Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Dynamics of modularity of neural activity in the brain during development MICHAEL DEEM, MAN CHEN, Rice University — Theory suggests that more modular systems can have better response functions at short times. This theory suggests that greater cognitive performance may be achieved for more modular neural activity, and that modularity of neural activity may, therefore, likely increase with development in children. We study the relationship between age and modularity of brain neural activity in developing children. The value of modularity calculated from fMRI data is observed to increase during childhood development and peak in young adulthood. We interpret these results as evidence of selection for plasticity in the cognitive function of the human brain. We present a model to illustrate how modularity can provide greater cognitive performance at short times and enhance fast, low-level, automatic cognitive processes. Conversely, high-level, effortful, conscious cognitive processes may not benefit from modularity. We use quasispecies theory to predict how the average modularity evolves with age, given a fitness function extracted from the model. We suggest further experiments exploring the effect of modularity on cognitive performance and suggest that modularity may be a potential biomarker for injury, rehabilitation, or disease.

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Date submitted: 15 Nov 2013 Electronic form version 1.4