Network Coupling & Congruency Status

Derek M. Smith[1], Thackery I. Brown[2], Eric H. Schumacher[2]

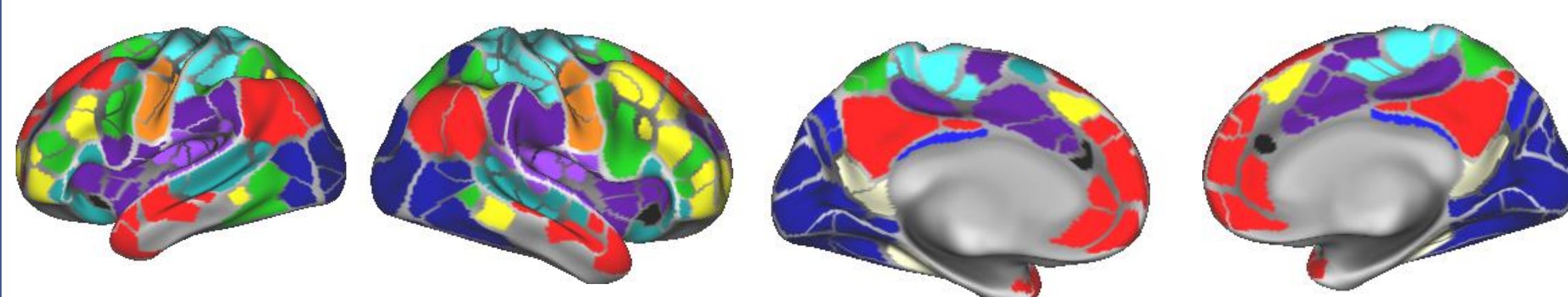[1]Northwestern University, [2]Georgia Institute of Technology

Introduction

- Both the Fronto-Parietal Network (FPN) and the Cingulo-Opercular Network (CON) have been implicated in cognitive control.

