No Evidence of Theory of Mind Reasoning in the Human Language Network

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BACKGROUND

Language and **theory of mind** (ToM) are linked in development (Astington et al. 99) and processing (Sperber & Wilson 87). Do they share neural circuitry?

No:

- Distinct brain networks (Fedorenko et al 10; Saxe & Kanwisher 03)
- Dissociable impairment (Dronkers et al 98; Willems et al 11)

Yes:

- Similar cortical topography (**Panel A**)
- Some direct evidence of ToM processing in language areas (Deen et al 15)

MAIN QUESTION

Is the language network engaged in theory of mind reasoning?

METHOD

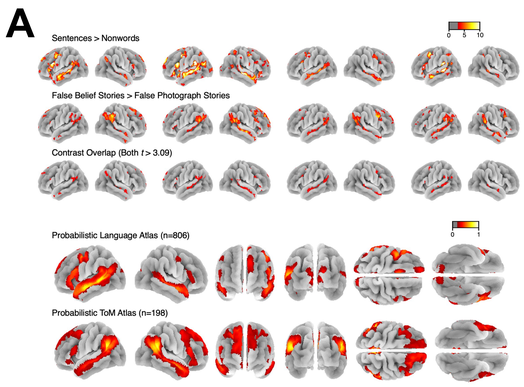
fMRI, 151 participants

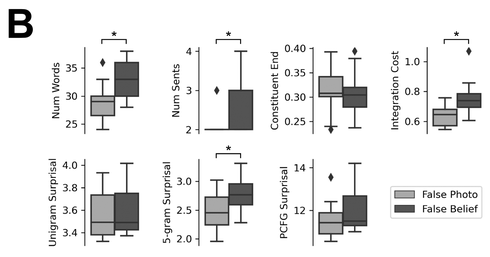
Individual-participant functional localization of:

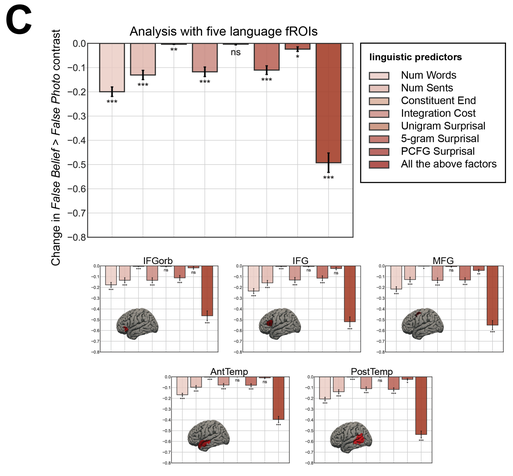
- ToM network
- Core LH language network
- RH language network
- Bilateral angular gyri

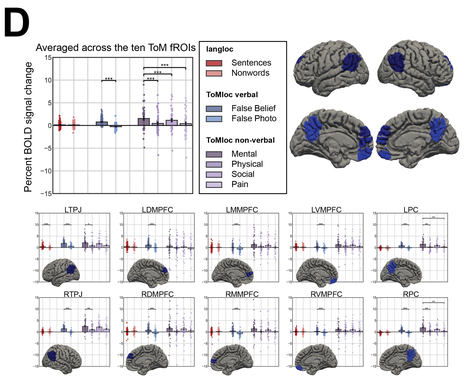
2 tasks:

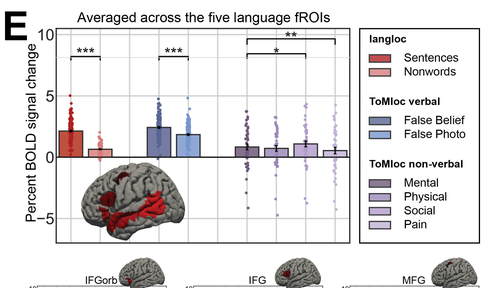
- Verbal ToM: false belief (FB) vs. false photo (FP)
- Non-verbal ToM: mental, physical, social, and pain segments of a Pixar short

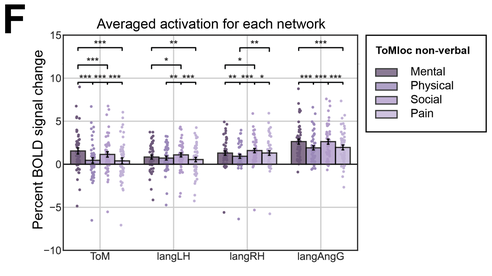


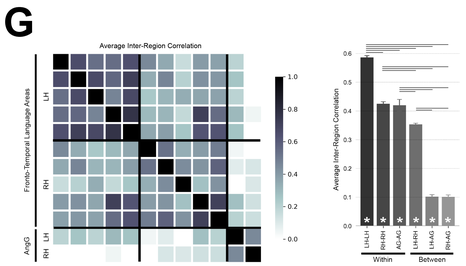


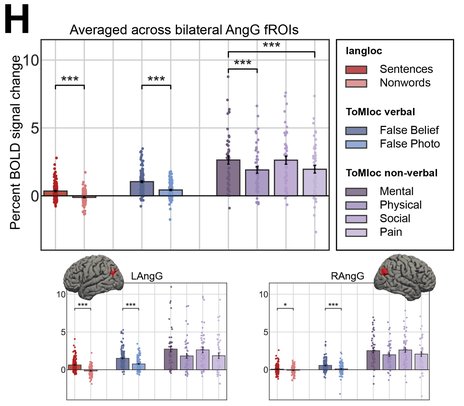


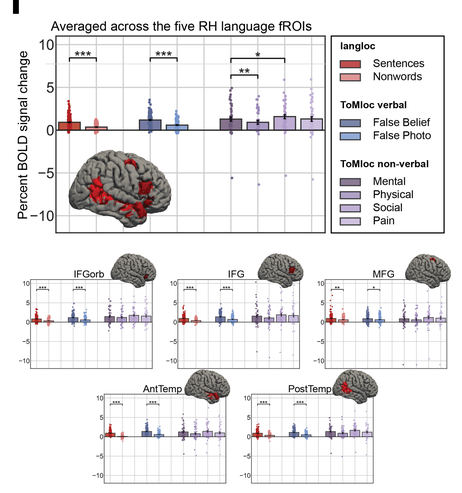












RESULTS

ToM network shows ToM profile (FP > FB; mental > other; **Panel D**)

Language network shows ToM profile **only in the verbal task** (**Panel E**)

Linguistic covariates explain **84%** of verbal ToM effect in the language network (**Panels B & C**)

Language periphery (RH language homotopes and bilateral AngG, **Panel G**) shows social effects but not selectivity for ToM (**Panels H & I**).

CONCLUSION

No evidence of ToM in core LH language network

Prior evidence of overlap using verbal ToM task likely influenced by linguistic factors

Some evidence of broadly social processing in language periphery, possible transition zone between linguistic and social cognition