

# Specific association between at-rest alpha power and restrictive and repetitive autistic traits: replication and extension in a clinical sample

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## Background

- Previous research indicates that different domains of autistic traits are associated with dissociable patterns of at-rest neural activity.
- Better understanding of the neural drivers of specific domains of symptoms may inform the neurobiological basis of behavioural variation and help to parse heterogeneity in autism spectrum disorder (ASD).
- Recently, a specific association between alpha power and restricted and repetitive traits has been reported in typically developing adults<sup>1</sup>.
- These findings require replication and testing in clinical samples.

## Method

### Participants

Participants were recruited from the Yale Autism Program research registry, which includes past research study participants and clinic patients, as well as from the surrounding community through flyer and recruitment events.

Group	N	% male	Mean Age	Mean IQ
ASD	91	77%	13.67	101.70
Typically developing	61	56%	13.07	106.97

### Measures: Behavioural

- Diagnosis was confirmed via the Autism Diagnostic Observation Schedule 2nd edition (ADOS), the Autism Diagnostic Interview (ADI), and clinician confirmation of meeting DSM-5 criteria for ASD.
- ASD traits were assessed in both groups using parent-report Social Responsiveness Scale-2 (SRS) subscales (social awareness, social cognition, social communication, social motivation, restrictive and repetitive behaviours (RRB)).
- Cognitive ability was assessed with the Differential Ability Scales-II (DAS-II)

### Measures: EEG

- EEG was collected at 500 Hz with 128 Hydrocel Geodesic Sensor Net, while participants sat with eyes open for 1 minute (x2), then closed for 1 minute (x2).
- Data were re-referencing to an average reference and segmented into 2 second epochs.
- Data were filtered from 0.1-100 Hz.
- Artifact detection and subsequent bad trial rejection were undertaken.
- Participants were included in the EEG sample if they had at least 40 seconds of artifact-free resting data.
- Multitaper Fourier transforms were used to estimate band-specific power using standard frequency bands.

## Method

- Based on previous literature<sup>1</sup>, we focused our analyses on alpha power on the parietal area (signal averaged across electrodes 52, 58, 62, 92, 96).
- Group differences in low (6-8Hz) and high (8-12Hz) normalized alpha power and SRS-rated RRBs were assessed with simple t-tests.
- Linear regression was used to test the association between RRB traits and low and high alpha power in the typically developing and the ASD samples separately.
- Where significant associations were found, age, cognitive ability, and sex were included as covariates.
- Topographical (i.e., whether significant associations between alpha power and RRB traits are specific to the parietal region) and oscillatory (i.e., whether associations between normalized power and RRBs are specific to the alpha band) specificity was assessed using multivariate regression.

## Results

- Lower normalized power in the low alpha frequency band was found in the ASD vs. typically developing group ( $t(150)=-2.32$ ,  $p=0.02$ ; Figure 1, left hand graph). No group differences were found in the high alpha frequency band ( $p=0.35$ ).
- As expected, group differences were found in SRS-rated RRBs, with the typically developing group showing little variation in their scores ( $t(143)=12.07$ ,  $p<0.01$ ; Figure 1, right hand graph).

