University of Zurich[UZH]

## Department of Economics – Neuroeconomics Seminar

**September 17, 2020 - 17:00 - 18:00**

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### Amygdala and PFC encode different associative structures and their connectivity helps predict markers of mental well-being

Humans and animals learn from reward but they also learn by observing statistical relationships in the world. It is the coalescence of these learning mechanisms that shapes our ability to produce complex goal-directed behaviours. While much is known about the neural encoding of updating signals during learning, there is relatively little knowledge on where and how learnt representations are stored.

The first study I will present explores the neural representations or 'associative structures' created by multiple different learning mechanisms using human fMRI and asks whether different learning mechanisms may guide the formation of representations in subcortical regions such as the amygdala and ventral striatum, compared with frontal cortical regions. We find that knowledge encoded via model-free RL is dissociable, neurally, from the encoding of statistically learnt relationships in PFC, and that the amygdala holds information about spatial proximity to reward. One advantage of acquiring relational knowledge is that it allows us to behave adaptively in new situations and make inferences about never previously experienced options.

In the second study I will examine whether macaque monkeys can make inferences about novel choice options and show that they recruit a hexagonal map-like coding scheme to represent relationships in an abstract option space.

Finally, I will present a third line of work which takes a different approach and focusses on an anatomical circuit centred on the amygdala, a region with abnormal metabolism in depression, and its connections to PFC and brainstem in a large cohort of healthy participants from the Human Connectome Project. This study examined whether measures of functional coupling of specific amygdala nuclei can predict markers of mental well-being. We find that a small number of specific amygdala connections is sufficient to predict factor-analysis derived markers of mental well-being which capture problems frequently encountered in mood disorders.