



# A Functional Neuroimaging Investigation of Moral Foundations Theory



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## BACKGROUND

Moral Foundations Theory (MFT) posits that human morality is comprised of distinct psychological systems that are innate and elaborated upon via cultural learning.<sup>1</sup>

The foundations—*harm (physical and emotional), fairness, loyalty, purity, authority, liberty*—can be organized into superordinate categories that emphasize the value of individuals (individualizing: *harm and fairness*) vs. the value of group unity (binding: *loyalty, purity, authority*).<sup>2,3</sup>

We use functional neuroimaging to investigate whether neural activity during moral judgments reflects the structure of MFT.

## STUDY DESIGN

27 healthy, right-handed adults (14 male; age=24.65 (4.21) years) judged the Moral Foundations Vignettes<sup>3</sup> while in the scanner.

**You see a teenager urinating in the wave pool at a crowded water park.**

1 Not morally wrong    2    3    4 Extremely morally wrong

6000 ms

**Index**    **Middle**  
**Odd**    **Even**

5

- 120 vignettes
- 15 per foundation
- Incidental encoding
- Even/odd active baseline between trials
- TR = 2000 ms

Jittered around 5000 ms

Recognition memory and confidence were tested after scanning.

**You see a teenager urinating in the wave pool at a crowded park.**

1 amusement    2 theme    3 water    4 new

Self-paced

**Confident?**

1 Not at all    2 Somewhat    3 Very    4 Extremely

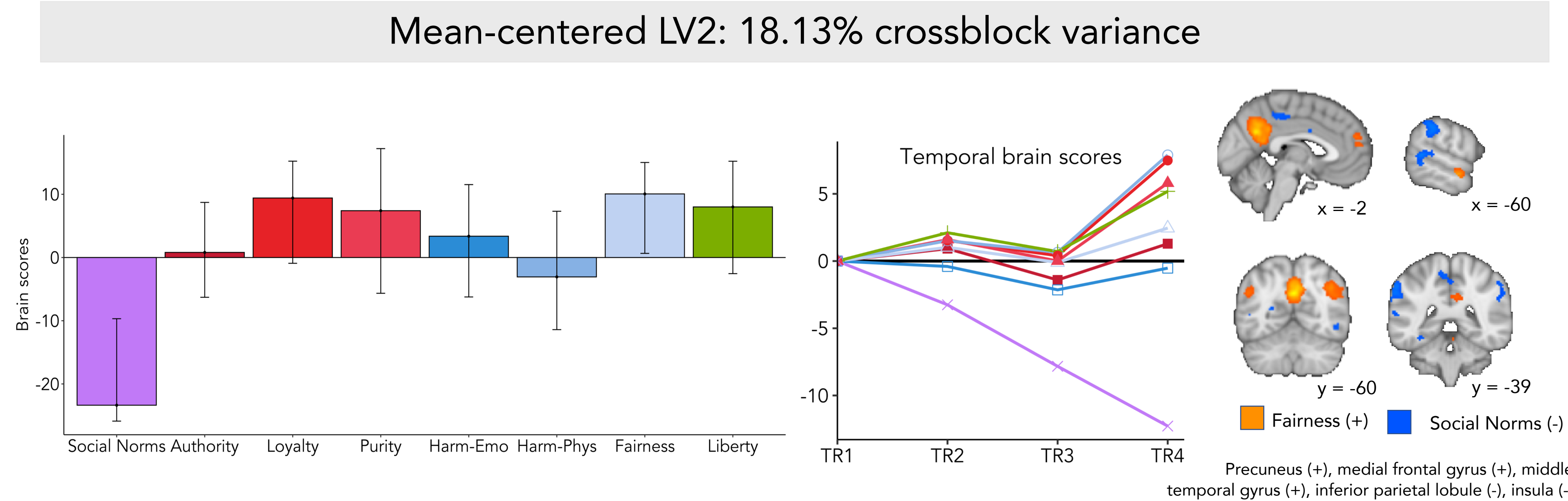
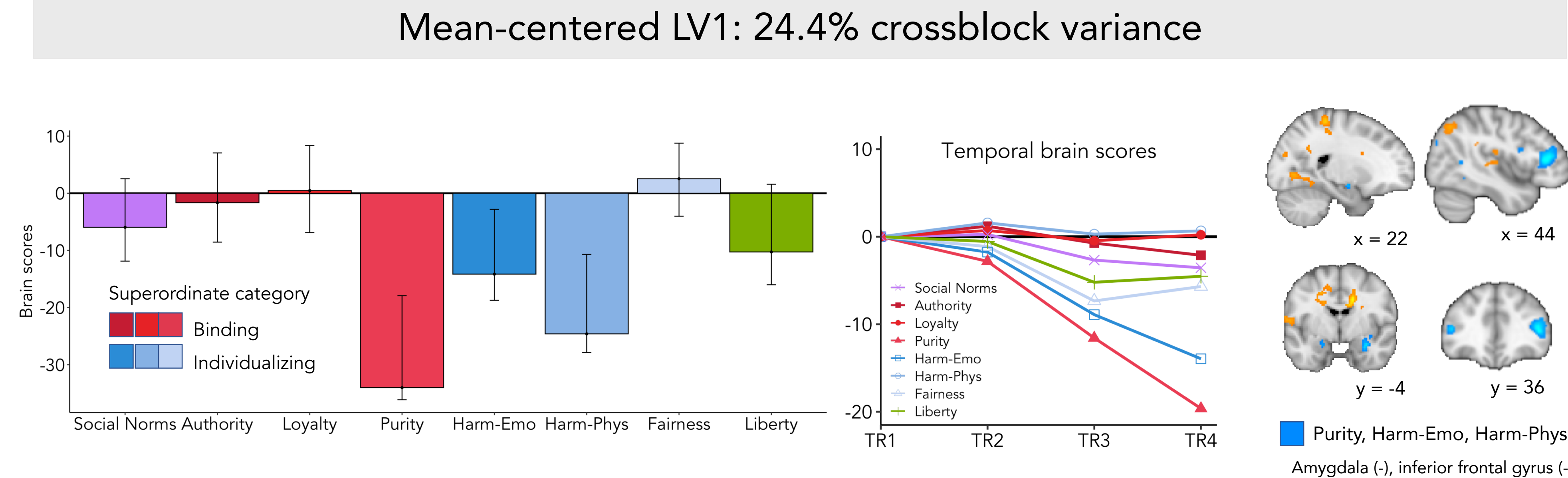
Self-paced

