



Thursday, June 26th, 9:30-10:00, room 4

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What's on the SLAB? - Building a Simple Living Artificial Brain

The Neurophotronics Lab is a multidisciplinary research group at the University of Nottingham with the goal of understanding fundamental aspects of information processing in the brain.

In order to understand how information is encoded and processed by a network of neurons it is thought to be necessary to be able to monitor and control all action potential activity, in particular, within the network for an extended period of time. Furthermore, the interaction between an organism and its environment is also essential for a meaningful description of information processing within the network. The continual flow of information from the network to the environment and back again allows the organism to explore, learn, and form a synergy with its environment.

Unfortunately, even in extremely simple organisms, it is not possible to monitor all the action potential activity, let alone the environmental signals, due to limitations in available technology. In order to overcome the complexities of real organisms the Neurophotronics Lab is developing a simple experimental system in which a small network of cultured neurons continuously exchanges information with a virtual environment implemented on a real-time computer; analogous to how a real organism interacts with its environment.

The intention is that this minimalist, but non-reductionist, experimental system will contribute to theoretical neuroscience by enabling the underlying cellular and molecular activity to be related to higher-level cognitive and behaviour events. Importantly it will allow a much closer correspondence between the experimental system and the mathematical models that describe it than is currently possible, which should aid the development of theory.

The theoretical challenges are still considerable however. In particular an abstract conceptual framework is required with which to link the low-level physical activity within a neuronal system and the body and environment that it is embedded in with higher-level notions such as cognition and behaviour. Theoretical linguistics may provide such a framework.

It is postulated that the resulting system, a Simple Living Artificial Brain (SLAB), contains the minimal, but essential, components required by a cognitive organism, while being technically feasible, experimentally accessible, mathematically formalisable and physiologically relevant to cognition at an elemental level.

This talk will cover the progress that has been made in developing the basic technology required to realise this ambitious goal and explore the theoretical challenges that relate to the use of this tool.