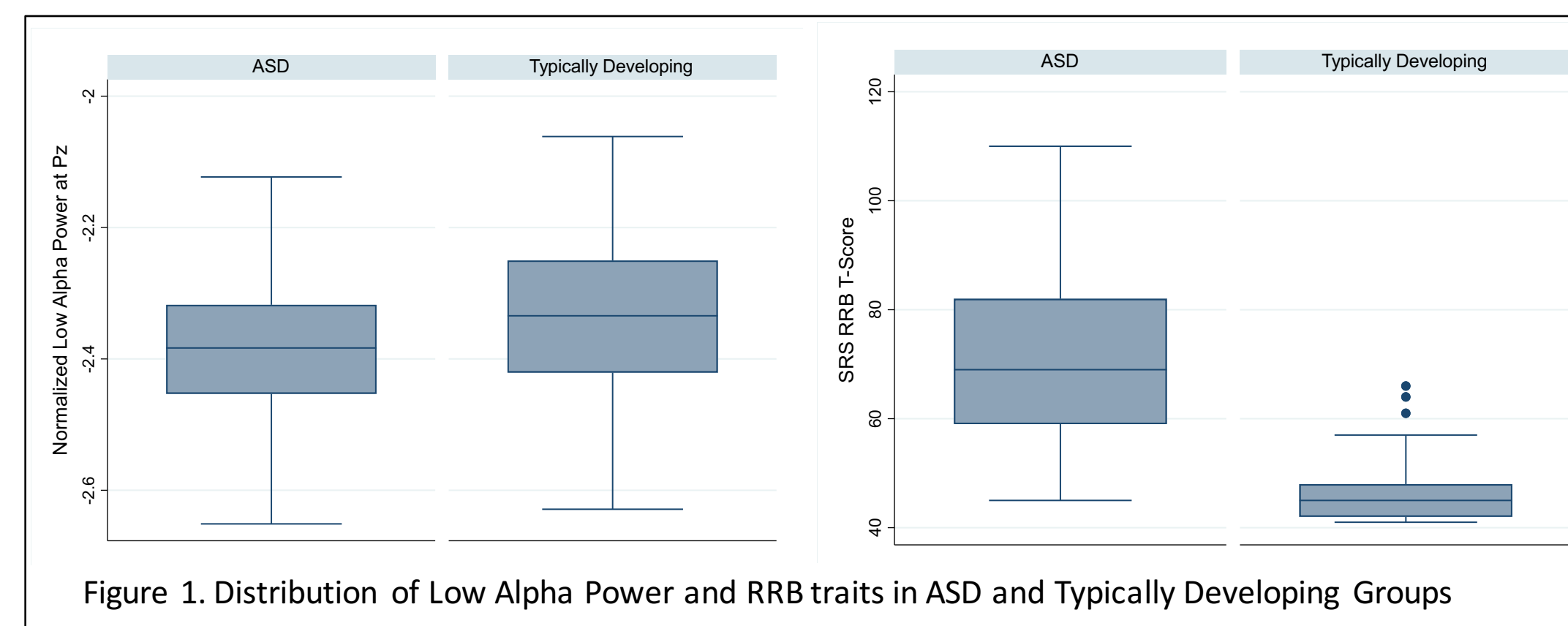


Figure 1. Distribution of Low Alpha Power and RRB traits in ASD and Typically Developing Groups

- Consistent with prior work, a positive association between normalized alpha power, specifically in the low frequency band, and RRB traits was observed in the ASD group ( $\beta=34.77$ ,  $p=0.02$ ; Figure 2, right hand graph). The effect remained significant when covariates were included in the model ( $\beta=34.07$ ,  $p=0.03$ ). No association was found in the typically developing group ( $\beta=-3.70$ ,  $p=0.54$ ).
- A comparable association between RRB traits and normalized low alpha power to that reported in the parietal region was found in the occipital (electrodes 70 and 83;  $\beta=41.87$ ,  $p=0.02$ ) but not in the frontal or central regions.

## Results

- No significant associations were found between normalized delta, theta, beta or gamma power in the parietal region and RRB traits in either group.

