

Dynamics of E/I Activity Predict Social and Sensory Symptoms Transdiagnostically

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BACKGROUND

- An imbalance of excitatory and inhibitory (E/I) brain activity has been posited as a mechanism driving symptomatology in autism spectrum disorder (ASD) and other psychiatric conditions, such as schizophrenia spectrum disorders (SZ)
- However, experimental findings linking E/I measures and symptoms are inconsistent
- The slope, or aperiodic component of the EEG power spectrum, is a noninvasive measure of E/I activity that changes in response to task demands, variations in behavioral state, and pharmacological manipulation
- Here we explore the hypothesis that dynamic E/I balance over time may provide insight into ASD and SZ symptomatology, above and beyond commonly used metrics of E/I that are averaged over time

METHOD

Group	n (n female)	Age (sd)	IQ (sd)
TD	44(19)	26(5.7)	113(13.8)
ASD	32(6)	24(5.6)	105(18.5)
SZ	24(4)	24(4.2)	100(9.3)

ASD and SZ groups had significantly lower IQ than controls. However, TD and ASD groups did not differ significantly from each other

EEG collection and processing:

- EEG was recorded at 1000 Hz with a 128-channel Hydrocel Sensor net
- EEG was recorded for 4 minutes with eyes open and 2 minutes with eyes closed
- EEG power was calculated in a 2s sliding window
- Slope of the PSD was calculated from 2-55 Hz
- Variability was calculated as (1) Entropy, reflecting the complexity of the signal; and (2) the Hurst exponent, describing the tendency of the slope to exhibit self-similarity in time around its mean

Behavioral data:

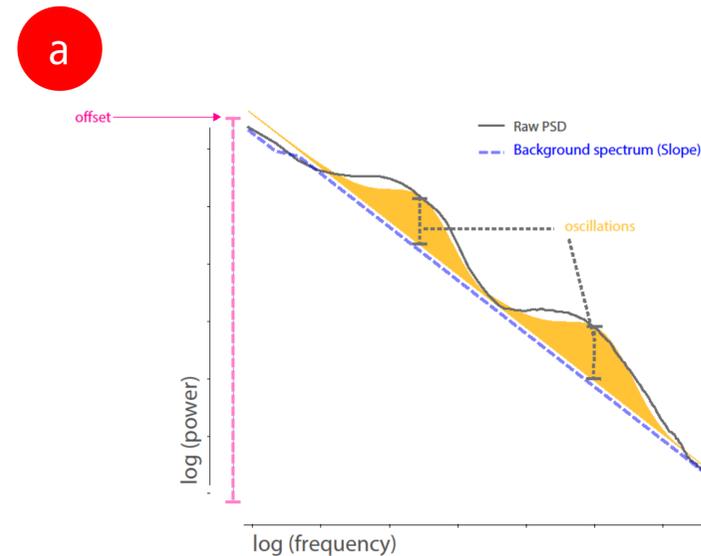
- Diagnosis was confirmed via the Autism Diagnostic Observation Schedule, 2nd Edition (ADOS), the Autism Diagnostic Interview (ADI), the Positive and Negative Symptoms Scale (PANSS) and The Structured Clinical Interview for DSM (SCID)
- Glasgow Sensory Questionnaire
- Sensory Gating Inventory

