The **Budapest Semester in Cognitive Science** and the T**heoretical Neuroscience and Complex Systems Group** of the *Wigner Research Centre for Physics* of the Hungarian Academy of Sciences

Workshop on Neural and Cognitive Architectures

Date: September 30th, 2016
Venue:Wigner Research Centre for Physics, "KFKI Campus" III bldg.

RSVP to vintyister@gmail.com by September 28th, 12am!!

10.05-10.10: Péter Érdi (WRCP - BSCS):Opening remarks
10.10-10.50 Vassilis Cutsuridis (Institute of Molecular Biology and Biotechnology,Foundation for Research and Technology - Hellas(FORTH); Heraklion, Crete (Greece): **Cognitive decision making models**
10.50-11.00 Discussion
11.00-11.10 Break
11.10-11.50 András Lőrincz (Neural Information Processing Group, Eotvos University): **Cartesian Abstraction**
11.50-12.00 Discussion

12.00 - 13.30: Break

13.30-14.10 Vaibhav Diwadkar (Psychiatry & Behavioral Neurosciences, Wayne State Univ. Detroit, MI, USA): **Functional and dysfunctional cognitive neuro-architectures: Evidence from functional and effective connectivity analyses of fMRI data**
14.10-14.20 Discussion
14.20-15.00 Zoltan Jakab, ELTE, Institute of Psychologíy for Special Education: **Quantifíing with mental files**
15.00-15.10 Discussion
15.10-16.00 Panel Discussion: What did we learn? (Panelists: TBA)
16.00-16.05. 10.05-10.10: Péter Érdi (WRCP - BSCS):Closing remarks

Abstracts:

10.10-10.50 Vassilis Cutsuridis (Institute of Molecular Biology and Biotechnology,Foundation for Research and Technology
- Hellas(FORTH); Heraklion, Crete (Greece): Cognitive decision making models

Response inhibition is the ability to override a planned or an already initiated response. It is the hallmark of executive control as its deficits favour impulsive behaviours which may be detrimental to an individual’s life. In this seminar I will talk about behavioural and computational guises of response inhibition. I will focus only on inhibition of oculomotor responses. I will first discuss a behavioural paradigm of response inhibition in eye movement research, namely the antisaccade task, proven to be a useful tool for the study of response inhibition in cognitive neuroscience and psychopathology. I will then briefly describe the neural mechanisms of response inhibition in this behavioural paradigm. Computational cognitive models of decision making that embody a hypothesis and/or a theory of mechanisms underlying performance in the behavioural paradigm will be discussed. All models assume the race of decision

processes. It has been shown that response latency is a stochastic process and has been proven to be an important measure of the cognitive control processes involved in response stopping in healthy and patient groups. Finally, I will talk about the inhibitory deficits in different brain diseases including schizophrenia and OCD.

11.10-11.50 András Lőrincz (Neural Information Processing Group, Eotvos University); Cartesian Abstraction
It has been long debated how the so called cognitive map develops in rat hippocampus. The question is relevant since the hippocampus is the key component of the medial temporal lobe memory system, responsible for forming episodic memory and, in humans, also for forming declarative memory, the memory for facts and rules that serves cognition. There is a large number of models spanning from functional to the neuronal level modeling. Here, a novel idea is put forth; we suggest that the cognitive map is a non-linear projection of the egocentric observations to a Cartesian allothetic factor,

13.30-14.10 Vaibhav Diwadkar (Psychiatry & Behavioral Neurosciences, Wayne State Univ. Detroit, MI, USA):
Functional and dysfunctional cognitive neuro-architectures: Evidence from functional and effective connectivity analyses of fMRI data
Discovering brain-behavior relationships from fMRI data remains a challenging endeavor (Logothetis, 2008). Regional brain activations do not provide sufficient constraints to distinguish between cognitive domains or tasks, because different cognitive tasks can modulate activity in the same brain region. As a result, function to structure relationships in the brain have been termed as “regressive” (Park & Friston, 2013). However, activation-based analyses depend on basic models of brain function that do not interrogate fMRI data for patterns of inter-regional connectivity (Silverstein et al., 2016). In this talk, we motivate the value of functional and effective connectivity analyses of fMRI time-series signals (Friston, 2011) in understanding functional and dysfunctional cognitive neuro-architectures. Such analyses allow us to discovery network dynamics at macro-scopic (temporal and spatial) scales that are driven by cognitive task demands. We will present data from multiple cognitive/behavioral domains (memory, motor and attention) and in healthy and pathological populations (including schizophrenia, psychosis and obsessive compulsive disorder).

14.20-15.00 Zoltan Jakab, ELTE, Institute of Psychologíy for Special Education: Quantifíing with mental files

The theory of mental files is a theory of concepts which emphasizes that concepts have two functions in cognition: grounding mental representations to objects in the external world (aka reference), and accumulating information about their objects/referents. This theory has been proposed by a number of philosoophers including Jerry Fodor and Francois Recanati. Recanati’s recent work on mental files has some applications in the area of theory of mind development. Josef Perner and his colleagues contend that Recanati’s theory supplemented by a few developmental principles accounts for data on children’s false belief attribution better than any of the earlier accounts. In our ongoing research we do not contest this claim;

instead we use the theory to interpret data on concept combination. To date relatively little research has been conducted on how children can combine concepts from different domains. To approach this issue we have chosen two areas of knowledge: social understanding, and numerical cognition. We devised tasks that require children to apply their numerical knowledge in the context of false belief attribution and physical perspective-taking. We found that these combination tasks are unexpectedly difficult: most children succeed in false-belief attribution by 5 years of age, and at this same age children also understand integers to a considerable extent. Still in our false belief plus counting tasks only about 50 per cent of 8-9-year-old subjects succeeded; physical perspective taking combined with counting was solved by about 75 per cent of the same subjects. We interpret these findings in light of an extension of mental file theory.