Dosenbach et al., 2007; Desenbach et al., 2008

- If the closed loop hypothesis is true inter-network connectivity should depend on task condition.
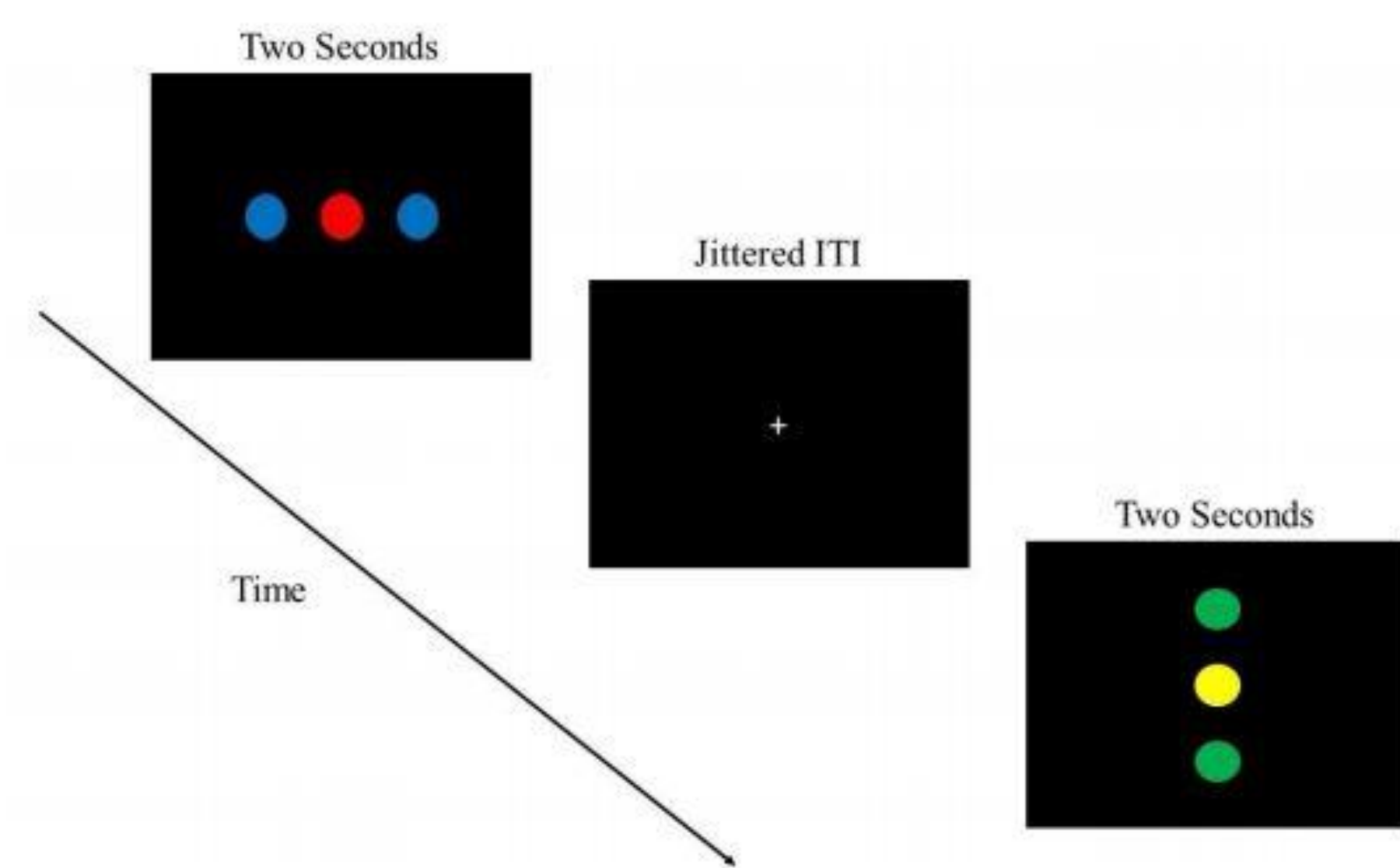

Gordon et al., 2016   CON FPN

Methods

- Task was inspired by a paradigm developed by Kim & Cho (2014)

- Jitter (Inter-Trial Intervals: 50% 2 secs, 25% 4 secs, 25% 8 secs)

- 6 blocks/runs of 96 trials each lasting 9.6 mins (feedback given at the end of the block)

- In each run each stimulus type presented an equal number of times and each congruency sequence (cC, cI, iC, iI) with the exception of one due to the first trial not having a preceding trial occurred an equal number of times

- Subjects completed a practice session in a behavioral testing room prior to scanning

Preprocessing & Beta Series Correlation

- Despiking, motion correction, alignment to the structural scan, warped to MNI space, smoothing with a FWHM kernel of 6 mm, and voxel time series were scaled to have a mean of 100.

