

Abstract Submitted  
for the CUWIP21 Meeting of  
The American Physical Society

**Development of control in brain networks over temporal and spatial scales using graph models**<sup>1</sup> LINDSAY SMITH, HARANG JU, DANIELLE BASSETT, University of Pennsylvania — Regions of the human brain vary in their capacity to control whole brain activity, in large part due to their location in the underlying structural network of interconnections crisscrossing the cortex. Recent work suggests that this capacity for control differs across spatial and temporal scales of the brains dynamics and can be formally probed using the Laplacian eigenspectrum of the brains structural network. Yet how such spatiotemporal control might differ from one human to another, potentially supporting and explaining differences in cognitive function, remains unclear. Here, we address this question by measuring several summary statistics of spatiotemporal control from human brain network architecture, as reflected in diffusion tensor imaging data acquired from 882 youth between the ages of 8 years and 22 years. We found that distinct features of network topology are correlated with a regions capacity to enact distinct control strategies, and we investigate these relationships as a function of discrete timescales, from markedly slow modes of dynamics to relatively swift modes of dynamics. Our results provide insight into how local variation in connectivity gives rise to distinct processes of global control as a function of timescales over modes of activity.

<sup>1</sup>L.S., H.J., and D.S.B. acknowledge support from the John D. and Catherine T. MacArthur Foundation, the Alfred P. Sloan Foundation, the ISI Foundation, the Paul Allen Foundation, the Army Research Laboratory (W911NF-10-2-0022), the Army Research Office (Bassett-W911NF-14-1-0679, Grafton-W911NF-16-1-0474, DCIST-W911NF-17-2-0181), the Office of Naval Research, the National Institute of Mental Health (2-R01-DC-00920911, R01-MH112847, R01-MH107235, R21-MH-106799), the National Institute of Child Health and Human Development (1R01-HD086888-01), National Institute of Neurological Disorders and Stroke (R01-NS099348) and the National Science Foundation (BCS-1441502, BCS-1430087, NSF-PHY-1554488 and BCS-1631550). We thank Jason Z. Kim for helpful feedback. L.S.

Date submitted: 04/19/2021  
Also acknowledges support from the University of Pennsylvania's University Scholars Program. The content is solely the responsibility of the authors and does not necessarily represent the official views of any of the funding agencies.