



Report on 2017 UCL-France Workshop on Computational Approaches to Decision and Affective Neuroscience

A French Embassy Sponsored Workshop

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Summary

A workshop on computational approaches to decision and affective neuroscience, supported by the French Embassy, was held on 8-9 June 2017 at the Max Planck UCL Centre for Computational Psychiatry in Russell Square House.

The aims of the workshop were:

- To promote collaboration between UCL and French institutions on the topic of computational decision and affective neuroscience, bringing together many of the leading groups advancing understanding of the computational basis of decision making and emotion and discussing the relevance of this work to the emerging field of computational psychiatry.
- To share an overview of the last research and future directions related to the following questions:
 - Can computational models be used to understand how subjective states relate to adaptive behaviour?
 - Can computational models be used to understand aberrant decisions and emotions in psychiatric disorders?

The workshop was attended by 7 academics from France and 5 from UCL (alphabetical order):

1. Dr Benedetto De Martino (UCL)
2. Dr Sophie Deneve (INSERM, ENS)
3. Dr Eran Eldar (UCL)
4. Dr Steve Fleming (UCL)
5. Dr Etienne Koechlin (INSERM, ENS)
6. Dr Stefano Palminteri (ENS)
7. Dr Mathias Pessiglione (INSERM, CNRS, UPMC, CRICM)
8. Prof Hilke Plassmann (INSEAD, ENS)
9. Dr Marion Rouault (UCL)
10. Dr Robb Rutledge (UCL)
11. Dr Fabien Vinckier (INSERM, CRICM)
12. Dr Yulia Worbe (INSERM, UPMC)

Program

Day 1 (Thursday, June 8)

12:50 Registration

13:20 **Robb Rutledge & Ray Dolan** - Opening remarks

13:30 **Etienne Koechlin** - Neural mechanisms of decision-making under uncertainty

14:00 **Eran Eldar** - Cortical dynamics of integrative decision-making

14:30 **Sophie Deneve** - Experimental evidence for circular inference in schizophrenia

15:00 Coffee break

15:30 **Marion Rouault** - Variability in psychopathology is linked to confidence but not performance in perceptual decision-making

16:00 **Robb Rutledge** - A neural and computational model of subjective well-being

16:30 **Fabien Vinckier** - How do you see your prospects? Neuro-computational account of how mood fluctuations arise and affect decision-making

18:00 Dinner (speakers only)

Day 2 (Friday, June 9)

09:00 **Mathias Pessiglione** - How to resist temptation: the dangers of executive fatigue

09:30 **Benedetto De Martino** - Compulsivity reveals a dissociation between confidence and action

10:00 **Hilke Plassmann** - Mechanisms underlying (dietary) self-control in health and disease: the role of gut hormone signaling and weight loss intervention

10:30 Coffee break

11:00 **Yulia Worbe** - Learning and habits in Gilles de la Tourette syndrome

11:30 **Stefano Palminteri** - Value normalisation in reinforcement learning

12:00 **Steve Fleming** - Disentangling neural representations of confidence and certainty

12:30 Lunch (all attendees invited)

Participants

Including the 12 speakers, there were a total of 48 attendees. Attendees were primarily researchers and medical doctors from centres at UCL including the Wellcome Centre for Human Neuroimaging, the Gatsby Computational Neuroscience Unit, and the Institute for Cognitive Neuroscience. A small number of attendees with specialist knowledge in the topics under discussion were invited from other institutions including Oxford and Cambridge.

Outcome

These were several beneficial outcomes from the workshop. First, the scientific content was greatly appreciated. The latest research tools and results were presented in great detail with opportunity for detailed and valuable discussion. Second, the informal and flexible environment allowed fruitful dialogues between the attendees and the speakers. It was an opportunity for different actors (researchers, clinicians) and future actors (PhD students) from the field to interact with each other. Notably, this provided the junior researchers the opportunity to describe their research projects and to interact with prominent experts in the field.

Invited participants from UCL and France have been active in developing new behavioural tasks for studying a wide variety of questions in decision and affective neuroscience, and novel computational models to describe the result. Strengths at UCL and in France in these emerging research areas made this workshop particularly timely.

A recent example of a successful exchange of ideas between the two sites is the happiness model of Rutledge, Dayan, and Dolan developed at UCL which has now been successfully applied to neural data from the Pessiglione group in Paris. This work was presented at the workshop by Fabien Vinckier and it demonstrated the effect of mood fluctuations on risky behaviour based on the model proposed at UCL. The workshop encouraged discussion likely to lead to more scientific exchange of tasks and models. The Pessiglione and Rutledge groups are planning to continue their work on this important topic. First, they are planning to study and to model the evolution of happiness at longer time scales (weeks and months instead of minutes) in a more realistic context (happiness fluctuation after real life events like unexpectedly missing the bus rather than after task events in a lab context). Second, they plan to quantitatively describe mood evolution in UK and French patients with bipolar disorder, to understand what drives extreme fluctuations in mood and how bipolar disorder could potentially be better treated.

Several other exciting possibilities for collaborative research between UCL and France have also emerged. Yulia Worbe, one of the speakers based in France, is now planning to use tasks that can quantify metacognition (the confidence one has about one's own performance) in the Obsessive Compulsive Disorder patients that she works with in her clinical practice. These metacognitive tasks were much discussed at the workshop by several of the UCL-based participants.

Another example of new projects having emerged from this workshop is a potential collaboration between Etienne Koechlin, one of the speakers based in France, and UCL clinicians regarding the study of patients with Huntington disease. Koechlin has developed tasks and computational models of learning which may be affected in Huntington disease patients. UCL clinicians are planning to use the same task and computational model to test for differences between controls and patients up to 10 years prior to any clinical symptoms. If changes in model parameters are present this may help to better understand the neural circuits affected in the disorder.

The authors of this report, on behalf of all participants and workshop attendees, would like to thank the French Embassy for their generous support. The meeting was a great success and many of the researchers from both UCL and France have expressed their enthusiasm for more frequent interaction on these topics. The French attendees have suggested that they might be able to host a similar UCL-France workshop on this topic in the future, where the fruitful discussions from this workshop can be continued.