- Functional connectivity was measured via the beta series correlation approach (Rissman, Gazzaley, & D'esposito, 2004). Each trial was modeled with its own predictor. A constant, a linear, quadratic, cubic, and quartic trends in addition to 6 motion regressors were included in the model. Global outlier trials were removed from analysis.
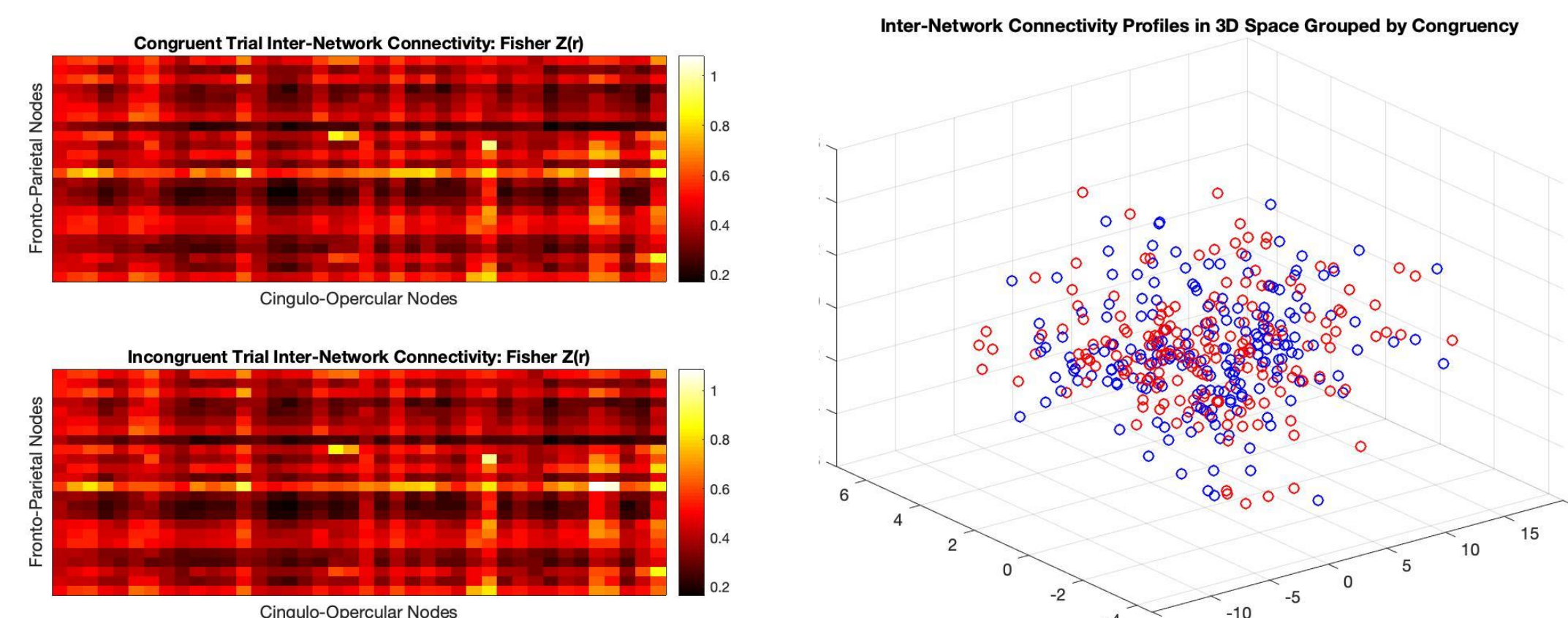
Congruency Effect