- All 120 vignettes from encoding
- 7-8 lures per foundation
- 183 memory & confidence trials

Post-test surveys: IRI (trait-empathy levels), emotional reactions to vignettes (anger, amusement, sadness, contempt, disgust, fear).

**References:**  
Haidt, J., & Graham, J. (2007). When Morality Opposes Justice: Conservatives Have Moral Intuitions Liberals May Not Recognize. *Social Justice Research* (20), 98-116. 2. Graham, J., Haidt, J., & Nosek, B. A. (2009). Liberals and conservatives rely on different sets of moral foundations. *Journal of Personality and Social Psychology*, 96(5), 1029-1046. 3. Iyer, R., Koleva, S., Graham, J., Ditto, P., & Haidt, J. (2012). Understanding libertarian morality: the psychological dispositions of self-identified libertarians. *PLoS One*, 7(8), e42366. 4. Clifford, S., Iyengar, V., Cabeza, R., & Sinnott-Armstrong, W. (2015). Moral foundations vignettes: a standardized stimulus database of scenarios based on moral foundations theory. *Behavior Research Methods*, 47(4), 1178-1198.  
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## SPATIOTEMPORAL PARTIAL LEAST SQUARES



A non-rotated PLS analysis contrasting binding, individualizing, and liberty superordinate foundations failed to reach significance ( $p < .519$ ). Another non-rotated analysis that included liberty with binding foundations also failed to reach significance ( $p < .353$ ). A third non-rotated analysis contrasting social norms to all of the other foundations trended toward significance ( $p < .059$ ).