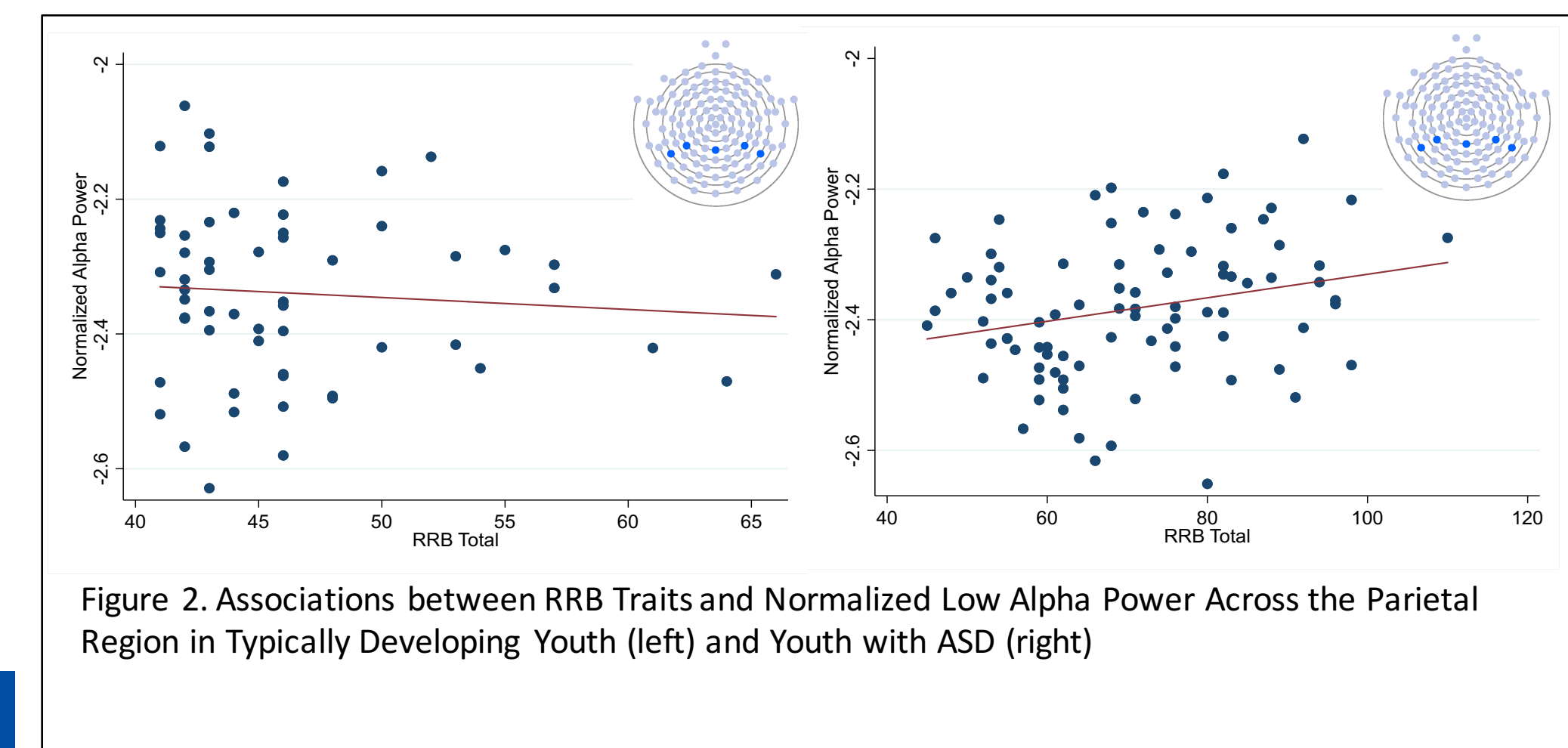


Figure 2. Associations between RRB Traits and Normalized Low Alpha Power Across the Parietal Region in Typically Developing Youth (left) and Youth with ASD (right)

## Conclusions

- Consistent with prior findings for autistic traits in typically developing adults<sup>1</sup>, we found a positive association between lower alpha power in the parietal region and RRB traits in a clinical sample of youth with ASD.
- Contrary to our previous work in adults, we did not observe this relationship in the TD sample; this may reflect the constrained range of RRB traits observed in the sample, or it may suggest that the effects represent a developmental phenomenon emerging in later adolescence or early adulthood.
- These findings, showing linkages among brain markers and with clinical symptomology, show promise for these biomarkers as indicators of treatment response and as potential targets for treatment development
- On-going work is analysing the eyes-open and eyes-closed EEG signal separately.

## References

1. Carter Leno, V., Tomlinson, S.B., Chang, A.S., Naples A.J., McPartland J.C. (2018). Resting-state alpha power is selectively associated with autistic traits reflecting behavioral rigidity. *Scientific Reports*, 8, 11982.  
Funding Sources: NIMH R01 MH100173 (McPartland), NIHR BRC Career Development Award (Carter Leno)

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