Print this Page

NEUROSCIENCE 2014

Presentation Abstract

Program#/Poster#:	DP06.02/DP2
Presentation Title:	Are the foundations for embodied activity already embedded in heterogeneous laminar networks?
Presentation time:	Tuesday, Nov 18, 2014, 8:00 AM -12:00 PM
Topic:	++A.09.a. Evolution of developmental mechanisms

Authors: ***E. L. OHAYON**, A. K. LEE, A. LAM;
Neurolinx Res. Inst., The Green Neurosci. Lab., La Jolla, CA

Abstract: What are the neural foundations necessary for movement in the environment? In this study we use embodied computational models to examine the relation of network structure to movement in artificial autonomous agents. Previous studies by members of our group have found that random networks tend to settle to a fixed-point state or limit cycle, oscillatory, behavior reminiscent of seizures. These behaviors could be quickly evolved into embodied movement by applying genetic algorithms to the connectivity. In another set of studies, spatial, laminar networks were shown to support persistent activity in cases where density was varied and connectivity made heterogeneous. However, the question of how the spatial features of laminar network architecture would contribute to interactions with the environment remained open. As such, we connected the laminar networks to a chassis and observed the behavior. RoHS compliant materials and open source platforms were used in building the embodied agents. Specifically, the Arduino platform was used to interface the neural networks running on an external computer. The chassis was equipped with servo motors for output motion. Sensory input included photoresistors and contact switches. The spatial networks were multi-layered and consisted of up to 100,000 spiking units. Simulations included both inhibitory and excitatory units connected in columnar geometries. Network density was varied by adding or removing units and their connections at 10% increments. Neural activity was initiated with a single initial contact to a touch receptor. Unlike the results in random networks, many of the embodied spatial networks immediately began to show movement, requiring no learning or evolutionary interventions. Specifically, in heterogeneous networks (e.g., density of 60%), embodied forward and turning movements correlated to the persistent propagating activity seen in the isolated networks. These initial observations suggest that the heterogeneous laminar structure is sufficient to generate movements that are reminiscent of nascent embodied motion seen in early development and evolution. The results of this study may thus help illuminate why (i) laminar architectures and (ii) changes in density are important neural features that appear repeatedly in evolution and development.

Disclosures: **E.L. Ohayon:** None. **A.K. Lee:** None. **A. Lam:** None.

Keyword (s): NETWORK

COMPUTATIONAL MODEL

EVOLUTION

Support: CIHR