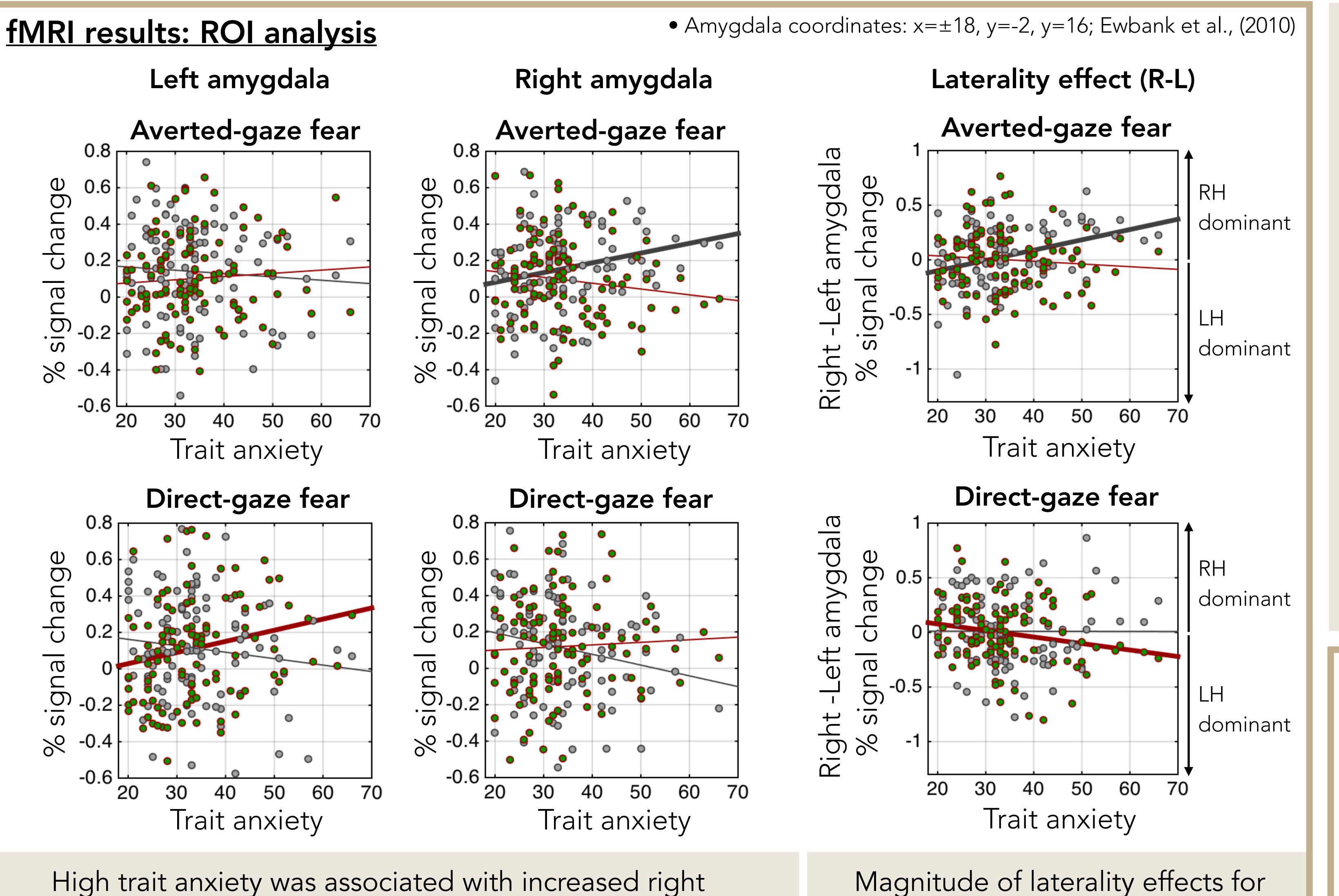
• Understanding the moderating role of trait anxiety on neural responses to threat.

Method

• 108 subjects (age: 18-70; mean = 37.05; SD = 14.7)

• Anxiety measurement: Spielberger State-Trait Anxiety Inventory (STAI; 1983)

• Multi-echo fMRI: 1.5T, TR: 2.5s, TE: 34ms

• Customized, manual shimming

Behavioral results

Faster RT with higher anxiety for M- and P-averted fear

Better accuracy with anxiety for M-averted fear

Accuracy decreased with anxiety for P-direct fear

- P-biased
- M-biased

fMRI results: group analysis

• N = 108
• Covariates: age and anxiety

P direct - P averted
M averted - M direct
2.6 — 4

Greater left and right amygdala responses to P-direct and M-averted gaze fear, respectively.

fMRI results: ROI analysis

• Amygdala coordinates: x=±18, y=-2, y=16; Ewbank et al., (2010)

Left amygdala — Averted-gaze fear / Direct-gaze fear

Right amygdala — Averted-gaze fear / Direct-gaze fear

Laterality effect (R-L) — Averted-gaze fear / Direct-gaze fear

High trait anxiety was associated with increased right amygdala for M-averted gaze fear and increased left amygdala for P-direct gaze fear.

Magnitude of laterality effects for M-averted and P-direct gaze fear increased with higher trait anxiety.

Conclusion

• M and P pathways are geared towards processing clear threat and ambiguous threat cues in facial fear (reflexive vs. reflective processing), respectively.

• Observers' trait anxiety specifically modulates these two major visual streams, both facilitating processing of M-biased clear threat cues and interfering with processing of P-biased ambiguous threat cues.

• Trait anxiety also differentially modulates the left and right amygdala reactivity to P-biased ambiguous and M-biased clear threat cues, respectively.

References

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