- For RT a within subjects ANOVA (Current Trial Congruency x Previous Trial Congruency x ITI) showed a significant main effect of congruency, $F(1, 36) = 96.816$, $p < .001$, $\eta_p^2 = .729$ (**44 ms**), and ITI, $F(1.717, 59.331) = 4.954$, $p < .05$, $\eta_p^2 = .121$.
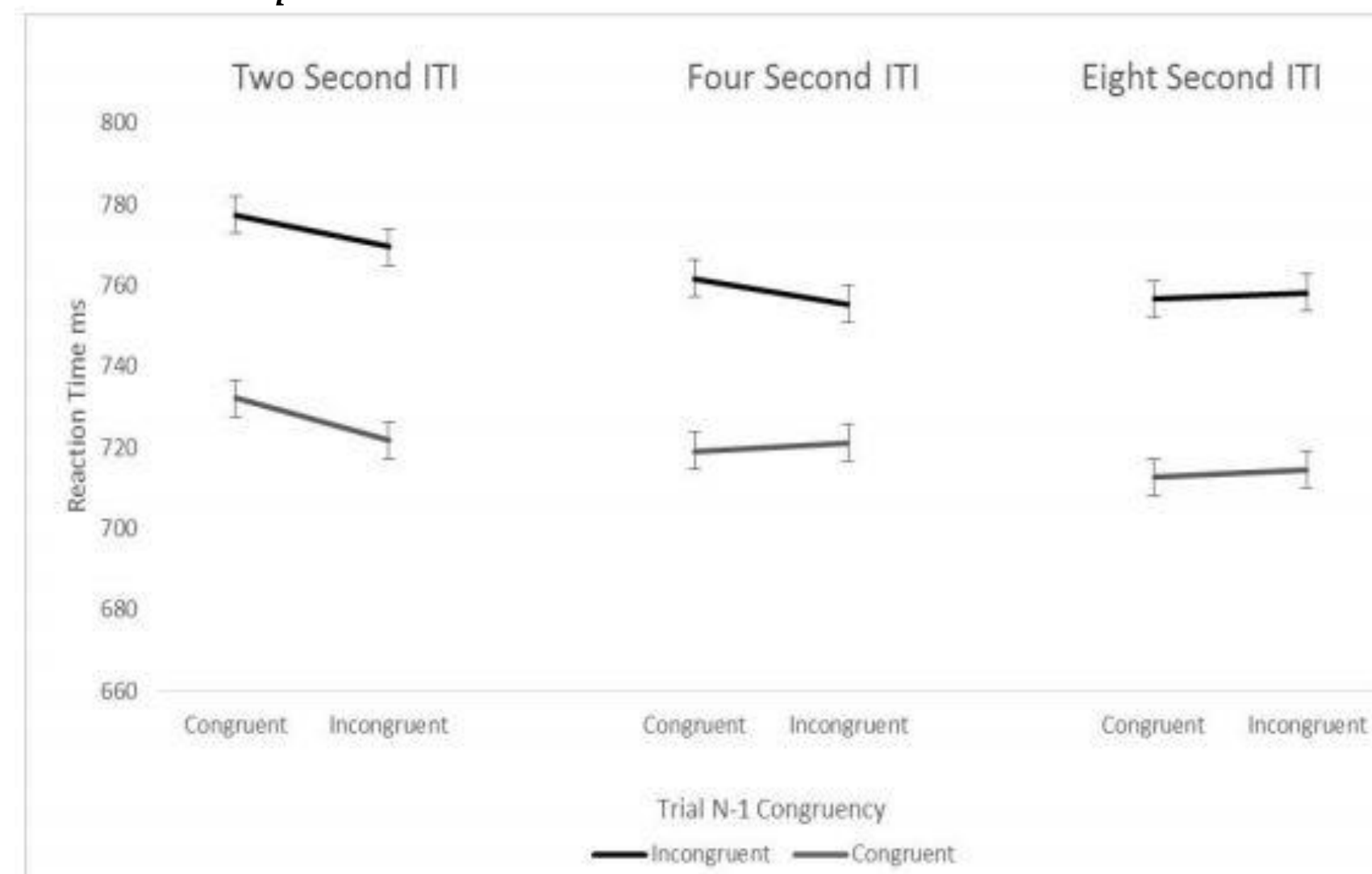
Similar Inter-Network Connectivity

