APERIODIC ACTIVITY IN RESTING STATE EEG DIFFERENTIATES AUTISM AND SCHIZOPHRENIA FROM A NON-AUTISTIC GROUP

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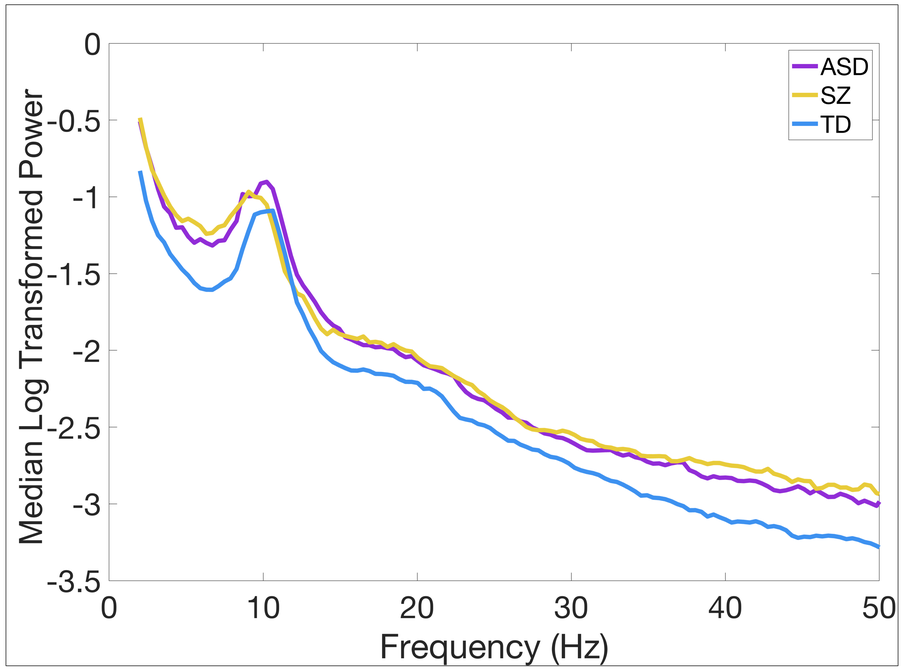
Background

- Measuring EEG oscillations requires an assumption about activity observed within a predefined frequency band, which disregards individual variance.
- Non-oscillatory signals (i.e., aperiodic power), often treated as noise, can affect power spectrum calculations and provide informative data.[1, 2]
- Aperiodic activity is accounted for by calculating the slope of the power spectrum—the rate of decay in spectral power as a function of frequency—which follows the natural decrease in power observed at higher frequencies in humans.[3, 4]
- Aperiodic brain activity has been observed in neurodevelopmental conditions, including schizophrenia[5] and autism.[6]
- In prior research with autistic and non-autistic participants, individual aperiodic power spectra revealed patterns of activity that discriminated between the two groups.[7]
- **Objective:** Evaluate aperiodic activity derived from resting EEG as a predictor of clinical diagnosis across adults with autism, schizophrenia, or no neuropsychiatric condition.

Methods

- Resting state EEG was recorded from 59 adults with autism (ASD; 47 men, 12 women; 17.9–43 years, *M* = 25.0, *SD* = 6.1), 42 with schizophrenia or psychosis (SZ; 37 men, 5 women; 19.2–43.6 years, *M* = 25.5, *SD* = 5.5), and 61 with no known neuropsychiatric disorder (NT; 35 men, 26 women; 18.3–46.6 years, *M* = 26.4, *SD* = 6.3).
- EEG was recorded for 80 seconds while participants' eyes were closed.
- Power spectrum densities were calculated across all electrodes in a 3-50 Hz frequency range.
- Linear regression was applied to frequency and median power to derive the slope for each participant.
- Participants' slopes were submitted to linear regression with group as a predictor.
- Pearson's correlations were conducted within clinical groups between participants' slope estimates and clinical scores.

Results



- Power spectrum density slopes (i.e., oscillatory + aperiodic activity) differed by group diagnostic status, $F(2, 151) = 3.69$, $p = .03$, $R^2 = 0.05$.
- TD participants' slopes were significantly more negative (i.e., steeper) compared to ASD ($\beta = -0.0014$, $p = .01$) and SZ ($\beta = -0.0013$, $p = .04$) groups.
- No difference was observed between ASD and SZ groups ($\beta = 0.0001$, $p = .84$).
- Although power spectrum density slopes differed across clinical diagnostic status, they were not correlated with diagnostic severity.
  - Autism Quotient (AQ): $r = .02$, $p = .80$
  - Autism Diagnostic Observation Schedule (ADOS): $r = 0.03$, $p = .72$
  - Schizotypal Personality Questionnaire (SPQ): $r = -.13$, $p = .13$
  - Positive and Negative Syndrome Scale (PANSS): $r = -.29$, $p = .77$
- No correlation among autistic participants between slope and AQ, r = -.02, p = .87, nor slope and ADOS scores, $r = -.02$, $p = .87$.
- No correlation among schizophrenic participants between slope and SPQ, $r = 0.17$, $p = .32$, nor slope and PANSS, $r = -.29$, $p = .27$.

Conclusions

- In this transdiagnostic sample, aperiodic EEG effectively differentiated between clinical and non-clinical groups.
- Specifically, participants without a neuropsychiatric condition had a steeper decay in slope compared to those with autism and schizophrenia.
- Clinical features were not associated with slope in either clinical group.
- Group differences may reflect variation in efficiency of neural processing, connectivity, or in excitatory and inhibitory balance (i.e., stronger low-frequency oscillations relative to high-frequency activity).
- Greater variability in EEG signals has been reported in both autism and schizophrenia which obscure differences in slope values between the two clinical groups.
- Indeed, both conditions share similar patterns of atypical functional connectivity as well as comparable behavioral traits, cognitive impairments, and genetic variants.
- Additional study of oscillatory *and* non-oscillatory neural patterns may help elucidate the biological underpinnings of autism and schizophrenia.

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References

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