The Reproducibility of Intrinsic Neural Timescale Atypicality in Autism Spectral Disorder

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Introduction: *Intrinsic Neural Timescales (INT) is a recently proposed property of brain regions that estimates the timescales of neural signals based on the decay of the autocorrelation function (ACF). Utilising open-source resting state fMRI data from the Autism Brain Imaging Data Exchange (ABIDE)[1], recent research by Watanabe et al. (2019)[2] suggested that atypical INT in a few sensory-related brain regions correlated with the severity of ASD symptoms in high functioning adult males. As such, INT was posited as a potentially fundamental neuro-aetiological feature of ASD. However, evidence suggests a low rate of reproducibility in cognitive neuroscience, and the current study aimed to reproduce Watanabe et al. (2019)[2] in the same data according to their published methodology.*

Methods: The study used *an MRI dataset of adult males from a single site (Utah School of Medicine) available at the ABIDE website (ASD = 25, Typically Developing [TD] = 26). Pre-processing protocol from the original publication was followed, with some extrapolation from the published details. Whole-brain maps of INT were achieved for each participant by applying an ACF to the BOLD signal at each voxel. INT was compared between groups using three independent Random Effects models (RFX) of increasing specificity; at a whole brain level as per Watanabe et al. (2019)[2], utilising explicit grey matter masking (GMM), and utilising GMM and small volume corrections (SVC) respectively.*

Results: *INT was not statistically significantly different between groups at any voxel after correction for multiple comparisons in all analyses ($p_{FDR} > 0.05$). When examining uncorrected values (Figure 1), clusters of atypical INT did not spatially align with Watanabe et al. (2019) in the whole-brain ($p_{uncorrected} < 0.001$) or explicit GMM RFX ($p_{uncorrected} < 0.005$), but were more closely aligned after SVC – albeit the clusters were smaller and had a lower level of statistical significance ($p_{uncorrected} < 0.05$). Furthermore, associations to symptoms were not statistically significant.*

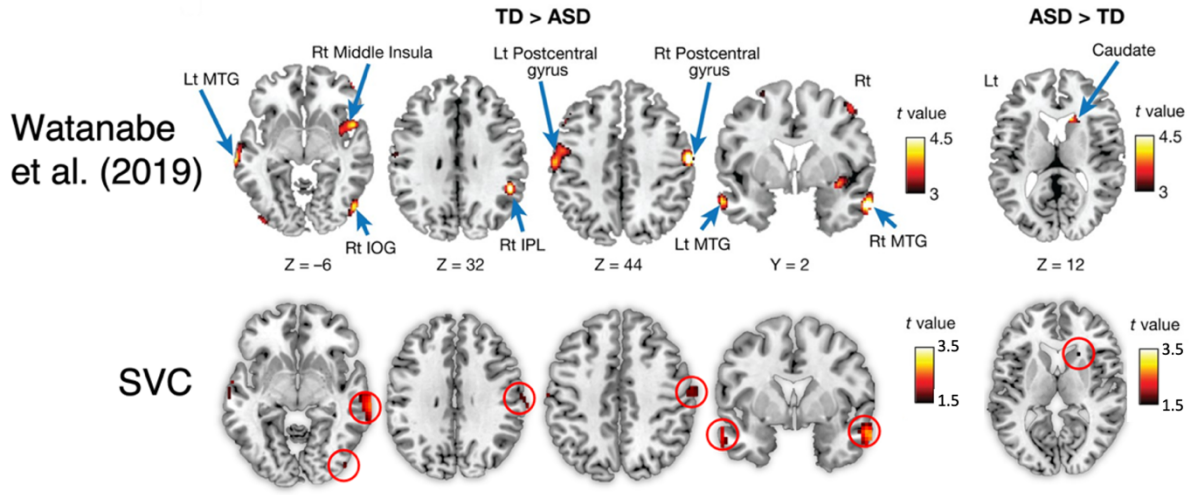

Figure 1. *Differences in intrinsic neural timescale between high-functioning autism and typically developing individuals reported by the original authors[2] (top) and obtained in this reproducibility study using small volume corrections (bottom).*

Discussion: *Overall the study failed to reproduce the original findings. Although some similarities were found, the statistical differences obtained here were smaller than reported, and the main findings did not survive correction for multiple comparison. Discrepancies in the findings may have resulted from inferences made due to the sparseness of details, particularly in relation to pre-processing and participant exclusion, published in Watanabe et al. (2019)[2].*

Conclusion: *The current findings add to a growing body of evidence for low reproducibility in cognitive neuroscience. It is suggested that the pipeline for estimating INT from fMRI data must be standardised before research can support INT as a fundamental neuro-aetiological factor in ASD. Further, the current study advocates for the sharing of more extensive methodological details to prospective replication studies to circumvent detail-poverty induced by publication constraints.*

References:

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