- The inter-network connectivity profile of the two trial types was very similar.
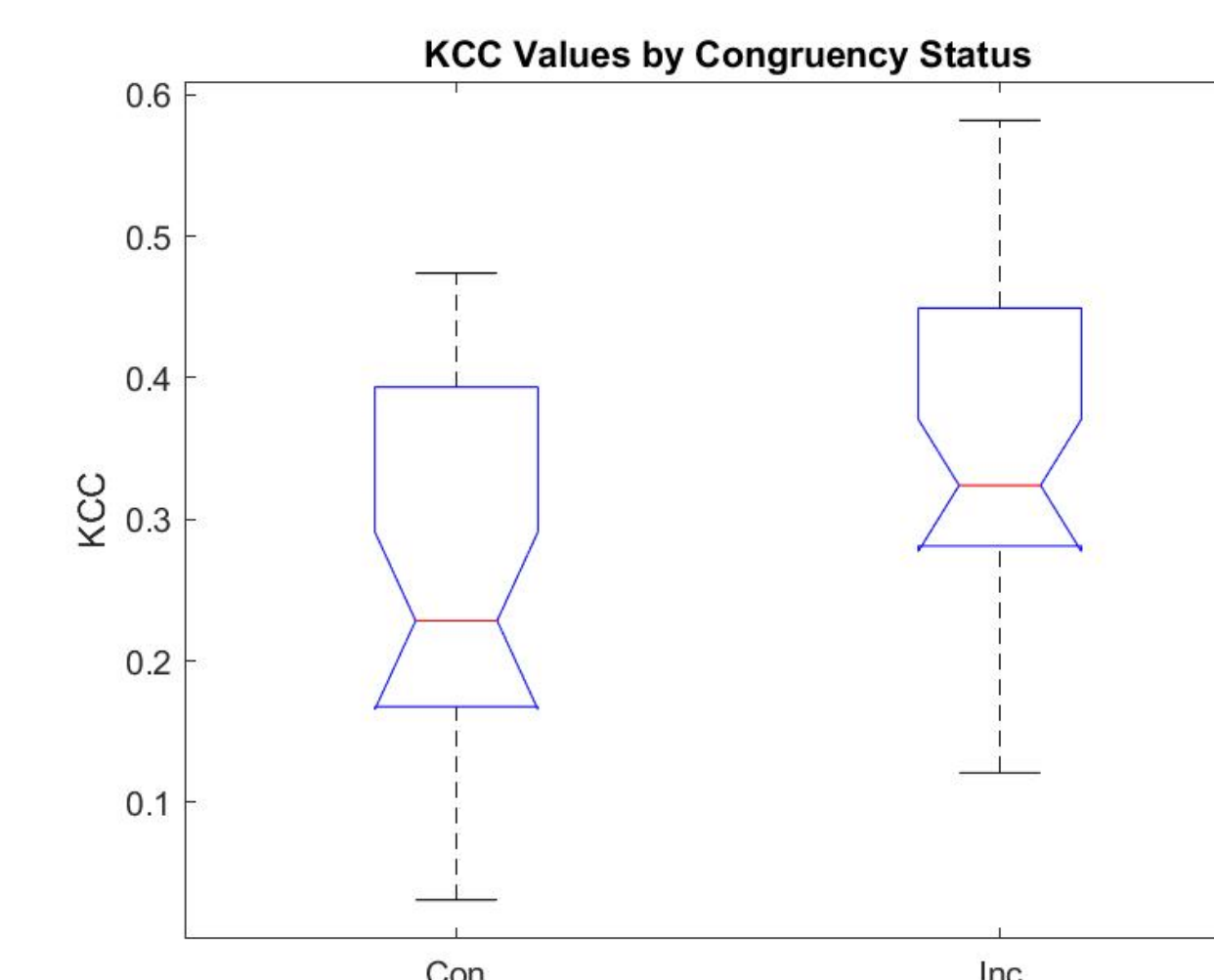

Inc = RED Con = Blue

- Average fisher Z transformed correlation between network nodes for each trial type