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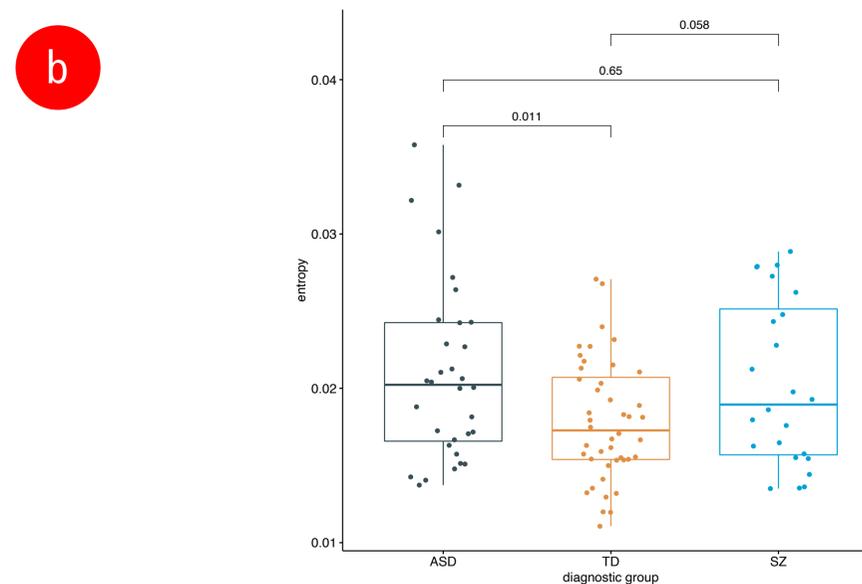


METHOD

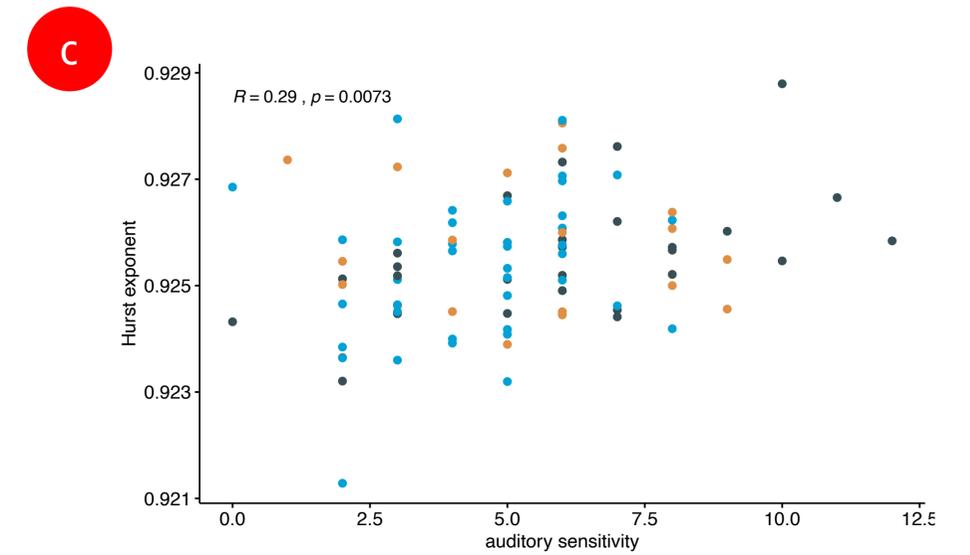


A. Resting EEG power spectra depicting how slope is abstracted from oscillatory bursts in the EEG power spectrum. The blue dotted line depicts the EEG slope

RESULTS



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- Individuals with ASD exhibited greater entropy ($p = .011$) than those with TD, and individuals with SZ showed marginally greater entropy than those with TD (Figure b)
- Increased entropy was associated with greater Autism Diagnostic Observation Schedule (ADOS) severity scores ($r = .21, p = .039$) and reduced facial recognition performance ($r = -.30, p = .002$)
- Across groups, the Hurst exponent correlated strongly with auditory hypersensitivity (Glasgow Sensory Questionnaire, $r = .29, p = .007$) (Figure c), and overall difficulties with filtering sensory input (Sensory Gating Inventory, $r = .29, p = .048$), indicating that dynamics of E/I balance over time is associated with greater sensory symptomatology

CONCLUSIONS

- Within individual variability of E/I activity differentiated groups and was associated with symptoms across groups
- Our results suggest that intra-individual variability provides useful information about brain activity relevant to transdiagnostic symptom expression. While global differences in E/I balance may drive symptoms, unpredictable shifts in this balance may exacerbate symptoms
- If an individual is unable to predict the severity of their own symptoms, from moment to moment, the impact of these symptoms may be more significant
- Our findings provide a first step towards characterizing this variability at the individual level within ASD and across diagnostic groups