**Neurally-derived superordinate structure: emotion/empathy, binding, fairness, social norms**

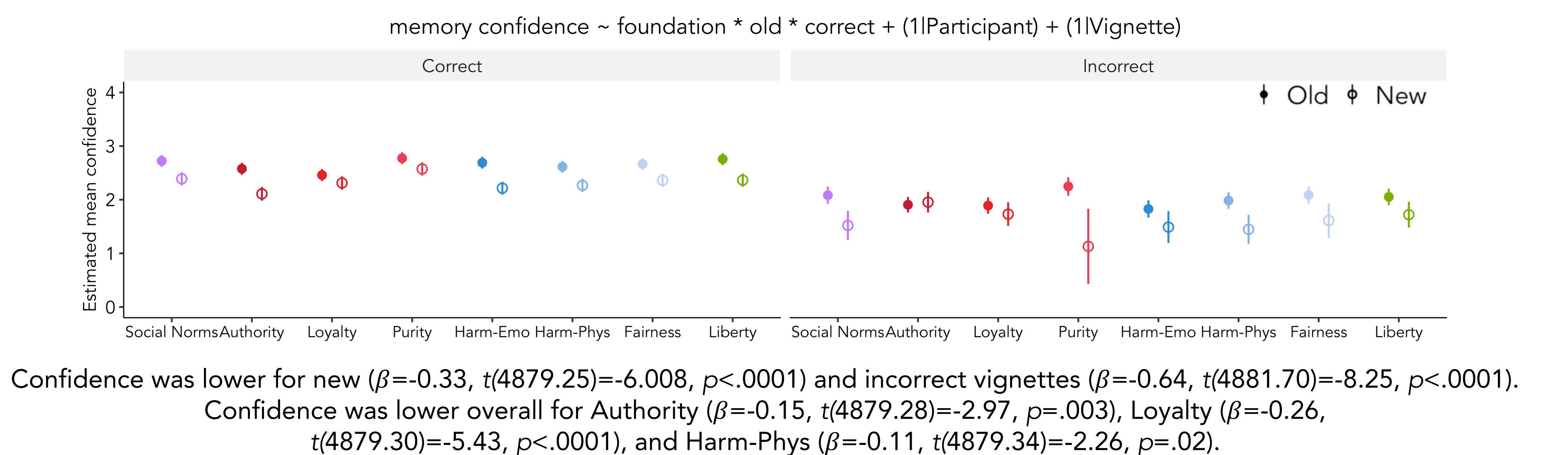
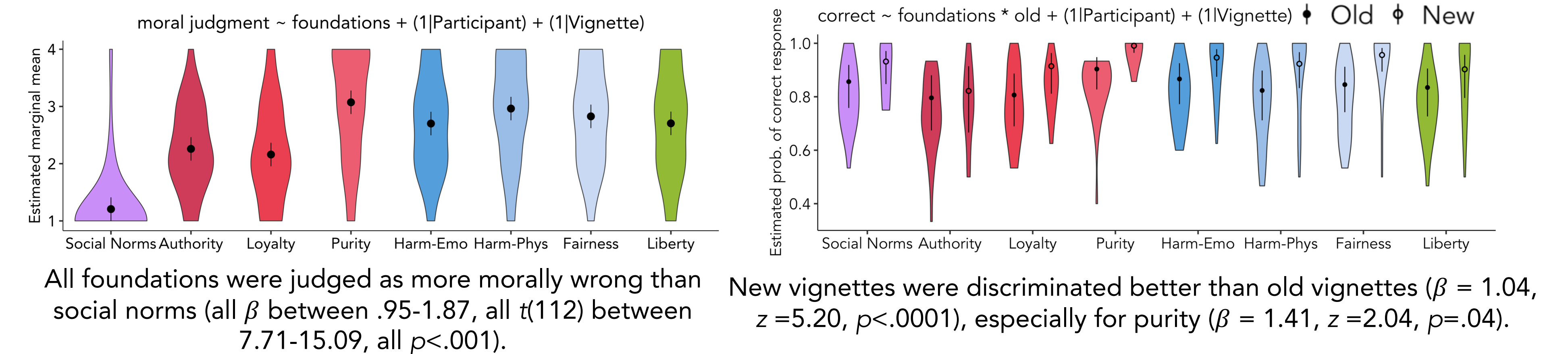
## SUMMARY

Brain activity reflects neither the superordinate- nor foundation-level structure posited by MFT.

Neural data suggests restructuring superordinate categories with respect to emotional and empathic arousal, binding violations, fairness, and social norms. This superordinate structure results in better mixed model fits for moral judgments of and memory for moral transgressions.

Adding trait-empathy and emotional reactions to moral transgressions results in better mixed model fits for moral judgments and memory accuracy than just including the foundations.