- Similarity of inter-network connectivity depicted via multidimensional scaling

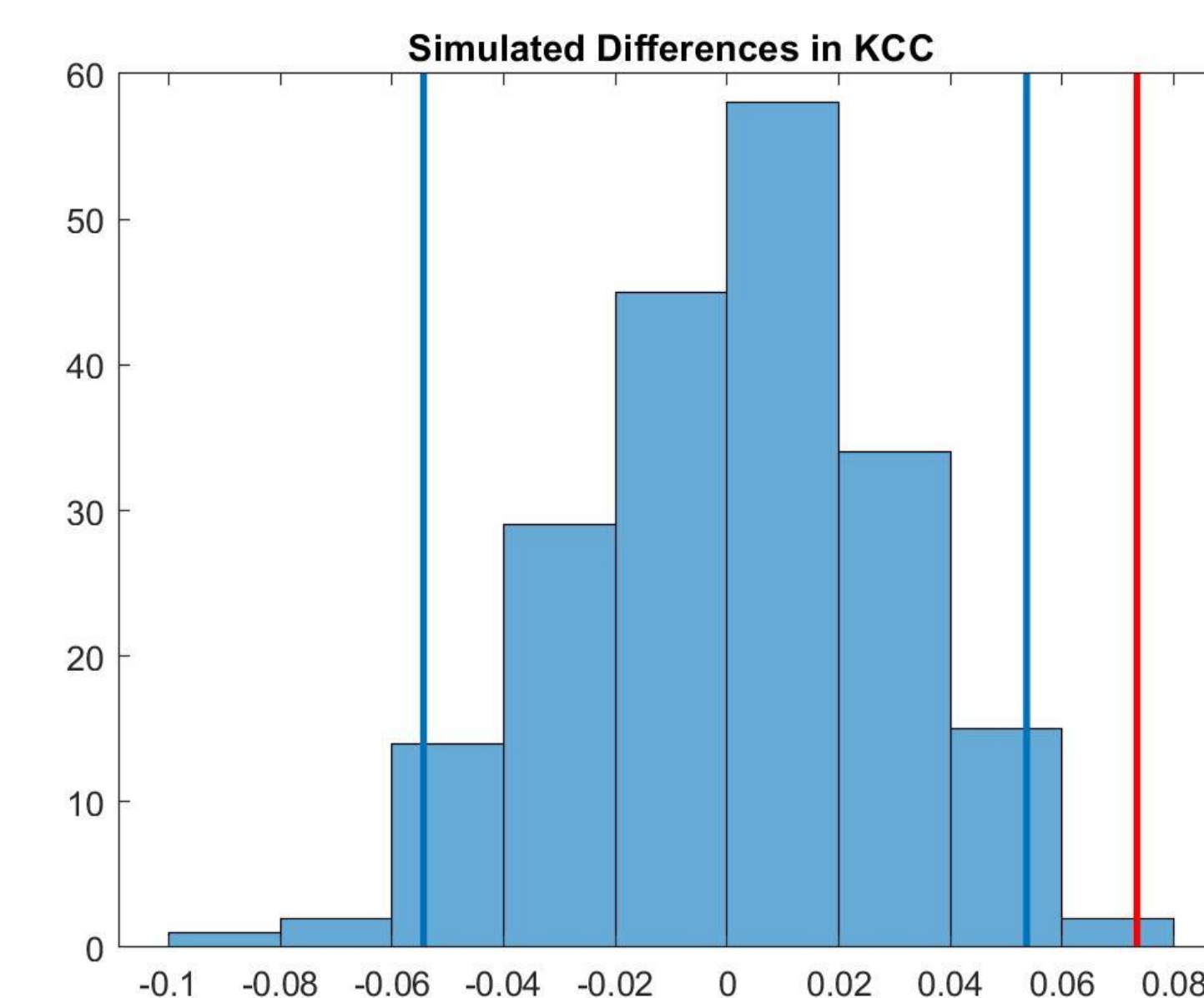## Inter-Network Connectivity Across Runs

- Kendall's coefficient of concordance captures the consistency in the run-wise rankings of the inter-network connections

Permutation Test

Actual Subject-Wise Difference in KCC

Confidence Interval

- The percentage of the variance in connectivity explained by the first principal component (PCA conducted for each subject) followed the same pattern as the KCC

Conclusions & Future Directions

- Inter-network Connectivity (beta series correlation) did not differ between congruent and incongruent trials

- The magnitude of the inter-network connections hung together to a greater extent for incongruent trials. The greater consistency in the connectivity fluctuations across runs for incongruent might be indicative of CON-FPN connectivity being implicated in a task related process that is under higher demands during incongruent trials.

- The beta series approach yielded high inter-network correlations. Re-analysis with global signal regression and/or a background connectivity approach is being considered.

References

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Acknowledgements