



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

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## **Using linguistic theory to aid the modeling of the physiological basis of the mind**

This paper puts forward the hypothesis that ideas from the modeling of language in Systemic Functional Linguistics (SFL) can be meaningfully applied in the development of an abstract model of cognitive and behavioural processes as being grounded in physical properties of neural systems. Although much progress has been made in recent decades to locate where certain cognitive or behavioural processes may reside in the brain, one important question remains: how do low-level physical properties of neural networks link to notions such as cognition and behaviour? In order to shed light on this question, an abstract model is needed.

The Simple Living Artificial Brain (SLAB) project, currently under development at the University of Nottingham, will provide the experimental means to inquire on the nature of such a model. As will be discussed, many of the properties required in this abstract model are also found in models of language in linguistic theory. These include the following: being multi-leveled, describing the influence of the environment and showing how spatially and temporally localized units relate to non-localized higher-level notions. This talk will put forward the claim that this fact opens up the intriguing possibility that what has been discovered about complex, multi-leveled systems in linguistics can provide clues to how such a framework may be applied in neuroscience.

This talk will focus on two aspects of the model, and explore why they are important to the modeling of cognitive behaviour. Firstly, the idea of stratification in a neural context will be discussed. This provides a multi-leveled model of increasing abstraction, with no necessary causal links between the levels (Halliday, 1991). Stratification captures the idea that cognitive behaviour is not the cause of the physiological state of the system, or vice-versa, but both are the same phenomenon but described at different levels of abstraction. Secondly, the notion of the *cline of instantiation* (Halliday, 1994) provides a way of thinking about the relationship between the underlying system under investigation and instances of that system as seen in observed behaviour. In a neuronal context, this notion offers a way to consider the feedback between individual instances of an organism interacting with the environment and the organism's potential for exhibiting certain behaviours in certain situations.

This presentation introduces a novel inter-disciplinary research approach, whereby ideas within abstract modeling in linguistic theory can be applied to neuroscience to further our understanding of the physical basis of behaviour and cognition.