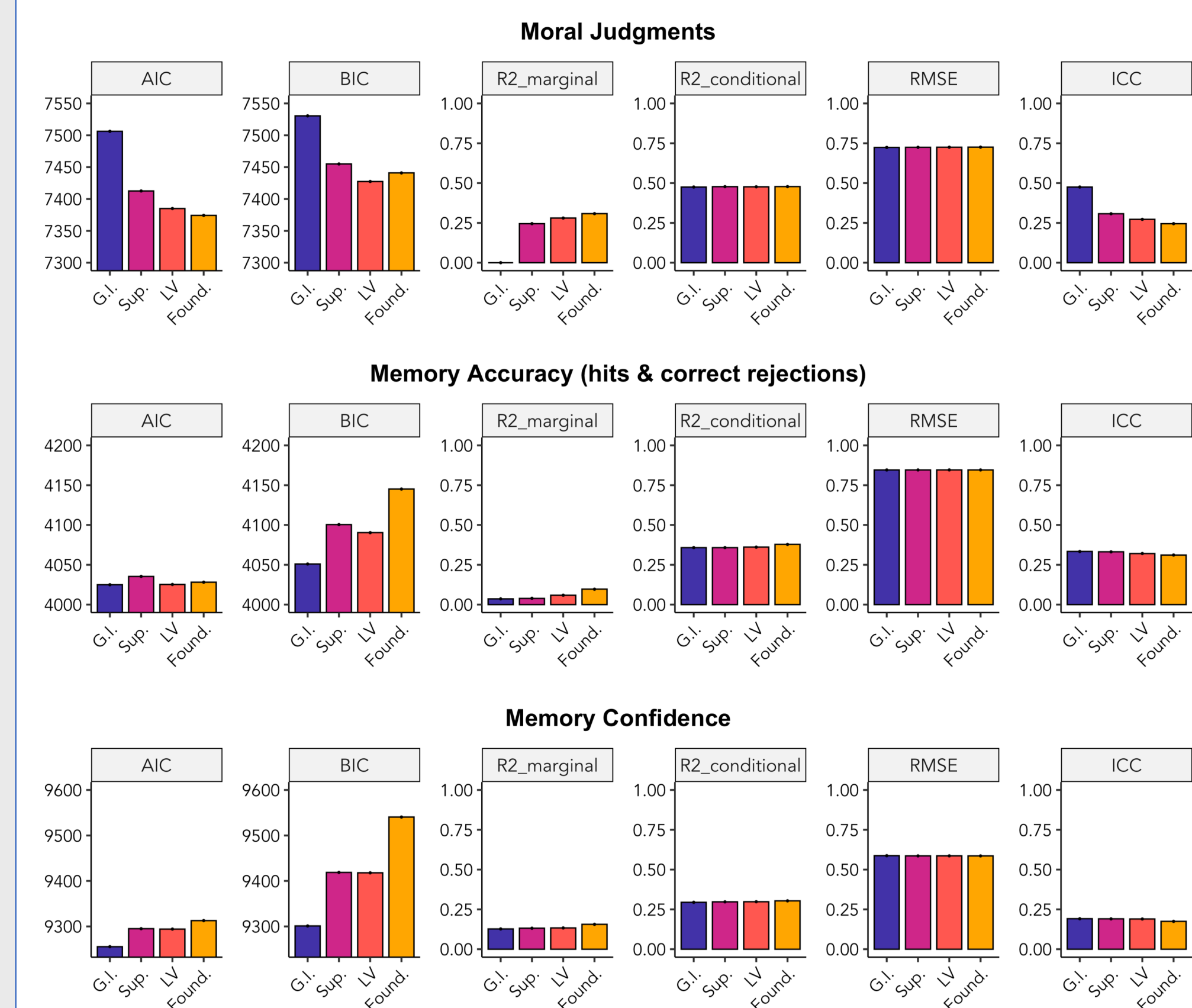
## BEHAVIOR



## Superordinate Comparisons

Global intercept    Traditional Superordinate Structure: Individualizing/Binding

Foundations    Neurally-derived Superordinate Structure: Emotion/Binding



## Emotion & Empathy Comparisons

Global intercept    Foundations + Emotions + Empathy (additive)

Foundations    Foundations \* Emotions + Foundations \* Empathy (interaction)

