



Validating an fMRI Task for Assessing Theory of Mind in Clinical Populations: Neural Response and Clinical Correlates



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Background

- **Theory of Mind (ToM):** the ability to infer the mental states of others
- Hundreds of neuroimaging studies have examined ToM correlates, identifying a complex **ToM network**¹
- ToM deficits are associated with psychopathology (e.g., autism spectrum disorder and schizophrenia)²
- Despite the complexity of the ToM network and its clinical significance, few fMRI localizers beyond the **False-Belief Task**^{1,3} have been standardized
- In 2014, Spunt & Adolphs standardized and validated the **Why/How Task** within a sample of healthy volunteers¹
- Our work demonstrates the first application of the Why/How Task in a clinical sample

QUESTION

	Why	How
Face	Is the person expressing self-doubt? 	Is the person looking to their side?
Hand	Is the person helping someone? 	Is the person using both hands?

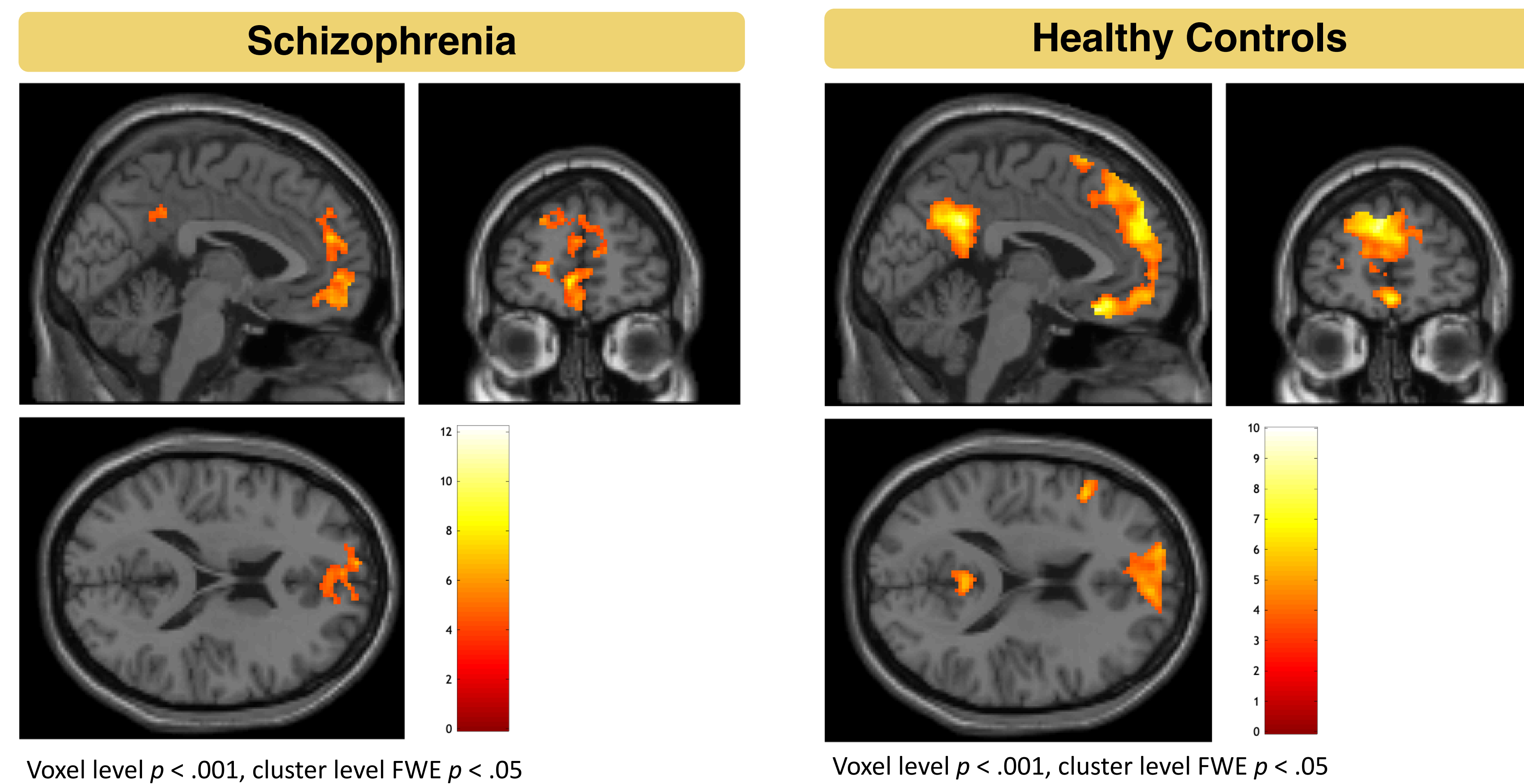
STIMULUS

Methods

- 28 healthy controls (HC) and 12 people with schizophrenia or schizoaffective disorder (SZ) completed the Why/How Task while undergoing fMRI
- Images acquired on 3T scanner and analyzed with SPM12
- Outside scanning, all participants were administered the Multiracial Emotion Identification Task⁴ to assess mental state understanding

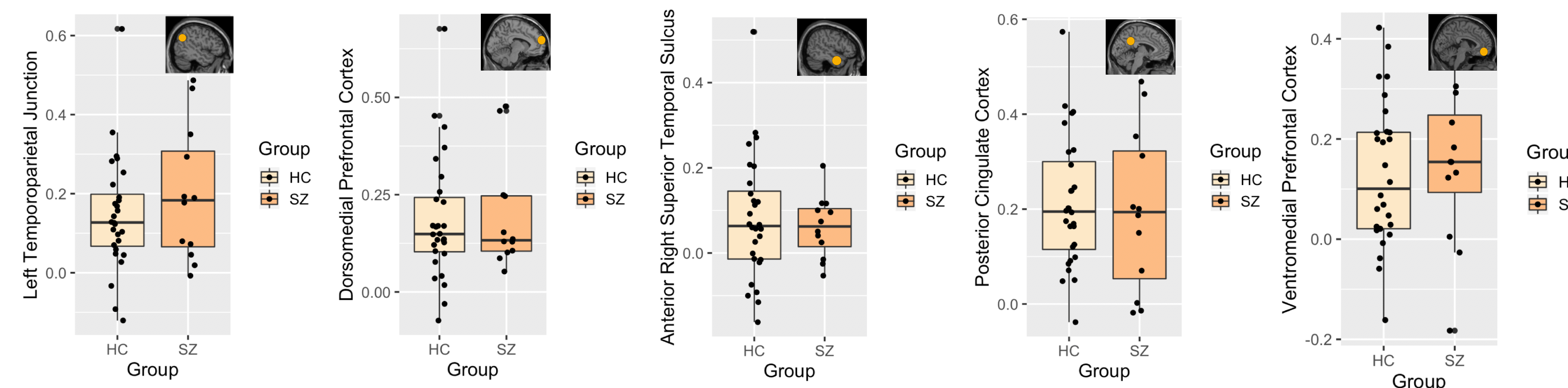
	Schizophrenia (n = 12)	Controls (n = 28)	p-value
Age	42.75 (14.87)	37.00 (15.05)	0.278
Years of Education	13.50 (2.65)	15.93 (2.65)	0.017*
IQ	103.20 (11.52)	107.64 (14.29)	0.339
% Male	83.33	35.71	.002**
Why/How Task Performance	86.59 (17.61)	93.11 (4.67)	0.231
Age of Onset	19.89 (6.97)		
Illness Duration (Years)	17.78 (14.55)		
PANSS Positive	19.00 (6.71)		
PANSS Negative	19.36 (6.39)		
PANSS Total	75.09 (23.63)		

fMRI Results

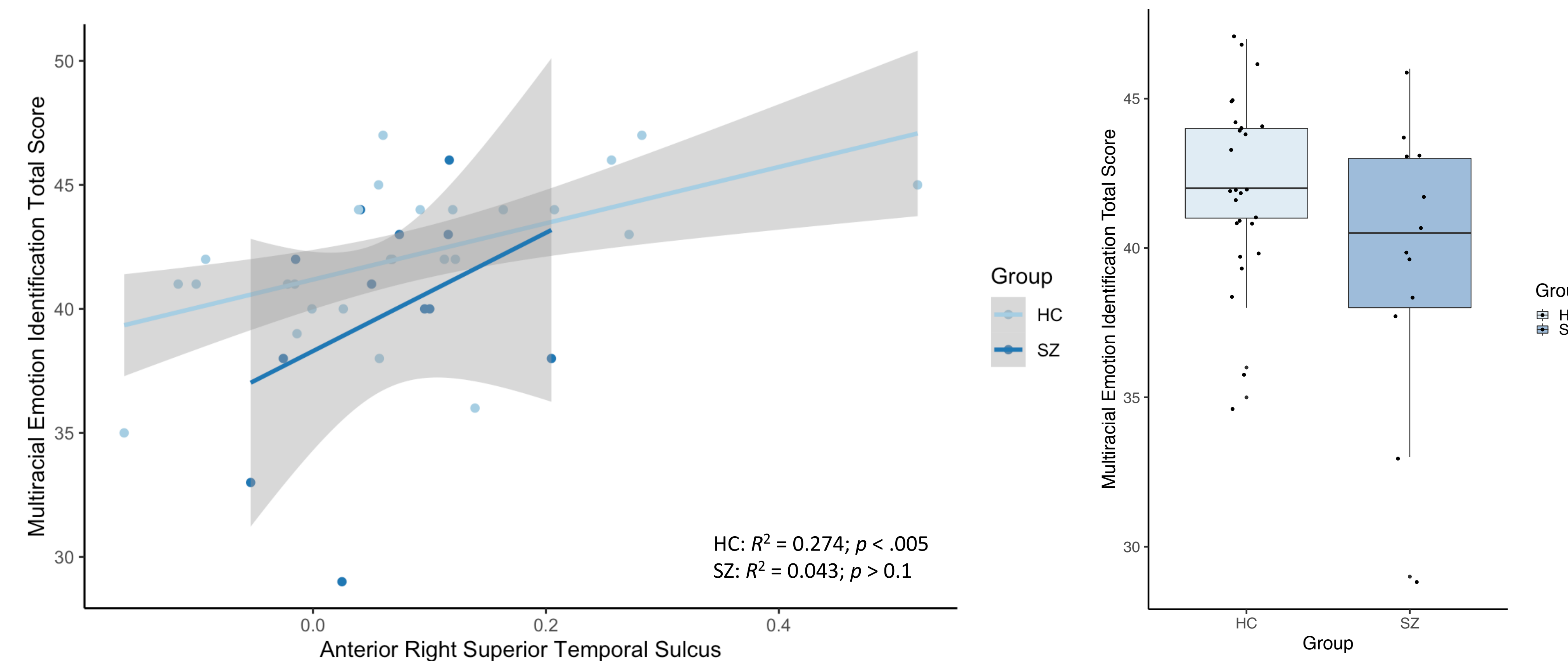


No significant differences found between patients and controls in whole brain analysis

Between-Group ROI Analyses



Behavioral Results



Conclusions

- This work presents the first use of the Why/How Task in a clinical population
- The Why/How Task demonstrates a robust response in key ToM network regions such as the medial prefrontal cortex, posterior cingulate cortex, and bilateral temporoparietal junction in healthy adults and people with schizophrenia
- ToM network region of interest (ROI) activity was correlated with performance on measures of social cognition in patients and controls
- The expected differences in neural activity from ToM network ROIs were not found between patients and controls; this could be due to an underpowered sample size at this point

Future Directions

- Running a full sample with 30 patients and 30 controls
- ROI analyses based on individually localized regions to determine individual patterns of differences between healthy and clinical samples
- Direct comparison to existing ToM tasks (e.g., False-Belief Task)
- Analysis through MVPA and psychophysiological interactions
- Additional validations in other clinical populations that have been shown to have deficits in theory of mind tasks (e.g., autism spectrum disorder)

References

1. Spunt, R. P., & Adolphs, R. (2014). Validating the why/how contrast for functional MRI studies of theory of mind. *NeuroImage*, 99, 301-311.
2. Pinkham, A. E., Hopfinger, J. B., Pelphrey, K. A., Piven, J., & Penn, D. L. (2008). Neural bases for impaired social cognition in schizophrenia and autism spectrum disorders. *Schizophrenia Research*, 99(1-3), 164-175.
3. Dodell-Feder, D., Koster-Hale, J., Bedny, M., & Saxe, R. (2011). fMRI item analysis in a theory of mind task. *NeuroImage*, 55(2), 705-712.
4. Dodell-Feder, D., Ressler, K. J., & Germine, L. T. (2020). Social cognition or social class and culture? On the interpretation of differences in social cognitive performance. *Psychological Medicine*, 50(1), 133-145.